8TH INTERNATIONAL WILDLAND FIRE CONFERENCE

GOVERNANCE PRINCIPLES:
Towards an International Framework

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ABSTRACT BOOK 2023

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AGIF AGÊNCIA PARA A GESTÃO INTEGRADA DE FOGOS RURAIS

REPÚBLICA PORTUGUESA

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UNDRR UN Office for Disaster Risk Reduction

Global Fire Monitoring Centre (GFMC)

afac

ITTO

Natural Resources Canada Canadian Forest Service

CIFFC

WORKING ON FIRE

Korea Forest Service

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UNDER THE HIGH PATRONAGE OF THE PRESIDENT OF THE PORTUGUESE REPUBLIC

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ORAL COMMUNICATIONS

ID1

OC56 - THE AUSTRALIAN FIRE DANGER RATING SYSTEM

Stuart Matthews[1], Rob Rogers[1], Simon Heemtra[2], **Meaghan Jenkins**
[1]NSW Rural Fire Service, [2]AFAC

The new Australian Fire Danger Rating System (AFDRS) was launched on 1 September 2022. The AFDRS replaced Australia's 60 year old rating system with a nationally consistent and up to date method of calculating and communicating fire danger. The AFDRS features: eight fit for purpose fire behaviour models, the first national fuel map for Australia, a consistent fire behaviour index and a simplified four-level rating system based on extensive social research. The AFDRS brings a new level of detail and sophistication to fire danger forecasting.

The technical build of the AFDRS included a new web portal, the Fuel State Editor, the manage fuel data; upgrades to Bureau of Meteorology forecast systems to implement fire behaviour calculations developed the NSW Rural Fire Service on a 1.5km grid; and a new national web site, the Fire Danger Viewer, to view and interrogate fire danger and weather forecasts.

The implementation of the AFDRS required an enormous coordinated effort from all levels of government across all States and Territories as well as the Commonwealth coordinated by AFAC (Australia's National Council for Fire and Emergency Services). This included developing nationally agreed ways of communicating fire danger, updates to policies and legislation, as well as replacement of physical infrastructure such as signs. Implementation was a significant IT project requiring redesign and upgrades to fire agency web sites and the Bureau of Meteorology public website.

This presentation will outline the history, development and implementation of the Australian Fire Danger Rating System.

ID31

OC60 - PEERING INTO THE FUTURE: IDENTIFICATION OF EMERGING WILDFIRE RISK HOTSPOTS DUE TO CHANGES IN CLIMATE AND POPULATION IN WESTERN AUSTRALIA

Amelie Jeanneau[1], Hedwig van Delden[1,2], Holger R. Maier[1], Aaron Zecchin[1], Roel Vanhout[2], Tim McNaught[3], Mike Wouters[4]

[1]The University Of Adelaide, [2]Research Institute for Knowledge Systems, [3]Department of Fire and Emergency Services, [4]Department for Environment and Water

Wildfire risk is likely to increase in the future due to the combined impacts of climate change and urban sprawl. However, quantifying future risk and impact for known and emerging wildfire risk areas is challenging. Such assessment requires integrated frameworks that dynamically consider hazards, values at stake (e.g. built and natural assets, communities, etc.) and how these interact.

For this reason, we used the Unified Natural Hazard Risk Mitigation Exploratory Decision Support System (UNHaRMED). This system integrates dynamic land use and building stock models (simulating changes in exposure and vulnerability to wildfires) with a fire behaviour model (modelling the intensity of fire events) to determine spatially distributed risk estimates expressed in terms of average annual loss. We applied UNHaRMED to a case-study area in southwest Western Australia, under plausible future climate and population growth scenarios, to quantify the impact of climate change, population growth and their combined effect on future wildfire risk over a 30-year time horizon.

Results indicate that increases in wildfire risk range between 40% and 60% for climate change and population growth combined. In contrast, population growth alone accounts for 20% to 40% of regional wildfire risk and climate change 10% to 15%.

Simulation results of this form can assist fire and land managers in developing policies that build well-prepared and resilient communities as society moves forward into an uncertain future. Such work could be extended to other regions or support the development of a national-scale decision-support tool quantifying future changes in long-term wildfire risk over decades.

ID225

OC58 - COMMUNITY FIRST: GOVERNMENT, FIRE AGENCIES, AND COMMUNITIES, LEARNING, DECIDING AND ADAPTING TOGETHER AS PART OF A BUSHFIRE RISK REDUCTION SYSTEM

Stefanie Russell[1]

[1]Country Fire Authority, [2]Victorian State Government

Objectives

The challenges of living with fire require constant adaptation. Governments all over the world have sought to build resilience to natural disasters. The Community First program applies a community-centred approach. Communities have strong incentives to participate in bushfire planning activities, as fire has the potential to affect their properties, health, and livelihoods.

Sharing responsibility for living with fire recognises that fire cannot, nor should it be eliminated from our landscapes. We can build our resilience if agencies, communities and partners work together to achieve systems-level change, in what we do, and how we think.

Methods

The Community First program is a Victorian government program that connects and involves communities in decisions about bushfire management. It is a principles--based, community development approach that places community knowledge, ideas and experiences alongside fire agency planning, research, and expertise. It recognises that fire preparedness requires an ecosystem of stakeholders learning, deciding and adapting together to meet the challenges of living with fire.

Results

Through a facilitated approach, communities and agencies are learning together, building a shared understanding about local areas, making connections, fostering relationships and trust. We are making decisions together about local risks and options for mitigation. This has lead to communities and agencies adapting to the landscape, and each other, activating community strengths, capability and collective resources, to build resilience and adapt to living with fire.

Conclusions

The Community First program is activating a fire risk reduction system built on strong relationships, shared understanding, and community at the heart of everything.

ID268

OC55 - STATE OF KNOWLEDGE, FUTURE CHALLENGES AND OPTIONS FOR AN INTEGRATED FIRE MANAGEMENT IN THE EUROPEAN ALPS

Harald Vacik[1], Mortimer M. Müller, Marco Conedera, Gianni Boris Pezzatti, Giorgio Vacchiano, Yvon Duche, Rolando Rizzolo, Boštjan Kosicek, Sébastien Lahaye, Christian Schunk, Michael Sautter, Augusto Cotterchio, Daniele Ryser, Sylvain Dupire, Aron Ghiringhelli, Peter Ondrich, Walter Wuggenig, Vila Vilardel, Trung Hoang, Christian Mayer

[1]*University of Natural Resources and Life Sciences*

Wildfires in the European Alps are an emerging issue that lead to high damages in protection forests, increasing natural hazards and result in threats for people and high costs up to millions of euros for fire suppression and restoration measures. The recent extremely dry and hot summers in the Alpine space, evidenced the need to be better prepared to face a changing fire regime with more intense and frequent fires. The EUSALP-EU Strategy for the Alpine Region is aiming to improve risk management and adapting governance mechanisms. In this context a panel on forest fires experts in the Alps was established, followed by the design and implementation of a multi-lingual online survey to develop the white paper "Forest fires in the Alps: State of knowledge and future challenges" for an integrated fire management. Scientists, authorities and members of action forces from Austria, France, Germany, Italy, Liechtenstein, Slovenia and Switzerland participated in the survey and workshops to identify major challenges in forest fire prevention, suppression and post-fire management. Success stories on fire management were used to formulate the framework of an integrated fire management for the Alpine region. The white paper contains four recommendations with several actions to put them into effect. They focus on the design and implementation of short- and long-term prevention measures, the adaption of suppression measures to the specific conditions of the Alpine region, improved understanding of measures for post-fire management as well as knowledge transfer and exchange of experiences. This contribution presents the key findings.

ID280

OC61 - ASSESSING DIRECTIONAL VULNERABILITY TO WILDFIRE - IMPLICATIONS FOR COMMUNITY PROTECTION PLANNING

Jen Beverly[1], Air Forbes[1]

[1]*University of Alberta*

Objectives

We use case examples to demonstrate a recently developed method for describing directional vulnerability to wildfire at community and landscape scales. Implications of these novel new assessments for strategic protection planning are explored.

Methods

A simple metric of landscape fire exposure that was developed for use in Alberta, Canada, and recently validated for use in Portugal, is used to describe viable wildfire trajectories into the built environment. At each assessment point (i.e., any location of value), we delineate 360 possible wildfire trajectories at 1° directional intervals. The length of each directional trajectory segment that intersects lands classified as having high wildfire exposure is then calculated to identify directions that constitute continuous, viable pathways of fire encroachment. A novel radial graph format is used to display results.

Results

Directional vulnerabilities for large inventories of values across entire management areas were generated quickly and easily with a single input (i.e., land cover). Assessed locations exhibited highly unique directional vulnerabilities. Compilations of results across an entire region highlighted wind directions that posed a threat for fire encroachment in the event of an ignition.

Conclusions

Despite the highly directional nature of wildfire threats to public safety, landscape fire risk assessments are typically omnidirectional. Our case examples suggest directional vulnerability assessments can provide valuable insight for strategic planning purposes and could help to inform a wide range of fire management activities including: prioritization of limited fire suppression resources, planning fuel reduction treatments, proactively identifying candidate locations for operational activities, and assessing evacuation vulnerabilities.

ID506

OC57 - THE EFFECTS OF PRESCRIBED FIRES ON LIZARD DIVERSITY INGRASSLANDS OF CENTRAL BRAZIL

Bruna Gomes[1], Marcio Martins[1]

[1]*University of São Paulo*

We explored the effects of prescribed fires on the diversity of lizards in the Serra Geral do Tocantins Ecological Station (SGTES), a large protected area where integrated fire management has been used since 2014. We used pitfall traps with drift fences to survey lizards in unburned and burned areas with time since the last fire (TSLF) ranging from 1 to 5 years. Pitfall traps were opened after the fires and remained active for 15 days. We used GLMs to test for the effect of fire on the abundance and richness of lizards. We did six surveys from 2019 to 2022, following the usual management schedule at the SGTES. We captured 3234 lizards of ten species in pitfall traps, 1883 individuals of eight species in unburned and 1351 individuals of nine species in burned areas. We found no effect of fire or TSLF on lizards richness. Fire had no effect on total abundance, but TSLF had. The abundance of lizards increase at two years of TSLF, but this effect was caused by one species. Tropidurus oreadicus is the most abundant species and shows a higher abundance in habitats with two years of TSFL and decreased in abundance after that. The abundance of lizards without T. oreadicus data shows no effect of TSLF. Our results indicate that prescribed burns do not negatively affect the diversity of lizards in grasslands of central Brazil.

ID33

OC37 - WILDFIRE OCCURRENCE IN FOREST AND TRANSITIONS LANDSCAPES OF GHANA: FARMERS' PERCEPTIONS AND ADAPTATION STRATEGIES

Isaac Nunoo[1], Mercy Owusu Ansah, Joseph Asante, Eric Osei, Boakye Twumasi-Ankrah

[1]*Tropenbos Ghana*

Human activities have been blamed as a major cause of wildfires. In the face of these, preventive and control measures must be founded on a thorough understanding of the factors contributing to the initiation and spread of wildfires. The study aims to assess farmers' perception of wildfire occurrence and adaptation strategies in the forest and transition landscapes. An individual interview was conducted with 120 farmers, and 20 farmers were involved in four focus group discussions in two agroecological landscapes. A combination of descriptive statistics and regression analysis was used for data analysis. Results showed that 85.75% of farmers observed an upward trend in wildfires. About 92% strongly agree that hunting, farm establishment (75%), and pasture renewal (67.67%) are the main causes of wildfires. About 72% agreed with the statement that the fire could have been completely avoided, and 88% agreed with the statement that the severity of the fire could have been reduced. The perceived impacts of wildfires included immediate crop burning, crop growth delaying and destruction of material goods. In dealing with this scourge, the following coping strategies have been adopted by the farmers. This includes the prohibition of hunting during the dry season, seeking permission and approval from a fire volunteering group before burning, a ban on cooking on farms, the establishment of firebreaks establishment and strict punishments and fines for perpetrators. To increase effectiveness and sustainability, policies and institutions that support local wildfire management activities must take advantage of the strong community knowledge and networks.

ID165

OC40 - A 2023 UPDATE OF THE POSITION PAPER ON "WILDFIRE PREVENTION IN THE MEDITERRANEAN"

Celia García Feced[2], Irene Núñez Blanco[3], **Eduard Mauri**[1], Elena Hernández Paredes[2]

[1]European Forest Institute, [2]Ministry for the Ecological Transition and Demographic Challenge of Spain, [3]Grupo Tragsa, Madrid, Spain

Mediterranean countries are a worldwide hotspot for wildfires. In 2011, FAO published the position paper "Wildfire Prevention in the Mediterranean"; since then, there has been much progress. In March 2022, at the 7th Mediterranean Forest Week, the European Forest Institute and the Spanish Ministry for the Ecological Transition and Demographic Challenge started a participative process to update the five recommendations and the 40 proposed actions to make them relevant for the next 10 years. During 2022, the editorial team conducted five workshops in international forums where fire experts and forest managers from around the Mediterranean expressed their recommendations and proposals on how wildfire prevention should be for the next 10 years. In parallel, the opinion of fire experts and land managers were collected through an on-line questionnaire. In 2023, the editorial team is collating the answers and starting the update of the text. This process is enhanced via feedback loops with the workshops participants and questionnaire respondents. Currently, the main conclusion is that the five existing recommendations are maintained, but a 6th new recommendation “Adoption of a governance model able to tackle the multidimensional aspects of the wildfires and the interdependency of their causes” has been added. In May 2023, the position paper will be fully updated. At the Conference, the updated version will be presented for the first time, focusing on the main changes in the proposed actions and the new governance model for wildfires. It shall become a reference document for Mediterranean policy makers and managers.

ID243

OC35 - SIMULATION OF PYROCUMULUS DURING A MEGAFIRE EVENT IN PORTUGAL USING A COUPLED ATMOSPHERE-FIRE SPREAD MODELING FRAMEWORK

Ricardo Vaz[1], Rui Silva[1], Susana Cardoso Pereira[1], Ana Carvalho[1], David Carvalho[1], Alfredo Rocha[1]

[1]University Of Aveiro

Atmospheric properties are likely to be perturbed around a forest fire due to the heat and mass fluxes at the lower boundary, which may change the vertical properties of the atmosphere, namely static stability, amongst others. Increased instability may drastically change the dynamics of the atmosphere which eventually feedback on the fire and can lead to the formation of pyrocumulus . Pyrocumulus can generate precipitation, downdrafts, and lightning events, and have been linked with extreme fire growth, devastating firestorms and even fire-induced tornados. It is therefore fundamental to be able to simulate the formation of pyrocumulus during fire events and characterize the physical mechanisms and conditions favorable to their formation. The fully coupled fire spread-atmosphere model WRF-SFIRE was used to simulate the fire propagation and interaction with the lower atmosphere, leading to the formation of pyrocumulus. Preliminary results show that the WRF-SFIRE is able to realistically simulate the formation of pyrocumulus during a fire event, and that the combined interaction between temperature, surface winds and fuel moisture play a critical role in the interaction atmosphere-fire during convection and pyrocumulus development.

ID302

OC41 - BUILDING A WILDLAND FIRE PREVENTION AND MITIGATION MODEL IN CANADA TO GROW WHOLE-OF-SOCIETY AWARENESS AND ENGAGEMENT.

Magda Zachara[1], **Ray Ault**[1]

[1]*CIFFC*

Canadians can adapt to climate change and be resilient in the face of more frequent and extreme wildfire events by adopting FireSmart Canada's recommendations and guidelines. Wildland fuels and the built environment can be modified to reduce fire spread.

In 2020 the Canadian Council of Forest Ministers (CCFM) developed an Action Plan to implement a Canadian Wildland Fire Strategy Using a Whole-of-Government Approach. This Plan includes detailed steps to achieve more resilient communities and infrastructure to the threat and impacts of wildland fire. The Canadian Interagency Forest Fire Centre (CIFFC) is taking the lead to ensure an all of Canada model is developed. With encouragement from CCFM, FireSmart Canada transitioned from a regional, stand-alone program to CIFFC as a national brand and program, with the aim of ensuring the integration of prevention and mitigation efforts among all jurisdictions and groups. As part of this shift, the CIFFC Prevention and Mitigation Action Plan was developed in 2021, listing 12 priority actions with a vision of Canadians working together to become better prepared and more resilient to wildland fire risks.

CIFFC and FireSmart Canada are at the early stages of implementing the action plan but are already seeing tremendous engagement and support throughout many of the Canadian jurisdictions and communities. Our current focus is to evolve the Action Plan to take a more whole-of-society approach and ensuring all sectors, private and public, and all communities, urban, rural, and Indigenous, have a role to play in building a more resilient future in Canada.

ID314

OC38 - LANDSCAPE FIRE AND SMOKE EXPOSURE: CURRENT KNOWLEDGE OF THE PRESCRIBED BURNING TRADE-OFF

Owen Price[1], Michael Storey[1]

[1]*University of Wollongong*

Prescribed burning reduces the risk of wildfire in the forests of eastern Australia, but it also produces smoke. Here, we summarise the results of a five-year investigation into the trade-off between prescribed burn smoke and wildfire smoke. We found:

1. Cultural burns consumed ~9% of forest biomass, contemporary Hazard Reduction burns consumed 20% and wildfires consumed 40%, so there is a marked difference.
2. Around most prescribed burns, particulate levels reduce to acceptable levels within 2 km from the fire in the day and 5 km at night, but cool, still weather conditions make broadscale impacts more likely.
3. The worst particulate impact of prescribed burning smoke in Sydney occurred when there was pollution lingering from the previous day, temperature and the ventilation index were low, and when sea breezes prevented air leaving the basin.
4. Trade-off analyses find that increasing the amount of prescribed burning will cause higher levels of particulates than wildfires, probably due to the weather conditions they occur in and the lower energy that reduces the amount of smoke lofted above the surface.

Smoke exposure from prescribed burning can be reduced by avoiding certain weather conditions, but this will reduce the number of days per year available for burning.

ID325

OC36 - CAN PRESCRIBED BURNS REDUCE AREAS BURNED BY WILDFIRES AND ASSOCIATED GREENHOUSE GAS EMISSIONS?

Livia Moura[1], Caio Sena[2], Julia Rodrigues[2], Leonardo Peres[2], Renata Libonati[2], Julia Boock[3], Osvaldo Gajardo[3], Daniel Silva[3], Isabel Schmidt[4]

[1]Institute Society, Population And Nature, [2]Laboratório de Aplicações de Satélites Ambientais (LASA/UFRJ), [3]World Wide Fund for Nature (WWF/Brasil), [4]Department of Ecology, University of Brasilia (UnB)

In 2014, Brazilian federal executive agencies initiated a pilot Integrated Fire Management (IFM) Programme targeting protected areas. Some of its main objectives are to reduce wildfire risks, annual burned areas, greenhouse gas (GHG) emissions and socioeconomic and ecological losses. An area of over 374k km2 are being or have been managed with prescribed burns to promote ecological conservation in adapted ecosystems and reduce fuel load. We assessed the burned areas of 113 protected areas in all six Brazilian biomes from 2000 until 2021 to evaluate if the Programme is being effective in achieving its goals. The areas managed for the longest time presented an expressive reduction on the areas burned in the late dry season, of up to 57%. Whereas the areas burned in the early dry and rainy season increased between 5 and 25%, though in a fragmented pattern, burning only strategic places and fire adapted vegetations. These decreases in late dry season burned areas led to the reduction of GHG emissions, up to 39%. Such successful results indicate that IFM has been the most efficient approach the country has ever experienced, and the current bill which institutes the National Policy for IFM, currently in evaluation by the senate, has a big potential to reduce wildfire issues and upscale the Programme to all rural Brazilian territories.

ID450

OC39 - FIREBREAK EFFECTIVENESS PREDICTION MODELS DEVELOPED FROM REAL WILDFIRES IN SOUTHERN SPAIN

Macarena Ortega Pardo[1], Mr. Francisco Rodríguez y Silva[1], Mr. Juan Ramón Molina[1]

[1]University Of Cordoba

Firebreaks aim to reduce the energetic progression of a wildfire, facilitating safe and efficient firefighting, and, consequently, reducing suppression difficulty and suppression costs. Firebreak effectiveness is defined as the probability of controlling a fire. The main goal of this study is to develop predictive models regarding firebreak effectiveness based on topographic, meteorological, fuel model, fire behavior and firebreak design variables. A database was generated by evaluating 563 intersections between fire fronts and firebreaks during real wildf res from 2011 to 2018 in southern Spain. The effectiveness of firebreak wildfire containment capabilities was modeled through machine learning techniques (artificial neural networks and decision trees) along with a classic statistical approach (logistic regression). Although the best results were obtained with an artificial neural network model, a decision tree is the simplest model for land managers to understand and apply. The factors identified as having the greatest influence on firebreak effectiveness were the type of suppression work supported on firebreaks, the flame length and the intersection angle between the fire front and the firebreak. This research entails a change in decision support models from using simulations to an empirical approach of assessing real fire events. Firebreak effectiveness assessment is a useful tool for optimizing fire containment capacity and firefighter safety. Our findings allow to address the construction of new firebreaks or the revaluation of existing ones, identifying areas and circumstances where their effectiveness could be maximized. The increase in effectiveness supports the operational decision-making process and budget allocation in fire management.

ID4

OC63 - THE FISC-CERRADO NEAR-REAL TIME WEB-SYSTEM FOR PREDICTING FIRE SPREAD

Professor Britaldo Soares-filho[1], UBIRAJARA OLIVEIRA[1]

[1]*Universidade Federal De Minas Gerais*

Firefighting has become increasingly difficult and costly due to climate change. In response, new tools, including online platforms, are emerging to help prevent and promptly combat ever more destructive wildfires. While those initiatives only provide maps of fire risk based on environmental and climatic conditions, which in general have a medium predictive capability, fire propagation models, although successful in predicting fire behavior and spread, particularly at local scale, can become impractical during emergency situations, since they require lots of spatial data that must be obtained, processed and input by the user. To overcome these limitations, we have developed a fire-spread prediction system for the Brazilian Cerrado, the biome most affected by wildfires in South America. The system, named as FISC-Cerrado, automatically uploads hot pixels and satellite data to calculate maps of fuels loads, vegetation moisture, and post-probability of burning for simulating fire spread thrice a day for the entire Cerrado at 25 ha and for nine conservation units at 0.09 ha spatial resolution. Unlike the requirements to operate fire spread models, the user-friendly interface of FISC-Cerrado, alongside the automatization of the entire chain of tasks, allows its use by practitioners who do not have technical skills, such as GIS knowledge. Model results together with ancillary data, e.g., historical burned areas and annual CO2 emissions from fires, are available on an interactive web-platform (https://csr.ufmg.br/fipcerrado/en/), which is being used for daily operations by the fire brigades of the selected conservations units.

ID164

0C64 - FIRE ANALYSIS CELL - PORTUGUESE METHODOLOGY FOR OPERATIONAL DECISION SUPPORT IN WILDFIRES MANAGEMENT

Fábio Silva[1]

[1]*ANEPC-FEPC*

In the context of the rural fires of 2017, it was demonstrated the extreme importance of having the capacity for rapid analysis of the ongoing situation, anticipating fire behavior, and identifying suppression opportunities. These capacities were especially relevant considering the size and geographic dispersion of the fires, their simultaneity, and the involvement of a large number of resources from different entities.

In 2018, the National Emergency and Civil Protection Authority (ANEPC) implemented a decision support cell (NAD-AIR) for the analysis of rural fires, operated by fire analysts of the Special Civil Protection Force (FEPC). It was created with the objective of assisting the command structure, at the national, regional, or district level, and at the incident level, in the collection, analysis, and interpretation of important data for the prediction of wildfire behavior and making tactical proposals. More than a simple organic and operational structure, this unit incorporates tools, methodologies, processes, and knowledge with the aim of continuously monitoring and analyzing the most important wildfires, based on a logic structured in three major areas: 1. Supporting the operational decision process in a preventive scope, with a strategic analysis on the daily fire risk (before an incident); 2) Analysis of each significant ongoing wildfire; 3) Collection of the most important data to perform post-fire analysis.

This presentation aims to provide insight into the NAD-AIR concept, especially the tools, processes, and work developed in the last 5 years.

ID189

OC66 - ENABLING INTEGRATED WILDFIRE RESPONSE OPERATIONS WITH CREWED AND UNCREWED AIR ASSETS: FLIGHT TEST EXPLORATION

Adriana Andreeva-Mori[1], Kohji Ohga[1], Keiji Kobayashi[1], Jeffrey Homola[2], Marcus Johnson[2], Parimal Kopardekar[2]

[1]Japan Aerospace Exploration Agency, [2]NASA Ames Research Center

Objectives

Since 2016, JAXA and NASA have partnered to investigate the safe and efficient integration of unmanned aircraft systems (UAS) in disaster response operations. The current research focuses on enabling the safe integration of UAS and helicopters in wildfire response operations.

Methods

A flight test using JAXA's experimental helicopter was conducted in August 2022 to validate the use of mission planning and traffic management technologies, including onboard pilot situation awareness support, to coordinate concurrent manned aircraft and UAS operations. A scenario was developed and performed that simulated a wildfire response operation including a helicopter conducting water drops in the presence of a UAS operating area defined by a bounding box. Post-flight debrief discussions were held with the pilots to better understand their needs and assess the effectiveness of supporting situation awareness tools.

Results

The advantages of the developed technology were demonstrated. It was confirmed that real-time awareness of the UAS operation airspace helped the helicopter pilot plan and execute a safe mission and minimize the flight time loss due to the potential interference with the UAS. Post-flight interviews with the pilots indicated no sufficient increase in the pilots' workload and provided ideas for future technology development.

Conclusions

Given the appropriate situation awareness tools, helicopter pilots can carry out wildfire missions in the vicinity of UAS without any significant impact on pilots' workload, mission safety, and efficiency. Further research is necessary to establish the most useful situation awareness and alert functionality methods.

ID306

OC65 - WILDLAND FIRE DECISION FACTORS CONSIDERED BY USFS AGENCY ADMINISTRATORS AFTER THE 2009 POLICY UPDATE.

Stephen Fillmore[1]

[1]US Forest Service, [2]University of Idaho

Objectives

The aim of this research is to validate previously discovered decision factors as well as identify factors that have emerged since the US federal wildfire policy was updated in 2009.

Methods

Data was gathered by selecting a representative sample of fires across the US where varying strategies were implemented. Researchers interviewed decision makers while the fire was still actively burning in order to gain time-of-fire decision factors without the presence of hindsight bias. Transcripts from interviews were coded in qualitative data analysis software to elucidate decision factors and themes.

Key results

We validated the presence of decision factors which had been identified prior to the 2009 policy update as well as 69 emergent decision factors. To contextualize decision factors within the decision-making process, we offer an updated Wildfire Decision Framework that has value for wildfire social science researchers.

Conclusions

Data shows that wildfire strategies are fluid and not easily discernible from outside appearances, and attempting to bin available strategies into strict categories does not reflect how contemporary wildfires are being managed. Instead, we suggest that researchers and managers alike should consider adopt messaging that reflects a polystrategic' approach when managing a wildfire with any strategy other than full suppression.

This research provides insight into the complex decision-making process fire managers engage in during wildfire events. Managers may gain a better understanding of the decision environment under which they are operating and use the factors and framework as a tool to verify that needed considerations are being made.

ID468

OC68 - A CELLULAR AUTOMATA MODEL FOR WIND-DRIVEN FIRES

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Portugal is recurrently affected by severe wildfires, and some of the most severe episodes are wind driven. We describe a cellular automata (CA) model designed to simulate wind-driven wildfires. The model considers three factors (wind, terrain slope and vegetation type) when evaluating the likelihood of fire propagating from a cell to a neighboring one and incorporates a wind rule to simulate spotting.

We present results obtained when the model was applied to simulate two wind-driven wildfires that took place at Pataias-Burinhosa and Quiaios on October 15, 2017. These wildfires resulted from the combination of very strong winds steered by the passage of hurricane Ophelia, very dry vegetation because of a prolonged drought affecting the country, and very low atmospheric relative humidity.

Elevation profiles were obtained from the SRTM digital model and land cover data were obtained from CORINE maps. Hourly winds were obtained from forecast by the regional model WRF and the WindNinja software was used to account for wind interaction with topography.

The model was calibrated by comparing the simulated burned area against shapefile maps provided by EFFIS in the case of the Pataias-Burinhosa event, and against burned areas as identified by Sentinel-2, in the case of Quiaios.

Maps of probability of burning were obtained by performing an ensemble of 100 simulations. In both simulations, the patterns of probabilities present a marked decrease out of the limits of the observed scar, indicating that the model may help deciding about the locations where to allocate resources for firefighting.

ID524

OC67 - AERIAL FIREFIGHTING WITH DRONE SWARM TECHNOLOGY – FUTURE IS HERE

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Introduction

Aerial firefighting is effective however very expensive solution to suppress forest fires. Drone application as a most developing branch of the aviation industry can be a c omplement, or perhaps even a competitive solution with the traditional aerial firefighting. Based on the input data drone swarm technology can be not just an effective but also an efficient solution suppressing forest fires.

Methods

In this study author used both practical and theoretical approach to investigate the possibility of drone usage delivering suppressant to fire front. Firstly, the required width of wetting strip and the required amount of water per unique area were investigated; practical experience shows that based on the flame length first responders can estimate both the effective width of the fire break and the amount of water required per a unique area. As a second part of the paper, the transport capability of a drone was investigated during its life cycle that is specially optimized for firefighting.

Results

In the example author took a 100 kg transport capacity that is easy to transfer to other drone design; in case of 0.3 MWm-1 fire intensity 100 kg water is enough to make 100 m long fire break, in case of 3.4 MWm-1 fire intensity 100 kg water enough to create only 2.5 m fire break. Even if this latest results can be seen a bit short experts have to take into account the swarm technology. In 10 km distance 30 drones can built a 5 m long fire brake per a minute that means 300 m per hour. This result is no worse than what large or very large air tankers can built averagely in this fire intensity. Expecting the technological development in the near future the length of the fire break will raise drastically meaning that drone swarm technology will be not a complement but a competitive solution to the traditional aerial firefighting.

ID525

OC62 - I4F TECHNOLOGY FOR MAKING AERIAL FIREFIGHTING MORE EFFECTIVE

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Introduction

This paper describes a new technology called I4F (Instant Foam Fighting Forest Fire - EU Horizon 2020) that makes the process of aerial firefighting more effective. Aerial firefighting uses mostly water or long term retardant, sometimes short term retardants (foam) suppressing forest fires however I4F technology uses instant foam which capability is stated between traditional foam and long term retardants.

Methods

I4F technology based on previously published research results called R-20F and R-10A methods Based on these methods instant foam technology can suppress fires in such dimensions where others like water or short term retardants has objective limits: aerial firefighting can suppress fire with water up to 3,400 kW/m fire intensity however I4F technology can reach the limit of 20,000 kW/m intensity.

Results

I4F technology consists of different elements like ground refilling station, on board tank with fittings and special nozzles and the special added class A foam. Ground refilling station provides the preparing of instant foam and the quick refilling of the on board tank before taking off. The on board tank is a compartment of the pressurized instant foam. Special nozzles can provide a very straight, invariant and homogeneous footprint on the surface covering the trees with thick foam blanket. The traditional used class A foam agent get an special add which keeps foam structure longer because draining time is reduces more than up to 60 minutes. Longer foam stability gives pilot more flexibility to optimize the release distance of foam jet from the fire front.

Project made both ground and aerial tests with different configurations of valve openings, flight speed and release altitudes. Results show footprint of released foam is very straight, invariant and homogeneous reducing drastically the wasted part of carried extinguishing material. I4F technology can be optimized to different platforms both on rotary and fix wing planes.

ID207

OC53 - POST-FIRE SOIL EROSION MITIGATION TREATMENTS: A GLOBAL COST-EFFECTIVENESS ANALYSIS

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The effectiveness of post-fire soil erosion mitigation treatments is relatively well-known, but there is a research gap as to how effective they are in relation to their costs since explicit monetary figures are rarely reported in the literature. In this work we determined the cost-effectiveness (CE) of these treatments from the existing literature on field studies conducted in wildfire-affected areas of the USA, Canada, Spain, and Portugal.

We assessed the efficiency at reducing erosion of the available treatment types and materials, obtained from field studies, and compared it against the real costs of application from each of the cases, to obtain their CE (cost of preventing a soil loss of 1 Mg per hectare for the first post-fire year).

Treatments providing a protective ground cover showed the best CE values, especially for agricultural straw (1,137 ± 1,282 $ Mg-1 ha-1) and wood-residue (1,966 ± 2,496 $ Mg-1 ha-1) mulches, while for hydromulch it was of 6,734 ± 9,228 $ Mg-1 ha-1. The CE of barriers was of 2,276 ± 2,348 $ Mg-1 ha-1, influenced by their implementation costs and design. Seeding showed a good CE (933 ± 1233 $ Mg-1 ha-1), related to its low cost.

Post-fire soil erosion mitigation treatments are cost-effective if applied in burned areas where background erosion rates exceed the tolerable erosion thresholds, and are less costly than the loss of the values-at-risk they are protecting. The assessment of post-fire soil erosion risk is vital to ensure the best use of the available resources.

ID368

OC54 - CHANGES IN SOIL WATER REPELLENCY CAUSED BY FOUR 2021-2022 WESTERN U.S. MEGA FIRES

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It is well known that heat from fires can greatly enhance soil water repellency due to heat-induced changes in the chemical composition of the soil organic matter (SOM). Fire-induced soil water repellency can result in the reduction of soil infiltration, which can lead to an increase in surface runoff, erosion, and the potential for flooding and mudslides. Recently increased frequency and intensity of western U.S. wildfires poses an important question: what are the short- and long-term effects of wildfires on soil's hydrologic responses, including water repellency and what is the role of SOM in post-fire soil water repellency?

In the summer and fall of 2021 and 2022, there were ongoing mega-wildfires (Caldor, Dixie, Beckwourth Complex, and Mosquito) in the Eastern Sierra Nevada mountains. These wildfires provided us an opportunity to collect post-fire soil samples and study the effects of fires on the physical and chemical properties of soils. We collected over 70 soil samples and perform multiple water-droplet penetration time tests in the field and laboratory contact angle measurements with the goniometer technique. Our field measurements of post-fire soils showed a significant increase in the water droplet penetration time (~ 5–10 times). The average contact angle of the burned soils was significantly higher (p-value <0.001) than the average contact angle of the control soils (~1.1–9 times). These results highlight the need for future research on the chemical composition of post-fire soils and need to study for how long the soil water repellency can last after fires.

ID381

OC49 - EFFECT OF FIRE DISTURBANCE ON SOIL RESPIRATION AND NITROGEN AVAILABILITY IN BOREAL FOREST OF CHINA.

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Fire is a crucial event that regulates the soil carbon (C) and nitrogen (N) cycle in boreal forest ecosystems. Only few studies have detected how fire affects soil respiration (Rs) which including soil heterotrophic (Rh) and autotrophic (Ra) respiration, and restoration type (natural restoration versus afforestation) after fire disturbance effect on N availability in boreal forest of China. In this study, we examined the response of Rs and N net mineralisation rates (Rmin) to fire in a Dahurian larch (Larix gmelinii) forest of northeast China. Our results showed that, 1) compared with unburned control stands, fire disturbance significantly increased Rh by ca. 24%, and significantly decreased Ra by ca. 54% in burned stands; 2) soil inorganic N pool of the upper and lower layers of the regenerated stands remained significantly lower than in burned stands; 3) Restoration type also had significant effects on upper layer soil N availability; compared with afforestation, natural restoration was more beneficial for the accumulation of soil inorganic N and the recovery of Rmin after fire disturbance. Specifically, the concentration of inorganic N and the mean Rmin in upper layer soils in the natural restoration stands were approximately 41% greater and 3.6 times greater, respectively, than in the afforestation stands. Our findings demonstrated that forest fires can cause considerable losses of soil C and N in a boreal forest ecosystem of China, proactive management of forest regeneration should be carried out after forest fire disturbances.

ID387

OC51 - SOCIO-ECONOMIC AND ENVIRONMENTAL IMPLICATIONS OF WILDFIRE ASH. A GLOBAL DATASET OF CHEMICAL CHARACTERISTICS

Carmen Sánchez-García[1], Cristina Santín[1,2], Jonay Neris[1,3], Gabriel Sigmund[4], Xose L. Otero[5], Joella Manley[1], Gil González-Rodríguez[6], Claire Belcher[7], Artemi Cerdá[8], Abbey Marcotte[9], Sheila Murphy[10], Charles C. Rhoades[11], Gary Sheridan[12], Tercia Strydom[13], Pete R. Robichaud[11], Stefan Doerr[1]

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During and after wildfires, the mobilisation of potentially harmful constituents in ash produced from biomass combustion poses widespread risks to society (e.g., risks to human health, and socio-economic and environmental impacts). To anticipate and mitigate these risks a fuller understanding of ash chemical composition is needed. We present a global dataset on ash constituents from wildfires occurring in a variety of ecosystems and burn severity conditions worldwide and examine their potential societal and environmental implications. We analysed physicochemical properties, including major nutrients and toxic metals for 148 ash samples, and completed an extensive review of studies analysing chemical composition of wildfire ash.

The main components in the ash (mean; minimum and maximum) were organic carbon (204; 2.5 – 450 g kg-1), calcium (47.9; 1.3 – 215 g kg-1), aluminium (17.9; 0.6 – 69.3 g kg-1), and iron (17.1; 0.6 – 77.2 g kg-1), while the largest concentrations of metals of concern for human and ecosystem health were observed for manganese (1,488; 34.5 – 15,350 mg kg-1), zinc (181; 25.5 – 1,016 mg kg-1), and lead (67; 1 – 782 mg kg-1). Burn severity and ash sampling timing were key factors influencing chemical parameters like pH, carbon, nitrogen, calcium, aluminium, and iron. In some ashes the concentrations of some elements of concern were very close to or exceeded international contamination standards for sediments and soils. These results will be relevant to an interdisciplinary audience and can be used to predict and assess risks from the mobilisation of chemical constituents following wildfires.

ID433

OC77 - POST-FIRE RECOVERY IN PORTUGAL: 100 YEARS IN FLASHBACK, 10 YEARS TO MOVE FORWARD

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Only recently has post-fire recovery been properly recognized in the Portuguese public polices as a true strategic fire management process despite large areas of the territory burned recurrently. The new integrated fire management governance (put in process after the 2017 fire season) represents one serious opportunity to assert itself as a key process, regarding forest fires risk mitigation and adaptation.

Based on the historical periods of the fire risk management public policies and on current projects, the past 100 years of post-fire recovery policies are analyzed, as well as the challenges for the next decade and the drivers behind.

In the initial phases of the 20th century, the State and private landowners' response was based on reforestation. From the 1960s on, post-fire recovery public intervention became more complex and the 2003 fire season triggered a shift in post-fire recovery strategies, albeit with low practical results.

In line with the National Forest Strategy (2006) and the brand-new Integrated Wildland Fire Management System Act (2021), post-fire recovery is now envisioned as an essential part of the rural fire management component, coordinated by ICNF, the agency responsible for forest and landscape management, activities which also showed a great increase after 2017.

Aligned with the UN Sustainable Development Goals and Sendai Framework for Disaster Risk Reduction, the new post-fire recovery strategy is also an opportunity for risk reduction and readiness improvements, as it is focused on better landscape restoration, people engagement and empowerment, as well as fire adaptation of the 21st century rural communities.

ID528

OC50 - HOW EUCALYPTUS GLOBULUS AND ACACIA LONGIFOLIA BEHAVE AFTER-FIRE IN PORTUGAL?

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Objectives

The assessment of a naturalized Eucalyptus globulus and an invasive Acacia longifolia behaviour after off-season fires in Portugal was performed by studying 1) natural regeneration of E. globulus in managed and unmanaged plantations and surrounding areas of isolated seed-trees and 2) the bacteriome diversity inside A. longifolia root-nodules. Also, the impact of A. longifolia green-waste compost (GWC) on E. globulus and other native species' growth and survival was inferred.

Methods

Natural regeneration of Eucalyptus globulus plantations and in surrounding areas of seed-trees affected by June and October 2017 fires was assessed and compared with unburnt areas. The bacterial community was identified after collecting A. longifolia root-nodules from unburnt and burnt areas affected by the 2017 October fire. In addition, the growth and survival of E. globulus were evaluated after incorporating GWC after a fire.

Results

Fire date and pre-fire management influenced E. globulus natural regeneration, with greater establishment in unmanaged plantations affected by the October fire and the presence of seed-trees enhanced establishment. A. longifolia bacteriome has lower diversity after fire, but the main symbionts were nitrogen-fixing bacteria (e.g., Bradyrhizobium spp.), indicating a specialization that could enhance post-fire invasion. The incorporation of GWC potentiated species growth, increasing survival.

Conclusions

Pre-fire management restrained E. globulus establishment even after autumn fires, and seed-trees must be considered an important seed source. Acacia longifolia established promiscuous symbioses while adapting to a disturbed environment, effectively outcompeting other species. GWC incorporation had a positive impact on vegetation recovery in degraded ecosystems.

ID28

OC01 - CONTEXTUALIZING THE IMPLEMENTATION OF ENVIRONMENTAL EDUCATION IN INTEGRATED FIRE MANAGEMENT BY THE FEDERAL INDIGENOUS BRIGADE OF PREVFOGO/IBAMA/MA

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IBAMA/Prevfogo in the State of Maranhão/Brazil, is composed of 8 Federal Indigenous Brigades, from the ethnic groups: Gavião, Krikati, Guajajara and Kanela. Developing environmental education activities within the context of Integrated Fire Management (MIF). Its general objective is to sensitize the indigenous community with a view to preventing forest fires, with the implementation of nurseries for native species, areas of ecological restoration and recovery of springs. Thus, integrating it into management planning as a preventive action by the MIF. They combine food production associated with soil recovery, production of wood and fruit species, listed by the indigenous people as essential for the traditional indigenous way of life. The methodological basis is participatory, culminating in action plans following their needs adapted to their way of life, respecting traditional knowledge. They develop integrated practices such as: collecting seeds, preparing substrate for seedlings, producing native seedlings, conducting nurseries and planting seedlings in ecological restoration areas, combined with spontaneous forest management, among other techniques. As a result, we have an average production of 12,000 seedlings, the development of an estimated area of 10 acre with ecological restoration and recovery of springs spread across all Indigenous Lands in the priority area of action of Prevfogo/Ma. In addition to the reduction in forest fires and the return of hunting, it was observed that the environmental education activities planned together with the brigades and local communities make it possible to improve the environment as a whole and promote awareness of the reduction in the number of forest fires.

ID75

OC03 - WANĨ-HÊWA PROJECT: COMBINING INDIGENOUS PEOPLES' UNDERSTANDING OF WILDFIRE WITH EXPERIENCES FROM THE NATIONAL CENTER FOR WILDFIRE PREVENTION AND SUPPRESSION (PREVFOGO)

Lawrence Nóbrega de Oliveira[1], **Talita Freitas**[1], Luiz Motta[1], Gildimar Xerente[2]

[1]Prevfogo/Ibama, [2]Prevfogo/Ibama

Through the use of a geoprocessing platform, the Wanĩ-Hêwa Project seeks to combine the expertise of Prevfogo's with the knowledge of indigenous forest inhabitants regarding wildfire behaviour.

The project has 3 phases. The first one is the indigenous firefighter's professional qualification. The second phase is the data generation of traditional wildfire management techniques and indigenous land information. The third one is the resource fund to guarantee the project's sustainability.

This study is about the qualification phase, which is focused on teaching geoprocessing as a tool to make the project's second phase possible. There will be two knowledge paths. The geoprocessing analyst path will promote many skills on the GIS-based platform, trained and advised by Prevfogo's multidisciplinary specialists crew. We expect to co-create an innovative environment of learning while respecting cultural and social diversity. The other path, the application users, will be taught by the indigenous geoprocessing analysts advised by Prevfogos' specialists.

At first, there will be 24 indigenous firefighters qualified from 13 distinct ethnic groups (Wapichana, Xerente, Karajá, Kurã Bakari, Javaé, Kraho, Mehinaco, Kuikuro, Wauja, Kaiabi, Kamayurá, Aweti, Txicão) located in 3 Brazilian states (Mato Grosso, Roraima, and Tocantins). They will be guided to prepare a final paper, applying their knowledge to a relevant issue regarding the territorial fire management of their own communities.

The first phase of Wanĩ-Hêwa Project aspires to create, through qualification, an integrated and articulated network promoting autonomy and protagonism in the generation of indigenous-owned data about wildfire.

ID77

OC76 - SPACIAL DISTRIBUITION OF INDIGENOUS FIREFIGHTERS IN RORAIMA/BRAZIL: SOCIOECONOMIC AND ENVIRONMENTAL OPPORTUNITIES OF PREVFOGO'S FEDERAL BRIGADES PROGRAM IN INDIGENOUS RESERVES.

Joaquim Lima[1], Talita Freitas[2]

[1]National Center for Wildfire Prevention and Suppression (Prevfogo/Ibama), [2]National Center for Wildfire Prevention and Suppression (Prevfogo/Ibama)

The main goal of this study is to characterize the socioeconomic and environmental impacts of the indigenous firefighters' participation in the National Center for Wildfire Prevention and Suppression (Prevfogo)'s federal brigades program.

We considered 3 indicators to analyze the socioeconomic impact of the formation of indigenous brigades: 1) the spatial distribution of indigenous firefighters as a social vector of income distribution through the indigenous territories; 2) training and professional qualification related to Integrated Fire Management (IFM) as a development factor; and 3) voluntary prescribed burns conducted by the own indigenous communities as a mechanism of understanding the importance of IFM. Utilizing historical institutional data from Prevfogo, the study quantified the three indicators using maps, spatial analysis, and statistics.

There are six indigenous brigades in the State of Roraima, with 130 firefighters from three ethnic groups. They are located in 10 indigenous lands and 49 indigenous villages on 2,523,000 hectares. We observed that the firefighters' dispersion throughout the State of Roraima helps to socialize the incomes and the knowledge perceived during their participation in the brigades. We also noticed that the increased access to qualifications made job opportunities available to those who didn't have much formal education. It contributed to professional and personal improvement by combining traditional knowledge with technical-scientific expertise, especially related to IFM and territory management.

Therefore, we conclude that being part of an indigenous federal brigade brought more citizenship and government presence to far and remote regions, as well as facilitating access to income and employment opportunities.

ID112

OC06 - CDF. 20 YEARS OF TRAINING AND AWARENESS CAMPAIGNS: LESSONS LEARNED.

Victor Fernandez Huertas[1], ENRIQUE REY VAN DEN BERCKEN[1]

[1]*CDF - Junta De Castilla y León*

The Autonomous Region of Castilla y León created the Defence against the Fire Centre (CDF) in 2003 as a centre for training, research and education. It's been 20 years. Where are we now?

Learning and training

The Centre develops initial and periodic training activities for all the regional forest firefighting workers. The effort is focused on developing the necessary skills and on promoting a safety and security co-responsibility. The number of learning contents has been reduced to increase the practical activities. Nevertheless, the duration of face-to-face training activities has been reduced, thanks to the remote learning.

Qualification and certification Plan

Our system defines the basic training required for each professional profile and the periodic updating activities. The Plan has been adapted to improve the national training working group conclusions. The current evolution tends to increase practical exercises and to reduce the theory courses.

Awareness campaigns

The educational project was launched with the design of a permanent exhibition and guided tours of scholarships. It was complemented with mobile exhibitions traveling throughout the Community. Recently, we have designed activities that teachers carry out in their classrooms, by developing specific digital resources consistent with the formal education. We are also launching a campaign of educational workshops in schools by environmental Agents throughout the whole Community.

ID133

OC02 - THE NOLEEDI PROJECT: EFFECTS OF IFM CONDUCTED BY INDIGENOUS BRIGADES IN WILDFIRE PREVENTION AND BIODIVERSITY CONSERVATION IN A SAVANAH/WETLAND ECOTONE

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[1]*Ufms*

The Noleedi project (fire in Kadiwéu language) studied the effects of IFM conducted by indigenous brigades in wildfire prevention and biodiversity conservation in Kadiwéu indigenous land. The area comprises an Ecotone between Cerrado and Pantanal in Brazil. In this way we studied the effect of different fire regimes on target communities of plants and animals. Moreover, we focusing on structural reproductive phenology of plant species used by indigenous people. The results demonstrated the effectiveness of IFM on the reduction of wildfires, the area burned had a reduction of 53%. We also detected a reduction of climate influence on fire occurrence. In view of investigate biodiversity response to fire, we investigated the influence of fire history, comparing areas that experienced high frequency of wildfires with areas of low frequency of fires. We also study the effect of the last fire occurrence on biodiversity comparing areas that burned in the beginning of the dry season with areas that burned from the middle to the end of the dry season. Our initial results reveal that areas with high frequency of fire had a delayed fruiting compared with areas with low frequency. About Fauna, we found no difference in the occurrence of mammals in different fire regimes and a reduction of Avian diversity in areas with high fire frequency. We also a detected an increase in Solifuga abundance after fires. Those results are important to guide fire management in view of reduce biodiversity impact mainly for those species that are useful to local people.

ID265

OC04 - WE ARE FEW, BUT WE ARE NOT ALONE – THE IMPORTANCE OF WOMEN PARTICIPATION IN WILDFIRE PREVENTION AND SUPPRESSION BRIGADES

Isis Akemi Morimoto[1], **Thainan Bornato**[1], Thaís Fernandes[1], Ana Rosa Marques[1], Mariana Momesso[1]

[1]*Ibama - Brazilian Institute of the Environment and Renewable Natural Resources, related to The Ministry of the Environment*

The present paper intents to talk about the women participation in Federal Brigades for the Prevention and Suppression of Wildfire - BRIFs. The motivation for choosing this theme came from the impressions taken from environmental educators who participated in a training process given by the Brazilian Institute of the Environment and Renewable Natural Resources - IBAMA in June 2022. After this training, the participants held 23 Environmental Education Workshops about Integrative Management of Fire in indigenous communities, quilombos and rural settlements from different regions of Brazil. The initial perceptions pointed to a small number of women in the BRIFs, however, they showed a very high potential for aggregation and determination that came to improve the brigade teams in many aspects. After a survey of data with the administration of the National Center for Wildfire Prevention and Suppression - Prevfogo and a consultation through a form with the IBAMA employees who participated in the training course for facilitators in Environmental Education, it was possible to verify the number of women participating in the brigades, the number of leadership positions held by them (state coordination, brigade supervision, brigade leadership and squadron leadership). By this experience, we could identify some aspects that came to contribute to women being able to participate in these activities, as well as some issues that can be improved to encourage and enhance women's access to the Wildfire Prevention and Suppression Brigades throughout the country.

ID464

OC05 - THE TRAINING OF INSTRUCTORS IN WILDLAND FIREFIGHTERS COURSES: A COMPARISON BETWEEN BRAZIL, THE USA AND CHILE.

Elisa Silva[1], Paula Lima[1]

[1]*Ibama*

Qualified fire brigade training is essential for safe and effective action in preventing and fighting forest fires. In order to evaluate how the training of these professionals occurs in different countries, this study compared the curriculum plans of training courses for brigade members given in Brazil, the United States and Chile. A comparative research method was adopted, seeking to identify the similarities and singularities of the guidelines given to course instructors, through documental analysis. From the collected data, basic components were identified in all lesson plans and instructor training manuals, such as basic concepts. However, it was identified that each course has a more specific focus: Brazil has a greater focus on Integrated Fire Management and Fire Behavior, the USA emphasizes techniques and combat practices and, finally, Chile emphasizes more aspects related to the profile and didactic training of instructors. The evaluation carried out can contribute to an analysis of each country on the emphasis given to their training courses and to the improvement of training processes in the countries.

ID125

OC10 - IMPLEMENTATION OF WILDFIRE TECHNOLOGY SOLUTION FOR CAL FIRE (CALIFORNIA), LESSONS LEARNED AND PATH FORWARD

Philip SeLegue[2], **Joaquín Ramirez**[1]

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Objectives

In 2019, CAL FIRE started a process to implement technologies to support the wildfire crisis, which continued dramatically during the 2020 and 2021 fire seasons. This process led to the creation of an Intel community that implemented state of art fire risk modeling, monitoring, and tactical tools.

Methods

There was a request for innovative ideas in 2019 to support fire detection, monitoring, and operational wildfire risk modeling, both in advance and for individual incidents. After 131 proposals, Technosylva was selected to implement Wildfire Analyst and Tactical Analyst statewide as the state's authoritative solutions to evaluate operational fire behavior and support wildfire operations.

Results

During the last three years, a community of more than 4000 users has been trained and used these tools during the initial attack and in major incidents, from Dispatch centers, Emergency Command Centers, Incident Command Posts, and in the Field.

More than 30,000 incidents received an assessment, and more than 70000 simulations supported the intel mission.

Real-time tracking of resources, updates of fire progression every 15 min with DoD data, integration of > 1000 cameras, high-resolution weather and fuel models, and stations data, including WRF-SFire and other operational models, together with information from a mobile app is changing the paradigm of the Situation Units with these new capabilities.

Conclusions

Taking these proven tools to real operations has allowed capturing the needed data to improve the scientific models and make the advances needed to support the Intel Community.

ID126

OC09 - SPARK OPERATIONAL: AUSTRALIA'S NEW NATIONAL BUSHFIRE SIMULATOR

John Bally[1], James Hilton[2], Andrew Sullivan[3], Will Swedosh[2], **Sandra Whight**[1]

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Improvements in understanding fire behaviour and associated modelling drove a need to update Australia's bushfire spread simulation capability to a more flexible, modular and computationally efficient. In 2020, the Spark bushfire spread framework, built by CSIRO, was selected by AFAC to form the foundations of the next generation national operational bushfire spread simulator. Spark Operational has been designed for, and with the input from, Australia's rural fire and land management agencies.

The underlying design paradigm for Spark (and its subsequent operational variant) has been flexibility of construction, streamlining of common processes, and speed and efficiency of computation and data management. Key elements in Spark include a computationally economical fire perimeter expansion algorithm that allows thousands of fires to propagate simultaneously and efficiently deal with perimeters that merge or overlap; the ability to implement numerous fuel type-specific fire spread models concurrently, and the ability to utilise state-of-the-art computer hardware to accelerate processing.

The Spark framework implements fire science components (e.g., primary fire spread and ancillary models) as scripts that allow new models to be added and evaluated rapidly, unlike older simulators that hard-coded models and associated data. Similarly, the data requirements for Spark's fire models are also defined such that new or different sources may be accessed or generated as required in the most streamlined manner.

This presentation will outline the intent, structure and operation of Spark Operational that makes it suitable as the next generation bushfire simulator with flexibility to be adopted internationally.

ID226

OC12 - HYBRID ENVIRONMENTAL MONITORING FOR EARLY WILDFIRE DETECTION

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[1]VTT, [2]TNO

When it comes to wildfire detection, high-altitude surveillance allows for more efficient monitoring of vast expanses, but the comparatively low-resolution is a source of ambiguity (false positives or negatives). Conversely, low-altitude flights will yield the accurate real-time data required for early detection but scaling it up would require an unfeasibly large fleet. The objective is to compare these two approaches in scenarios featuring different models of autonomous unmanned air vehicles (UAV).

We investigate how a network of patrol routes, the topology of which reflects the constraints of the different drone models, would allow for the detection and disambiguation of a fire event at variable stages. We use a simple simulation-based method informed by reasonable assumptions about the relationship between altitude, autonomy, maneuverability, observation range and accuracy, to produce quantitative performance estimates for several alternative types of UAV (e.g., fixed-wing vs. quadcopter).

Our results emphasise the benefits of a hybrid approach combining multiple types of autonomous UAVs operating on different scales. In such a scenario, a fleet of high-altitude, long range, fixed-wing aircraft is used to continuously update a coarse-grained picture of a large area. Upon detecting a suspected fire event, these units may call for a disambiguation mission to be executed by a smaller, low-altitude drone.

We conclude that machine intelligence enablers such as division of labour and flight plan coordination, as well as other important factors such as optimal positioning of automated UAV facilities, are critical to the performance of such a hybrid wildfire detection strategy.

ID238

OC13 - ESTIMATION OF BYRAM'S FIRE INTENSITY AND RATE OF SPREAD FROMSPACEBORNE REMOTE SENSING DATA

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Fire intensity is the most commonly used term describing fire behaviour in the wildfire community. It is, however, difficult to observe from space. Here, we assess fire spread and fire radiative power using infrared sensors with different spatial, spectral and temporal resolutions. The sensors used offer either high spatial resolution for fire detection, but a low temporal resolution, moderate spatial resolution and daily observations (VIIRS), and high temporal resolution with low spatial resolution and fire radiative power retrievals (Meteosat SEVIRI). We extracted fire fronts from Sentinel-2 and use the available fire products for S-NPP VIIRS and Meteosat SEVIRI. Rate of spread was analysed by measuring the displacement of fire fronts between the mid-morning Sentinel-2 overpasses and the early afternoon VIIRS overpasses. We furthermore tested assessing rate of spread from Planet and Sentinel -2 data, which are both available at high spatial resolution and overpasses are only a short time apart. We retrieved FRP from 15-min Meteosat SEVIRI observations and estimated total fire radiative energy release over the observed fire fronts. This was then converted to total fuel consumption per unit area. Using rate of spread and fuel consumption, Byram's fire intensity could be derived. We tested this approach in a frequently burning West African savanna landscape. Comparison to field experiments and fire behaviour models showed similar results between field observations, model outputs and remote-sensing-derived estimates. Further development may lead to a remote sensing and model-based fire intensity product replacing widespread assumptions on fire intensity based on fire season.

ID351

OC07 - TERRESTRIAL LASER SCANNING FOR THE ESTIMATION OF TREE VOLUME AND BIOMASS OF CONIFER STEMS TO PROJECT FIRE BEHAVIOR

José Antonio Hernández-Moreno[1], Diego R Pérez-Salicrup[1], **Alejandro Velazquez**[2]

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Accurately estimating tree volume and biomass is necessary for forest ecology and fundamental for fire management. However, traditional methods for their estimation are expensive, require a large amount of labor and material resources, and may require destructive sampling. In this study, we used a terrestrial laser scanner (TLS) and free software to estimate the volume and biomass of tree trunks in individual trees of two coniferous species, Abies religiosa (Kunth) Schltdl. & Cham and Pinus pseudostrobus Lindl, in two plots of the Monarch Butterfly Biosphere Reserve, Michoacán, Mexico. Comparisons between measurements with predictive models (destructive method) and TLS (non-destructive method) showed no significant differences. The TLS represents an alternative to the traditional methods of measurement, which allows for the estimation of diameters at different heights through the cloud of points, which opens new opportunities to characterize standing tree volume and biomass and their burning potential, as well as ladder fuels. The results show that this increasingly accessible technology can be used by local rural inhabitants to adequately estimate aerial biomass and fuel loads in a non-destructive manner and with a more efficient use of time.

ID378

OC08 - NASA'S WILDLAND FIRE MANAGEMENT PROGRAM

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The NASA Wildland Fire Management Program was initiated within NASA's Earth Science Division in 2021. Its mission is threefold: 1) assemble communities of practice through collaborative efforts with government, academia, and the private sector; 2) co-develop knowledge and applications with relevant stakeholders in the wildfire community; and 3) improve wildland fire management through the transitioning of NASA technology and applied science to stakeholder organizations.

The program is focusing on supporting proactive fire management, including situational awareness, preparedness, and risk mitigation. This will be accomplished through selected projects that identify management challenges, relevant partnerships and users, and the NASA technology that will be utilized to deliver innovative solutions to managing wildfires. Examples include: 1) investigation of evaporative stress from OpenET to help predict the risk of wildfire occurrence in watersheds, 2) incorporation of space based LiDAR for the generation of 3-dimensional forest fuel metrics, used to improve wildfire risk and behavior models, 3) integration of global, multi-platform geostationary active fire data in near-real-time into NASA's Fire Information for Resource Management System (FIRMS), and 4) identification of post-fire ecohydrological conditions using thermal, multispectral, synthetic aperture radar (SAR), and hyperspectral remotely-sensed data to improve flood hazard forecast models.

In addition, the program is hosting the Actionable Fire Science Hub, a NASA portal for stakeholders to share fire management information and to enable more effective collaboration. This will include open data and other content, and an environment for development and assessment of solutions for adapting to, managing, and living with wildfires.

ID516

OC11 - MAPPING BURNED AREAS IN THE BRAZILIAN AMAZON USING DEEP LEARNING AND PLANETSCOPE IMAGERY.

Leonardo Peres[1], Diogo Nunes Gonçalves[1], José Marcato Junior[2], Márcio Santos de Araújo[2], Isabella Favero[2], Wesley Nunes Gonçalves[2], Renata Libonati[1]

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The mapping of burned areas has been important for the implementation of public policies for planning, control and suppression of fires. Deep learning based methods have been considered state-of-the-art in several environmental applications, although they have limitations in generalizability when training samples collected from a spatial region different from the one used in the mapping. Therefore, our objective is to assess the generalization and mapping capability of burned areas in the Brazilian Amazon using deep learning and PlanetScope imagery. Respecting to generalization, we used only images from the Brazilian Pantanal for training, which is the largest wetland in the world. These images were divided into patches with 512 x 512 pixels and manually labeled, comprising 4-band PlanetScope multispectral imagery with spatial resolution of four meters. The dataset consisting of 5222 patches for training and 88 patches for validation was used to train SegFormer, an efficient semantic segmentation method that combines transformers and multilayer perceptron decoders. For the test, 448 patches from the Brazilian Amazon were used to investigate the ability of the proposed methodology to map burned areas, as well as its generalization. Our methodology achieved 80.57% of IoU, 90.71% of pixel accuracy and 89.24% of F-Score. The obtained results indicate that transformer-based networks are suitable to deal with the mapping of burned areas based on high spatial resolution images, even when trained and evaluated in different regions. Future studies should explore the potential of vision transformer architectures to mapping burned areas.

ID0

OC75 - HOW ARE RESIDENTS' EVACUATION DECISION-MAKING PROCESSES AFFECTED BY CHANGING WILDFIRE BEHAVIOR? INVESTIGATING THE 2020 EAST TROUBLESOME FIRE IN COLORADO, USA

Catrin Edgeley[1], William Cannon[1], Scott Pearse[2], Branko Kosovic[2], Gabriele Pfister[2], Rajesh Kumar[2]

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A growing body of research explores how fire behavior and related environmental conditions affect evacuation decision-making during wildfires. Understanding how fire behavior and human behavior interact can help improve evacuation models, develop more effective emergency communication, and support the design of evacuation plans that better reflect local social and ecological contexts, among other benefits. The objective of our research is to better characterize the role that extreme fire behavior plays in wildland-urban interface evacuation. To better understand the fire behavior-human behavior nexus, we conducted 35 interviews with 47 individuals affected by the East Troublesome Fire that burned in Grand County, Colorado USA during October 2020. This fire exhibited extreme behavior, which made it ideal for investigating how considerations such as wind speed and direction, smoke and broader air quality concerns, and the fire's rate of spread, affected the timing and execution of decision-making related to evacuation. During the interviews, we introduced a series of 3D visualizations of the fire's behavior and related weather conditions for October 21-22nd, the period when fire behavior and related social impacts from the fire were most intense. Visualizations were developed from fire and weather model data in partnership with the National Center for Atmospheric Research. We will present a timeline of the fire's behavior paired with common behaviors that were triggered by each notable environmental cue. We conclude with recommendations for incorporating social responses to fire behavior into community hazard planning for risk reduction.

ID106

OC73 - TERRITORIAL VULNERABILITY. ASSESSMENT USING AN EXPERT OPINION BASED MULTICRITERIA MODEL.

Eric Maillé[1]

[1]*Inrae-recover*

Objective

The objective is to develop a model for a relative assessment of territorial vulnerabilities to wildfire, to support local responsible in land management decision making. The aim is to compare the global vulnerability of local territories in order to prioritize correction actions on the most critical situations.

Methods

In order to assess territorial vulnerabilities, we used the multicriteria formalism and method. The formalism requires to organize the territorial stakes in a sematic hierarchy, ie. in classes and subclasses. A relative weigh is assigned to each stake classes and subclasses at the same level of a hierarchy. The weigh represents the importance of the stake class relatively to the others. Weight are assessed using analytical hierarchy processes applied to expert opinions individual judgments. Specific metrics were developed in order to properly take into account both the number of objects (class instances) and the dimension (size) of each object. The method was applied to the Baronnies Provençales Natural Regional Park.

Results

Results show a high variability of vulnerability level even on neighboring communes, due to high variations of stakes population of each classes. The specific vulnerability indexes allow to identify hot spot of vulnerability, mainly related to the person's related criteria (inhabitants, touristic accommodation sites, health infrastructures, etc.

Conclusion

Application of a multicriteria approach for territorial vulnerability assessment provide useful diagnosis in order for decision makers to anticipate the previewed future expansion. Some methodological questions, notably related to the quantification of the stakes dimension and population have still to be deepen.

ID168

OC71 - INCLUSIVE COMMUNITY ENGAGEMENT IN DISASTER PREPAREDNESS AND RESPONSE FOCUSING ON WILDFIRES AND THE GENERATED SMOKE: BEST PRACTICES AND LESSONS LEARNED

Sofia Karma[1], Milt Statheropoulos[1]

[1]*National Technical University of Athens*

The intensified weather events recorded on a global basis have been correlated with the so-called “climate crisis”; prolonged droughts, extremely high temperatures and heat waves usually result in destructive wildfires and huge quantities of smoke that may cross the borders with the respective impacts on the exposed populations.

Objectives

1. To tackle the importance of inclusive community engagement in disaster preparedness and response for reducing vulnerabilities according to the Sendai Framework goals, focusing on wildfires and the generated smoke.

2. To highlight the significance of running tabletop exercises or simulated drills with groups that may be considered vulnerable in disasters, like people with disabilities, or children for standardization of procedures.

Methods

Best practices and lessons learned on how locally-led action with inclusive criteria may strengthen communities’ disaster resilience upon emerging risks in reference to international experiences, are gathered and presented here; experiences based on the research prepared so far by the European Center for Forest Fires of the EUR-OPA Major Hazards Agreement, will also be shared.

Results

Community-level disaster risk management could be proved a critical element for the training of communities at risk to cope with emergencies, leaving no one behind; possible synergisms and interconnections among the key players will be discussed.

Conclusions

Empowerment of a people-centred approach and active involvement of citizens with no discrimination in disaster preparedness and response activities may reinforce communities’ resilience in a more sustainable manner; the combination of a bottom-up with a top-down approach could be considered in disaster risk governance.

ID205

OC69 - THE MODIS FIRE SATELLITE PRODUCTS: A MULTIDECADAL BASELINE FOR GLOBAL FIRE ACTIVITY AND FIRE REGIMES

Luigi Boschetti[1], David Roy, Louis Giglio

[1]*University of Idaho*

NASA's Terra and Aqua satellites enabled, for the first time, systematic production of high quality, multi-year, global 1 km active fire and 500-m burned area maps using observations from the Moderate Resolution Imaging Spectroradiometer (MODIS). The 20-year NASA MODIS fire product record is the only science quality, reprocessed record of global fire activity, and plays a fundamental role in understanding the spatiotemporal drivers of fire activity and for emissions estimation and the relationship between climate and fire.

This presentation will focus on:

- The current state of the MODIS active fire and burned area products, and on the planned transition to the VIIRS instrument in order to provide the first ever global fire record covering the 30-year period conventionally required for climate analysis

- The use of the MODIS fire products to support national to continental level fire assessment and reporting, with particular regards to the tools developed available in the Global Wildfire Information System (GWIS).

We will illustrate the use of documented, transparent and reproducible methods for the derivation of summary statistics for supporting analysts and policy makers for the analysis of historical data, for the detection of anomalies in timing and intensity of the fire season, and for compiling summary reports and emission inventories.

ID274

OC70 - INTEGRATION OF RESIDENTIAL STRUCTURES LOSS FUNCTIONS INTO WILDFIRE RISK ASSESSMENT

Jonathan Boucher[1], Ahmad Abo El Ezz[2], Vittorio Nicoletta[1], Anne Cotton-Gagnon[1], Raphaël Chavardes[1]

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Understanding wildfire impacts on structures in wildland urban interface (WUI) communities is fundamental for emergency response and mitigation planning to reduce potential social and economic losses. The magnitude of structures loss determines the direct economic costs for re-building, indirect economic losses due to evacuation and disruption of economic activities as well as shelter needs. Here we will present a framework for the development and implementation of wildfire impact assessment of WUI residential structures for both deterministic incident-level and probabilistic community or regional scale analysis. The framework is made of the following successive components: hazard, inventory, exposure, and impact. The hazard model generates spatial and temporal distribution of fire intensity for wildfire event scenarios; the inventory model provides spatial pattern of exposed structures; the exposure model estimates the fire intensity at WUI locations; and the impact model evaluates the structures loss. This last component is done by applying newly developed empirical response functions represented as the relationship between fire intensity, distance from forest edge, resulting in expected proportion of burned structures. Risk analyses using this framework are synthesized into a number of impact indicators that will be showcased through two case studies using both deterministic and probabilistic based approaches.

ID278

OC72 - THE EVOLUTION OF THE ACCIDENT REVIEW PROCESS WITHIN THE USDA FOREST SERVICE

Joe Harris[1], Ben Iverson[1]

[1]USDA Forest Service, [2]California Institute of integral Studies

Objective

To describe the evolution of accident reviews within the USDA Forest Service.

Methods

A case study in how an organization went from focusing on the pointy end operator in the aftermath of an accident, to focusing on a systems approach with an emphasis on organizational learning as a means of preventing accidents.

Results

The Forest Service went from blaming pointy end operators as a means of preventing accidents to focusing on the system of work to prevent accidents. This entailed setting the stage for those who were present during an accident to tell their accounts of what happened so that the organizational leadership could suss out the conditions and pressures present at the time of the accident. Once the organization has a better understanding of the conditions of the accident, they are better positioned to make up-stream changes to the system of work so that the people on the ground are better supported by the agency. This then grew into a metareview effort that took into account 10 years worth of accidents that focused on relieving pressure up-stream in the organizational system of work. This metareview captures themes to focus on into the future to set the stage for a better organizational accident record moving forward.

Conclusions

Changing the nature of accident reviews in this way profoundly increased the trust within the ranks of the organization. The result was a reporting and learning culture within the Forest Service as a whole.

ID500

OC74 - DEFORESTATION AND AGRICULTURE DRIVE AMAZON FIRE ACTIVITY, WHILE DROUGHTS RIDE IN THE SHOTGUN SEAT.

Prof Renata Libonati[1,2,3], José Miguel Cardoso Pereira[2], **Carlos C. da Câmara**[3], Leonardo Peres[1,4], Ricardo M. Trigo[1,3], Duarte Oom[2], J. A. Rodrigues[1], F. L. M Santos[1], Celia M. Gouveia[3,4], A. Enrich Prast[1,5], F. Machado Silva[1,6], J. M. N Silva[2]

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The effects of land cover changes, compounded by the severe droughts of 2005 and 2010, pushed the Amazon Basin towards outstanding fire seasons. The record-breaking drought of 2015, exacerbated by El Niño, raised concerns about a fire season of unprecedented severity. However, using reliable remote sensing data, we show that fire activity in 2015 remained weak, at 54% and 44% of the levels attained in 2005 and 2010, and 25% below the average of the preceding 13 years. This contrast was enhanced when analyzing the energy released by persistent fires associated with deforestation activities, together with their spatial distribution. A principal component analysis yielded spatio-temporal patterns emphasizing that fire activity is higher, and the drought-fire relationship is stronger, when and where deforestation occurs. We then demonstrated that the overall decrease in deforestation rate was key to prevent the outbreak of biomass burning, despite the adverse meteorological conditions triggered by the outstanding drought of 2015. By dismissing the recently suggested decoupling between deforestation and fire activity driven by 21st century droughts, our results clearly show that the Amazon sensitivity to on-going shifts in anthropogenic pressure cannot be disregarded. The Amazon forest – still the largest tropical rainforest in the world – again is experiencing increasingly uncontrolled land occupation by agribusiness and mining interests, leading to increased deforestation rates. Therefore, ongoing undermining of environmental regulations and increased drought frequency projected by climate models are likely to bring large scale fire-disruption upon the Amazon ecosystem.

ID13

OC30 - WATER UTILITY RISK PERCEPTIONS AND ENGAGEMENT IN WILDFIRE MITIGATION ACTIVITIES IN WATERSHEDS IN THE WESTERN UNITED STATES

Ben Jones[1], Julie Padowski[2], Melinda Morgan[3]

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Climate-adaptation in wildfire-prone watersheds requires innovative partnerships and funding. Water utilities are one stakeholder group playing a role in these efforts with an increasing number of utilities engaging directly or indirectly in wildfire mitigation activities. The objective of this study was to understand how risk perceptions and other factors influence the engagement of water utilities in wildfire mitigation efforts in the western United States. We conducted an online survey of water utilities in nine states and received 180 responses. While most respondents were concerned or very concerned about future wildfire events and the impact of wildfire on their operations, only 72 utilities (40%) felt they were at least partially responsible for mitigating wildfire risk. Using binary regression models, we explored how a utility's risk perceptions, biophysical characteristics, and utility characteristics explained these perceptions of responsibility for wildfire risk mitigation. Of the 72 water utilities engaging in wildfire risk mitigation, the most prevalent activities were forest thinning, building fire breaks, and creating fire access roads. These water utilities typically partnered with federal and local government agencies or other water utilities to complete this work. Water utilities funded these activities through a mix of water user fees and grants. Funding was identified as a major barrier to wildfire mitigation activities; other barriers included land ownership and information needs. These findings shed light on what factors influence water utility engagement in wildfire mitigation for water security and help identify leverage points to increase future engagement.

ID52

OC29 - MONCHIQUE'S INNOVATION LABORATORY - A SPACE FOR DIALOGUE AND KNOWLEDGE SHARING TO FOSTER COMMUNITY-BASED DISASTER RISK REDUCTION IN FOREST-PRONE AREAS

Maria Partidário, **Joana Dias**[1], Guilherme Saad, Ana Soares, Isabel Loupa Ramos, Rute Martins, Margarida Monteiro

[1]*Instituto Superior Técnico*

BRIDGE (Bridging science and local communities for wildfire risk reduction) is an action-research project developing a community-based disaster risk reduction (CBDRR) process which is being fostered through a collaborative innovation laboratory (InnoLab). The purpose is to integrate different forms of knowledge and action, linking science and local communities to reduce their vulnerability and to enhance strategies for forest fire risk reduction. With application to Monchique, a forest fire-prone municipality in Portugal, the InnoLab creates a space for dialogue and knowledge sharing between the multiple actors (local communities, science and organizations) that, directly or indirectly, manage Monchique's forest territories. This way, BRIDGE attempts to facilitate social learning about the risk of forest fires, strengthen collaborative networks and enhance adaptive capacities, both socially and institutionally, for the prevention of forest fires. This presentation aims to share the results of the InnoLab activities, which include (i) school community activities on wildfire risk perception; (ii) participatory mapping of Monchique's vulnerabilities and risks; (iii) participatory sessions to create the community visioning for Monchique's territory, to define priorities and capacities to be improved and to identify functions and responsibilities to act; (iv) workshop on CBDRR strategies for action. Lessons are shared on how the different actors perceive their territory (vulnerabilities, risks and opportunities), and on how they can build local capacities towards a more enduring commitment with wildfire risk reduction policy.

ID175

OC31 - ADDRESSING EQUITY AND JUSTICE IN INTEGRATED WILDFIRE RISK MANAGEMENT

Eduard Plana[1], Thomas Schinko[2], Claudia Berchtold[3], John Handmer[2], Teresa Deubelli-Hwang[2], JoAnne Linnerooth-Bayer[2], Eva Preinfalk[2], Anna Scolobig[2], Marta Serra[1]

[1]Forest Science And Technology Centre Of Catalonia, [2]International Institute for Applied Systems Analysis (IIASA), [3]Fraunhofer Institute for Technological Trend Analysis INT

Throughout history, ecosystems and societies have adapted to wildfires, but there is increasing evidence that anthropogenic climate change as well as socioeconomic development are altering wildfire regimes leading to increasing wildfire risk globally and to unprecedented extreme events. More communities and sectors are impacted by wildfires, escalating existing inequalities and leading to conflicts or disfunctions in defining and implementing integrated wildfire risk management (WFRM) strategies. Particularly, what is perceived as fair in terms of outcomes and processes in the development of integrated WFRM approaches is a key concern.

Bringing together the concepts of integrated WFRM and Just Transition (JT), we identify emerging conflicts and challenges along justice dimensions (distributional, procedural and restorative), as well as justice gaps across WFRM phases (prevention, preparedness, response and recovery).

We show that distributional, procedural and restorative justice challenges are evident across all four phases of the WFRM cycle, and across social, economic, cultural and ecological dimensions that impact the process. The challenges are linked to trade-offs arising from (in)actions influencing hazards, exposures and vulnerabilities and the risk ownership definition.

To limit conflicts and inequalities and increase political feasibility and good governance for risk management, justice issues need to be proactively addressed with the goal to establish integrated WFRM approaches that are perceived as fair by all relevant stakeholders. Hence, in upgrading WFRM strategies at the local, national and regional levels, policy and decision makers are advised to explicitly address the (often) implicit justice considerations across the WFRM cycle.

ID344

OC33 - A PARTICIPATORY METHODOLOGICAL APPROACH FOR POLICY DESIGN IN THE FOREST SECTOR

Sandra Valente[1], Alexandra Marques[1], Marta Martins[1], Carlos Fonseca[1]

[1]ForestWISE

The transition from ‘government’ to ‘governance’, integrating the relevant cross-cutting policies and enhancing the active participation of a range of stakeholders, is still a long journey to be performed by the forestry policies in several European countries, including Portugal. Despite a general understanding of how participatory processes can lead to beneficial outcomes, there is still a lack of evidence-based knowledge on what works, where and for whom, and the need to generalize from these experiences and develop theories to explain factors leading to a successful stakeholder engagement.

This communication aims to present the methodological framework that has been used and improved to gather and generate common interests and future objectives for the territories affected by wildfires. The framework design is supported by the literature pointing to the benefits of collaborative and participatory approaches and their impact on forest governance. The methodology has been used in a case study in Portugal, which deals with complex and wicked problems, such as rural abandonment and wildfires. Researchers developed the methodological framework and facilitated its implementation at the case study level. There is a widespread consensus across different stakeholder groups on the main priorities, some of them already covered by public policy. It was observed that stakeholder groups tend to prioritize projects located in their actuation sphere and role, reinforcing the role of systematic stakeholder representation in participatory decision-making approaches.

ID419

OC34 - BUILDING INDIGENOUS FIRE MANAGEMENT IN SOUTH AMERICA. THE EXPERIENCES OF PARUPA INTERNATIONAL NETWORK & CIR (RORAIMA INDIGENOUS COUNCIL), BRAZIL.

Vincenzo Lauriola[1], Sineia Bezerra do Vale[2]

[1]Mcti Ministerio de Ciencia Tecnologia & Inovação, [2]CIR Conselho Indigena de Roraima

Objectives

Indigenous peoples in different biomes have long been using fire for several ends. For many years, these practices have been ignored or forbidden in protected areas and other fire-related State & Government policies. More recently, the "zero fire" paradigm is being questioned, as fire management is increasingly acknowledged as a conservation ally, and so is traditional ecologic knowledge, including indigenous fire practices.

Methods

Two related cases will be presented: 1) an international network which, born in Parupa science station, in Gran Sabana, Pemón indigenous territory, Venezuela, in 2015, then promoted activities in Brasilia (2017) and at Wildfire 2019, Campo Grande, Brazil; 2) the activity, lead by Brazil's Indigenous Climate Change Committee (CIMC) member Sineia Vale Wapichana of CIR (Roraima Indigenous Council), a paramount indigenous organization, in partnership with IBAMA's Prevfogo (federal initiative to counter bushfires in Brazil's federal lands).

Results

We observed a richness and wide diversity of mutually agreed results analyzing these process-cases along almost a decade, such as: i) agreement on common goals and challenges, ii) mutual recognition of different perspectives and legitimacy, iii) need for intercultural and participative approach to design and implement viable solutions.

Conclusions

Despite Indigenous peoples' involvement in policy-making remains limited, things have been evolving in promising ways in several cases, provided an earnest and peer-to-peer dialogue be established involving indigenous experts, scientists and policy practitioners. The complexity of intercultural dialogue requires strong and permanent investments in social capital, representing a key contribution to the resilience needed by socioecosystems to face sustainability challenges.

ID481

OC32 - CLIMATE-ADAPTED FIRE RISK MANAGEMENT: AN INTEGRATED PORTFOLIO APPROACH FOR THE SOUTHWESTERN USA

Carolyn Enquist[1]

[1]US Geological Survey

Trends in wildfire size and severity are increasing across the globe, resulting in loss of property, life, and alteration of ecosystems. In the USA, this trend is most pronounced in the Southwest, where seven of the ten largest wildfires in 2020-2021 occurred. These trends are projected to continue at an increasingly rapid pace, resulting in significant challenges for natural resource managers, in addition to human populations that live adjacent to fire-adapted ecosystems. To reduce wildfire risks, implementation of adaptation is critical for effective natural resource management under ongoing climate change. The Southwest Adaptation Science Center (SWCASC) works across California, Arizona, New Mexico, Nevada, and Utah to meet wildfire and other climate-induced challenges. Established in 2011, the Center supports actionable science and implementable solutions in partnership with resource managers, policymakers, Native Nations, and researchers. This talk will highlight the diverse set of partnerships related to wildfire and its unique research portfolio focused on the nexus of fire ecology, climate science, and management. Our approach to climate adaptation and risk management includes a deliberate integration of western science with Indigenous knowledge systems in a variety of formats to leverage synergistic adaptation actions, such as prescribed fire and cultural burning practices, a form of low-intensity burning, to promote ecosystem and cultural resilience. The SWCASC incorporates stakeholder engagement at all phases of our work to ensure the co-production of science for broader buy-in at different scales. In turn, the SWCASC is positioned to effectively address the growing urgency of climate change and wildfire risk.

ID508

OC28 - IMPROVING WILDFIRE PREPAREDNESS: LESSONS FROM A SCHOOL RADIO EDUCATIONAL PROGRAM

Jose Azevedo[1], **Fantina Maria Tedim**[1], Isabel Reis[1], Professor Miguel Midões[1], Filipa Pereira[1], Ivone Santos[1], Susana Neves[1], João Barreiros[1], Raquel Torres[1]

[1]*Porto University*

Objectives

To examine the relationship between participation in a wildfire education program and levels of risk perceptions, and preparedness by comparing students in four high schools.

Methods (Three steps method)

1. A survey (risk perceptions, wildfire experience and household preparedness) high school students- 4 different locations Portugal.
2. A 14 sessions school program workshop about wildfire awareness and preparedness through a participatory radio production was performed in 4 participant schools. Topics: a) wildfires awareness and preparedness, b) radio production, c) creation of a participatory radio program.
3. Interviews with participants considering their evaluation of the experience and learnings acquired.

Results

Wildfire awareness and practices were found to be poor. The research highlights areas of change for future wildfire education programmes and provides support for the continued inclusion of this topic in the curriculum. Using radio as a tool seems to have a high potential for integrating climate change and widlfire topics across the curriculum with a focus on civic action. In other words, this learning approach will help build the mindsets and know-how of the world's young people to be the drivers now and in the future of climate-smart nations.

Conclusions

The paper offers insight into the effectiveness and benefit of incorporating fire preparedness education into the school curriculum in Portugal. Together with an emphasis on multiple domains of knowledge, including indigenous, place-based, and intergenerational knowledge, wildfire education can become an important entry point to developing a breadth of "green skills" and pro-environmental behaviors.

ID96

OC48 - SOCIAL NETWORK ANALYSIS (SNA) AND ADAPTIVE CO-MANAGEMENT TO FOREST FIRES: A CASE STUDY OF SERRA DE MONCHIQUE, PORTUGAL

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This communication presents the results of a master dissertation on Social Network Analysis (SNA) and Adaptive Co-management to forest fires. The research was developed under the scope of the BRIDGE project (PCIF/AGT/0072/2019), focusing on the case study of Serra de Monchique (Portugal). It aimed to carry out an in-depth study about the structure and the dynamics of the actors' network that intervene, directly or indirectly, in the management of forest territories in Monchique, enabling the analysis of the actors' network characteristics that may contribute to promote collaboration and social learning, key aspects of adaptive co-management to forest fires. The SNA method was adopted in the actors´ network involved in the management of Monchique forest territories, including entities of the Integrated Rural Fire Management System (SGIFR) and local landowners, enabling to identify patterns of interaction (structure), connectivity and dynamics/flows of the actors network, as well as the role (influence and/or articulation) played by the actors within network. As a result, were identified aspects of the current actors' network that may contribute to an initial phase of adaptive co-management, namely the high density of interactions and the potential role of central actors to promote social learning and articulation among actors less integrated in the SGIFR Network. On the other hand, aspects such as the predominance of low intensity and/or frequency interactions between actors (weak ties) and the peripheral position (less integrated to the network) of local entities and local landowners represent constraints for adaptive co-management to forest fires in the long-term perspective.

ID169

OC43 - IDENTIFYING TRAFFIC STRATEGIES FOR WILDFIRE EVACUATIONS USING PAST BEHAVIOUR OF EVACUEES

Stephen Wong[1]

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Evacuations are a critical tool for municipalities to move people safely away from hazardous situations. Most research on wildfire evacuations has largely focused on the decision to evacuate or stay. However, other key choices in evacuations (e.g., departure time, transportation mode, route, destination, and shelter type) have been largely understudied despite their important implications for transportation systems, evacuation planning, and traffic operations. To address this critical research gap, we surveyed individuals impacted by the 2017 December Southern California Wildfires (n=226) and the 2018 Carr Wildfire (n=284).

Using these data, we developed two portfolio choice models (PCMs), which jointly model choice dimensions to assess multi-dimensional evacuation choice. This presentation focuses on the transportation response needs for municipalities based on evidence from the PCMs. For example, we find that respondents from both wildfires stated that they had a joint preference for within-county and nighttime evacuations and a joint dislike for within-county and highway evacuations. First, this indicates that transportation and emergency management plans should prepare sufficient traffic control strategies, available shelters, and key resources (e.g., towing, gas) at night and locally (i.e., in the vicinity of the wildfire). Second, the results suggest that traffic operations to reduce congestion should be focused locally and on smaller roads. We also found a number of individual characteristics, household characteristics, and risk perceptions that influenced transportation choices, which help inform additional traffic operation needs. To conclude, we describe a series of supply-, demand-, and information-side strategies for wildfire evacuations based on the research results.

ID199

OC44 - WE ARE FIRE: INDIGENOUS FIRE PRACTICES IN THE SASKATCHEWAN RIVER DELTA

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[1]*Parks Canada*

The Muskrats to Moose project in the Saskatchewan River Delta, Canada seeks to provide Indigenous-informed and accessible resources to (1) develop a vision and a set of management objectives to use fire on the land, (2) increase the role of Indigenous Peoples in the policy development, governance and stewardship of lands and resources in the Saskatchewan River Delta, and (3) promote meaningful engagement of Indigenous Peoples in burning and related habitat restoration. The project team interviewed 16 Indigenous peoples who carried knowledge on burning and the impacts/implications in relation to local and regional habitat restoration in the Saskatchewan River Delta. Approximately 90% of the interviews were conducted in Cree. An outcome of this project is the development of a toolkit for understanding fire on the land that is timely, relevant, reader friendly, accessible and culturally-congruent - sharing current and wise practices and related resources on various dimensions of burning and corresponding habitat restoration for Indigenous Peoples and wildlife in the Saskatchewan River Delta. From a holistic perspective, this includes ecological, spiritual-cultural, and economic elements. The toolkit provides resources, wise practices, lessons learned and case studies focused on (i) uses of fire on the land, (ii) Saskatchewan River Delta landscape, (iii) Indigenous fire history and Indigenous-led fire stewardship, (iv) Western fire management, (v) fire reconciliation and relationship building (includes allyship), and (vi) Indigenous fire prescriptions (e.g., assessing, developing, applying and reporting on an Indigenous fire prescription).

ID255

OC46 - SCENARIOS FOR SUSTAINING COMMUNITY-BASED WILDLAND FIRE MANAGEMENT STRUCTURES IN THE TRANSITION AND SAVANNAH ZONES OF GHANA

Joana Akua Serwaa Ameyaw[1], Lucy Amissah[2], Shalom D. Addo-Danso[2], Mike Sefa Boachie[1], Francis Siibu Nimbaje[1], Akosua Acheampomaa Sefah[1]

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Wildland fires remain a major challenge globally, and also in the transition and savannah zones of Ghana. The devastating effects of these fires require a multifaceted approach to creating fire resilient landscapes. In Ghana's forested landscapes, community wildland fire management structures, commonly known as fire volunteers, serve as the basic unit for creating fire resilient landscapes. For over three decades, establishment and incentivizing these community structures have relied heavily on funding from external organisations, leaving the structures ineffective without them. This paper assessed scenarios and conditions for sustaining community-based wildland fire management structures in the transition zone of Ghana. A mixed quantitative and qualitative approach was used in the study. A total of 370 respondents were engaged, comprising fire volunteers, community members, community leaders, state and non-state institutions. Data was collected using semi-structured questionnaire administration, focused group discussions and interviews. The study covered twelve communities across three regions (Bono, Bono East and Savannah) within the transition and savannah zones of Ghana. The study established that the business-as-usual scenario of community- based fire management structures relying on incentives from external sources is unsustainable in the long term. Across all communities studied, locals are willing to own and pay to support their fire management structures. A scenario where communities make financial contributions to support wildland fire management would achieve limited impacts. However, a scenario where communities make in-kind contributions, defined by community-specific opportunities, and managed by a robust and transparent leadership structure would promote effective wildland fire management in the long term.

ID357

OC47 - INDIGENOUS FIRE USE CAN FACILITATE CLIMATE ADAPTATION: CONTEMPORARY EXAMPLES

Peter Fule[1], Amanda Stan[1], Melvin Hunter, Jr.[2], Citlali Cortés Montaño[3]

[1]Northern Arizona University, [2]Hualapai Tribe, [3]KfW Bank

Objectives

Indigenous peoples are at the forefront of the critical global challenge of restoring the ecological and social benefits of fire regimes. We assessed fire and forest characteristics from the Hualapai Nation, USA, and the Rarámuri (Tarahumara) people of Chihuahua, Mexico, of sustained fire use in Pinus-Quercus ecosystems adapted to frequent surface fire regimes.

Methods

Fire regimes were characterized using tree-ring analysis of fire-scarred tree samples. Forest structure was assessed from field plots. We determined the history of management activities from historical records and interviews.

Results

Pine-oak forests on the Hualapai Nation underwent over eight decades of fire exclusion beginning after 1886, but surface burning was re-introduced in the 1960s and continues to the present. The Rarámuri forest had consistently frequent fires throughout the 19th and 20th centuries, comprising the least interrupted surface-fire regime reported to date in North America. Forests at both sites were relatively open, dominated by larger-diameter trees, and had less hazardous fuels (fuel ladders, woody debris) than nearby sites not under Indigenous management. The two communities have some differences but share support for fire use.

Conclusions

Forest management for utilitarian purposes including wood and agricultural production is compatible with restoration and conservation of frequent-fire regimes. These examples of forests managed by Indigenous people are better adapted to resist severe wildfires and warming climate than neighboring ecosystems. Other Indigenous and non-Indigenous communities can benefit from adopting site-specific fire management practices that match local fire ecology characteristics and cultural perspectives.

ID365

0C45 - COLLECTIVE ACTION IN PRESCRIBED BURNING: A SOCIAL NETWORK ANALYSIS OF TWO US STATES

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Prescribed fire is emerging as an essential component of maintaining and recovering fire-adapted landscapes, which include various ecosystem types such as grass/rangelands and forests. Additionally, the practice can be beneficial for agriculture and the reduction of invasive species including for woody plant encroachment into grasslands. This research attempts to define the characteristics of prescribed fire organizational networks in the US states of Oklahoma and North Carolina in order to better understand how state and federal agencies, prescribed fire organizations, and other Non-government organizations work together to practice this strategy. Two states are compared so that place-based elements of prescribed fire networks might be revealed as well. We rely on social network analysis methods to address our research questions and focus on structural components of the networks that are theoretically related to social capital, collective action, and adaptive management capacity. Results indicate that both networks resemble core-periphery structures where a small group of well-connected organizations likely diffuse information and resources throughout the network and to the peripheral actors. Sub-group analysis also suggests that the networks are similar in terms of density, and centrality, but that there is likely a difference in terms of heterophily among actors. The results suggest that there may be general interventions that improve network operations and resources flows, but that network structures may differ in sub-group composition.

ID29

OC23 - WHAT CAN WE LEARN FROM COMMUNITY-BASED WILDFIRE INITIATIVES? A CASE FOR MORE SITUATED APPROACHES TOWARDS LIVING WITH WILDFIRE

Isabeau Ottolini[1]

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Wildfire communication tends to happen top-down: experts telling society what they should (not) do for wildfire prevention and preparedness. Even so, wildfire communication can also happen through local, community-based wildfire initiatives. However, such initiatives are often not recognized nor researched due to their high level of informality and invisibility for non-locals. Hence, this research aims to shed light on how community-based initiatives can contribute to, and transform, wildfire communication practices and knowledge.

Present research is conducted through an in-depth case study in southeast Spain, using qualitative research methods like interviews, participant observation, and focus groups. By zooming into the citizen initiative Pego Viu (that emerged as a social response to the 2015 Vall d'Ebo wildfire, and developed further when another wildfire affected the same area in 2022), we can gain key insights for wildfire communication. For instance, wildfire communication goes far beyond just wildfire prevention and preparedness, becoming instead deeply intertwined with root causes of extreme wildfires at the local level; community-based initiatives respond to local needs and interests typically left unaddressed by top-down wildfire communication; and, while citizen initiatives frequently emerge after impactful wildfires, only few last over time.

Overall, community-based wildfire initiatives are key in increasing the resilience of wildfire-prone territories, by carrying out a wide scope of wildfire prevention and mitigation actions embedded and responding to the local realities. What is needed now is further support for such situated actions, e.g. through policy support and strengthening ties with other wildfire actors in the territory.

ID39

OC25 - EDUCATING FOR PREPAREDNESS: A REVIEW OF WILDFIRE EDUCATIONAL MATERIAL WORLDWIDE

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[1]Ceabn/isa

In the context of climate change, wildfires are becoming one of the main environmental concerns in many parts of the world. In this sense, it is fundamental to educate the population, to increase their wildfire preparedness, and to manage forests, making them more wildfire resilient. The present study is a review of wildfire pedagogical materials from around the world. The aim is to find the main topics and concerns covered by these materials along with their knowledge gaps. This information will help us to create pedagogical materials about wildfire for the project EduFire ToolKit. So far, over 180 references from 30 countries have been analyzed. Most references (around 47%) are targeted at the general public, and around 42% are aimed at students (from preschool to high school). Some materials found specifically target firefighters, about 9%, and just 1% is directed to the rural population. Regarding the topics addressed, most materials explain the main concepts (physics and chemistry) around wildfires (60%), as well as fire prevention (52%), and community fire safety measures (51%). Very few materials, less than 1 %, approach historical, social, health, and economic concerns related to wildfires. In addition, climate change and its links to wildfires is not a very explored topic in the retrieved materials. It is expected that the results of this thorough an extensive review will guide and inform the content creation processes in future wildfire manuals to provide the most essential knowledge, helping the population to adapt to the changing climate and fire regimes.

ID217

OC22 - RISK COMMUNICATION EFFECTIVENESS TO MITIGATE HUMAN-CAUSED RURAL FIRES: THE MENTAL MODEL APPROACH APPLIED IN TWO EUROPEAN UNION PROJECTS

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Fire is a traditional land management practice, despite the high risk of rural fires due to climate change and fire misuse. Researchers have sought to understand the key features of communication practices to improve rural fire risk management. The Carnegie Mellon mental models approach encompasses participatory processes to deepen risk understanding and addresses what can be done to mitigate future impacts. This study aims to demonstrate the applicability of the mental model approach to improve risk communication effectiveness to reduce accidental fire ignitions caused by debris burning and leisure activities in the wildland-urban interface. This systemic approach is being applied in two projects. First, the rePLANT project, whose purpose is to increase sustainable forest management, the competitiveness of the Portuguese forestry sector, and reduce the impact of rural fires. Second, the FIRE-RES project, will develop a holistic and integrated fire management strategy to efficiently and effectively address Extreme Wildfire Events in Europe in 11 Living Labs thanks to its Innovation Actions. Overall, this study provides guidelines to help decision-makers and stakeholders, highlighting the importance of exploring the underlying reasons for resistance to behavioral change and defining guidelines to support the design of new risk communication strategies, including disseminating new behaviors and practices to mitigate human-caused rural fires.

ID324

OC27 - EXAMINING BUSHFIRE PREPAREDNESS AND COMMUNITY RESILIENCE IN THE CHANGING SOCIAL LANDSCAPE OF HALLS GAP, AUSTRALIA

Gabrielle Miller[1], Andrea Rawluk[1]

[1]*The University Of Melbourne*

Non-resident landowners, alongside changing local fire regimes, pose complex challenges for local governments trying to support capacity-building and resilience in communities across Australia.

Objectives

Working with local government, this study examines community resilience in Halls Gap (Victoria) and surrounding areas. We focus on non-resident landowners who are responsible for preparedness and response to bushfire, in order to better understand this 'hard-to-reach' group.

Methods

In 2019 we conducted 29 semi-structured interviews with non-resident landowners and one workshop with resident and non-resident landowners about their bushfire risk perceptions, preparedness, and needs.

Results

We found both widespread interest and new opportunities for facilitating social learning and knowledge-sharing amongst community groups. Thematic narrative analysis revealed absentee landholders bring diverse values, knowledge and experiences of fire in the landscape. Further, there was significant interest from this group in establishing local connections and being part of the community, although they lack the how-to knowledge. These findings contribute to dispelling the myth of the "disengaged" non-resident landowner and secondly, the importance of investment in local social network programs.

Conclusions

New insights were used to make recommendations for better integration of non-resident landowners' knowledge, capacity and needs in bushfire risk communication and engagement. This informed the development of a new Community Resilience Group plus a mobile app to disseminate bushfire information. This case-study demonstrates the role that absentee landholders can play in community-led bushfire mitigation, preparedness, and response. We suggest the findings of this study have broader relevance for risk communication and community engagement in dynamic fire-prone landscapes.

ID445

OC24 - WILDFIRE RISK COMMUNICATION VIA NEWS MEDIA: BRIDGING THE GAP BETWEEN JOURNALISTS' APPROACHES AND SCIENTIFIC CREDIBILITY

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Mainstream media often report on wildfires when they threaten communities, lead to evacuation, loss of live or property, or have an extensive direct environmental impact. These mainstream news reach a large proportion of the general population as well as decision makers. They therefore represent a potentially very effective means of risk communication and for improving society's understanding of the causes and consequences of wildfires.

However, the tendency for sensationalistic and simplistic reporting, with a focus often on the causes of ignition, suppression activities, losses and how to avoid future fires, rarely leave room for balanced reporting on risk and the wider understanding of fires. These limitations also apply when scientists are interviewed or asked to contribute to the writing of news articles. This is a reason why only a small proportion of academic researchers are willing to work with the media, together with very short deadlines and differences in communication styles between journalists and academics.

Here we report on our experiences with TV, radio and online media following major wildfire events across the globe in recent years including, for example, the 2018 US Camp Fire, the 2019/20 Black Summer fires and the extreme European fire season of 2022. We highlight the benefits and pitfalls of this work and of acting as 'fact checker' for social media. Together with published views by other media active scientists in the US and UK, we conclude with some thoughts on ' dos and don'ts ' in working with the media.

ID449

OC26 - REGIONAL EASTERN AFRICA FIRE MONITORING RESOURCE CENTER: THE ROLE OF OPEN ACCESS SPATIAL TOOLS FOR STAKEHOLDER ENGAGEMENT IN FIRE MANAGEMENT

Harifidy Rakoto Ratsimba[1], Gaston Hedwigino Tahintsoa[1], Dimby Raherinjatovoarison[1], Haritiana Zacaharie Rakotoarinivo[1], Rajira Nambinintsoa Ratsimandresy[1], Johann Georg Goldammer[2]

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The Regional Eastern Africa Fire Management Resource Center (REA-FMRC) is serving countries of East Africa, by provisioning, archiving and interpreting scientific-technical information and satellite-derived near-real time and historic data on landscape fires. This kind of Center has been established in different parts of the world to decentralize the role of the Global Fire Monitoring Center (GFMC) for an adapted response to the local, national and regional needs of stakeholders in fire management data.

The REA-RFMRC has developed a specific geoportal, first for Madagascar, and now for all the eastern Africa countries, in order to share all the available data on active fires, on fire forecasting and monitoring. This kind of tool has been developed as a science-policy interface to reconcile the needs in between local communities, natural resource managers and policy makers to face landscape fire management issues.

The daily fire danger forecast is based on the Forest-Weather Index Method (FWI) which is made up of six components that take into account the effects of the water content of fuels and weather conditions on fire behaviour. For burnt area monitoring, two spectral indexes (Normalized Burn Ratio, NBR and Burned Area Index for Sentinel-2, BAIS2) are used to distinguish burnt surfaces from Sentinel-2 images. These two indices are calculated and compiled in monthly data. All of this information is publicly available at the www.rfmrc-ea.org geoportal and has been used in Madagascar to catalyze a better understanding of the role of fires in the landscapes by all stakeholders.

ID505

OC21 - THE IMPORTANCE OF DATA IN DISASTER MANAGEMENT: A LOOK AT VOST PORTUGAL'S INITIATIVES IN REAL-TIME INFORMATION SHARING AND DISINFORMATION PREVENTION

Isabel Silva[1], **João Ribeiro**[1,2], Marco Maia[1], Jorge Gomes[1]

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Social media has become a vital tool in disaster risk management as it allows for rapid dissemination of information, real-time updates on the status of a disaster, and facilitates communication and coordination between various entities involved in disaster management. This can help people make informed decisions about their safety and can assist emergency responders in planning and executing their response. In addition, social media can also facilitate communication and coordination between different entities involved in disaster management, such as government agencies, NGOs, and volunteers. By leveraging the power of social media, it is possible to improve the effectiveness of disaster response and increase the resilience of communities.

VOST Portugal (VOST-PT) is a volunteer-based organization that focuses on the use of technology and social media in disaster risk management. One of VOST-PT's key initiatives is CONFIRM, an open-source platform that allows for the acquisition and presentation of relevant information during disasters. This tool has been successfully used in a number of contexts, including in the response to forest fires. In addition to its technical efforts, VOST-PT also plays a crucial role in fighting disinformation during times of crisis by providing accurate and timely information to the public, training volunteers, and collaborating with government agencies and other organizations to develop strategies for combating false information. These efforts help to ensure that the public has access to reliable information and can make informed decisions during times of crisis.

ID48

OC20 - CURRENT OPPORTUNITIES AND CHALLENGES FOR WILDFIRE RISK REDUCTION IN WESTERN EUROPE

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Wildfire management in Western Europe is close to a tipping point and the last fire season has been a preview of conditions to be expected in the future. The rise in temperatures due to human-induced climate change will lead to conditions more conducive to the spread of wildfires in this region. A shift in wildfire governance is needed to proactively reduce wildfire risk as business-as-usual approaches to risk management are deemed to fail.

We conducted semi-structured interviews with experts on wildfire/forest fire in Western Europe to understand, the current challenges and opportunities in wildfire risk reduction and resilience. The proposed analysis provides helpful information for the various national perspectives and for identifying risk reduction priorities and strategies for decisionmakers to ensure that society, landscapes and forest become more resilient to wildfire. These strategies potentially reducing the impact of future wildfires on Western European society and delivery of ecosystem services.

Results indicate that there is need for lessons to be learnt from other countries and urgent actions is needed to be prepared for the conditions that are anticipated. Similarities in landscape and challenges provide for synergies and opportunities to collaborate on a regional level.

Currently there is not enough done to adapt to future wildfire conditions anticipated. There is opportunity to implement and adapt lessons and best practices from other fire-prone counties and other risks without having to learn through experience. Wildfire risk reduction need to be fast-tracked to make society, agencies and civil protection resilient to new wildfire risks.

ID103

OC19 - EGIF INTERNATIONAL EXCHANGE PROGRAM. THREE COUNTRIES AND FIVE ORGANIZATIONS SHARING VISIONS AND EXPERIENCES ON CHILEAN FIRE SCENARIOS

Juan Caamaño Azcárate[1], Jorge Saavedra[1]

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In recent years we have been observing how in many parts of the world forest fires have become extremely complex emergencies, in many cases exceeding the national response capacities of the country where they occur, causing an increase in the demand for international resources to complement national efforts.

These emergencies underscore the need to gradually improve international cooperation between countries, to respond to large and complex emergencies.

Therefore, it is necessary to create exchange programs between firefighting organizations from different countries that build trust between them and where the transfer of experience and knowledge for capacity building around the management of this type of event is the backbone of these programs.

The international program EGIF was born with this idea, sponsored by the Chilean National Forestry Corporation (CONAF) and organized by the Pau Costa Foundation (PCF).

In the EGIF program, professionals from three different countries, Chile, Portugal and Spain and from five different organizations have participated to address four specific thematic areas of knowledge: forest fires behavior analysis, emergency organization, operations with technical fire and finally air operations.

During the presence of the EGIF in fires and through workshops, training sessions and lessons learned meetings, the EGIF shared work methodologies around these thematic areas.

Undoubtedly, through the transfer of knowledge and the creation of common working methods, bridges of trust have been created that will have an impact on better cooperation thanks to EGIF program.

ID156

OC14 - TOWARDS FIRE-SMART LANDSCAPES – GLOBAL EXPERIENCES AND KEY LESSONS

Nick Pasiecznik, Johann Georg Goldammer, Bibiana Bilbao, Atiek Widayati, Harifidy Rakoto Ratsimba, **Rosalien Jezeer**

[1]*Tropenbos International*

This reports the findings from 'Towards fire-smart landscapes' (Tropical Forest Issues, volume 61) published in November 2022. It includes 26 articles from 100 contributors; 22 case studies from across tropical America, Asia and Africa, three explaining the importance of fire ecology, management and concepts, and a synthesis, that add to the expanding global knowledge on integrated fire management. They show how fire science, traditional knowledge, supportive policies, community inclusion, landscape governance and capacity strengthening, when suitably combined, will lead to a future with less destructive fire, in part by encouraging the wise use of benign fire. The fire management expertise presented, opens the door to new and promising solutions to climate change mitigation and adaptation, by learning from and preserving cultural heritage and diversity and developing future-oriented nature-based solutions. Fire management the world over will surely benefit by learning from these tropical experiences. Local participation is crucial, for all parties to share perceptions and jointly design and implement fire prevention and suppression. The importance of indigenous and traditional knowledge of fire management emerges strongly, and equitable landscape governance is key. Where they are lacking, national integrated fire management strategies, policies and action plans must be developed, with cross-sector collaboration, capacity development, clear roles and responsibilities, and adequate resources. And it is clear is that a paradigm shift is urgently needed, from a focus on suppression, to one on prevention and integrated management.

ID252

OC15 - LANDSCAPE FIRE MANAGEMENT IN THE WESTERN BALKANS – JOINT EFFORTS FOR REGIONAL LANDSCAPE FIRE RESILIENCE

Cvetan Nikolovski[1], Marija Sterjovska[1], Nikola Nikolov[2]

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To mitigate the negative impacts of landscape fires (LFs) in the Western Balkans (WB), it is necessary to have inclusive, cross-boundary cooperation, and to strengthen the capacities and policies for landscape fire management (LFM) in the region. The Landscape Fire Management in the Western Balkans (LFMWB) Programme embeds these aspects with an aim to increase forest and landscape resilience to LFs. The increased resilience to LFs and the strengthening of Regional Southeast Europe / Caucasus Wildland Fire Network and establishing national networks will contribute to cross-boundary knowledge exchange and cooperation. To achieve the objectives of the LFMWB Programme, landscape and participatory approaches are applied involving different stakeholders in multi-stakeholder dialogue. The LFMWB Programme is working towards achieving the following results: establishing operational regional and national networks, developing country reports, preparation of regional strategies and regional policy guidelines. Moreover, a multi-stakeholder policy dialogue for integrating LFM into broader frameworks at the national level is initiated. All of the gained experience and knowledge will be put into practice by establishing and managing a competitive fund for community-based LFM in highly vulnerable regions to fire. The Programme activities contribute to strengthening the capacities of the stakeholders on LFM, adaptive landscape management and climate change as well as to improve the cooperation, capacities and policies regarding LFM in WB. The Landscape Fire Management in the Western Balkans is a regional initiative financed by the Global Programme Climate Change and Environment of the Swiss Agency for Development and Cooperation – SDC and implemented by Farmahem and the Regional Fire Monitoring Center (RFMC) based in Skopje, North Macedonia, with backstopping support from the Global Fire Monitoring Center (GFMC) and Helvetas Swiss Intercooperation.

ID335

OC16 - USAID/US FOREST SERVICE SOUTH AMERICA REGIONAL FIRE PROGRAM SUPPORT FOR STANDARD INTERAGENCY FIRE MANAGEMENT QUALIFICATION SYSTEMS

Isidoro Solis[1], Naomi Mills[2], Jayleen Vera[3], Óscar Rodríguez[4], Juan Ramón[5], Franco Pinatte[6], **Henrique Costa**[7]

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The objective of the USAID/US Forest Service South America Regional Fire Program is to improve the countries capacity to understand, prevent, manage, and recover from wildland fires.

To achieve this, first, the program conducted assessments of the overall fire management situation in Peru, Brazil, Ecuador and Colombia, including existing training, curricula, and qualification systems. With this information, actions have been taken to support improvements in existing systems or, when needed, develop new interagency qualification systems.

As a result, the four countries started to work on their qualification systems integrated with ICS and international resources classification. Peru now has developed a new interagency qualification system, has given several standardized courses and all qualified responders will be registered in a new national database. This will contribute to a more efficient and effective national and regional capacity to coordinate fire management efforts, wildland fire suppression, resource sharing and mutual aid agreements.

An interagency standard qualification system ensures better interoperability in fire management activities. It is a system that qualifies training, experience, and physical fitness by incident position. As this system is performance-based, the responders assuming incident-related positions are the most qualified for the job, regardless the agency, jurisdiction or country they belong to. Peru, Brazil, Ecuador and Colombia have made significant progress in this matter. The joint work with the USAID/US Forest Service has proven to be fundamental to develop this tool and strengthen regional fire management overall capacity, which will help to mitigate wildland fire related problems in South America.

ID426

OC18 - FIRE MANAGEMENT ASSESSMENT IN BRAZIL: STATUS OF INTEGRATED FIRE MANAGEMENT AND WILDFIRES IN BRAZIL

Marcelo Siqueira de Oliveira[1], **Henrique Costa**[1], Isidoro Solis[1], Jayleen Vera[1], Rafael Aguado[1], Forrest Behm[1,2], Helaine Matos[1]

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In 2022, the U.S. Forest Service internally published the Fire Management Assessment in Brazil and made it available to institutions that are part of international cooperation actions in the country. One of the objectives of the study was to present the current and future status of wildfires and fire management, based on joint work with institutions and key stakeholders. Considering the relevance of the assessment for strategic actions in Brazil, this summary presents reflections on the process of preparing the document, the methodology used, and the information obtained. In total, 50 questionnaires were answered by representatives of fire management institutions in Brazil, including 8 federal institutions, 21 state institutions, 4 municipal institutions, 13 Non-Governmental Organizations (NGOs) and 4 public universities. Through quantitative and qualitative data, there is information about fire prediction systems, training and qualifications in Brazil, the Incident Command System (ICS), wildfire investigation, fire ecology, and the management structure on Indigenous Lands and Conservation Units. As a result, the assessment asserts the need for integrated public policies and government practices in Brazil that address the biomes most impacted by fires, the standardization of institutions regarding qualification to strengthen fire prevention and management systems, and long-term actions to minimize the size, severity and impact of these events in the country.

ID479

OC17 - REMOTE TRAINING ABOUT WILDFIRES: ONLINE COURSES OF THE UNITED STATES NATIONAL FOREST FIRE COORDINATION GROUP (NWCG) APPLIED IN BRAZIL

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During the Covid-19 pandemic (since 2020) firefighters and fire prevention programs in Brazil were initially challenged to provide fire training while complying with safety protocols, such as social distancing, and later faced the complete inability to provide in-person training. Remote (online) courses became a feasible alternative, and within the framework of international cooperation, the United States Forest Service (USFS) carried out, in partnership with public institutions in Brazil, short-term online training for instructors, firefighters, employees, volunteers, and civil servants who work to prevent and suppress wildfires. Here we report on USFS' experience in adapting and implementing two international courses (S-190: Introduction to Wildland Fire Behavior, and FI-110: Wildland Fire Observations and Origin Scene Protection for First Responders), originally designed for in-person delivery by the United States National Forest Fire Coordination Group (NWCG), but authorized (by NWCG) for translation and adaptation for remote training by USFS in Brazil. In total, 192 trainees (104 women and 88 men), completed the two courses. Participants also completed pre- and post- training evaluation surveys and results are presented here. We discuss remote-training format in fire courses and possible challenges of the two cited courses (S-190 e FI-110) for fire prevention and suppression in Brazil.

ID3

PO75 - FIRE REGIMES AND RURAL LANDSCAPE DYNAMICS IN CENTRAL MOUNTAIN SYSTEM

Catarina Sequeira[1], Francisco Castro Rego[1]

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Rural fires have historically been one of the main factors of landscape change in the inner mountain areas of the Iberian Peninsula. Although the interaction of fire and rural landscape throughout the 20th century has been extensively studied in the Iberian Peninsula, long-term historical knowledge is limited and can provide a valuable context to understand landscape resilience. The Central Mountain System is a natural regional unit beyond political-administrative boundaries. Estrela and Ayllón massifs have similar landscape characteristics, although they are oppositely located at the end of the mountain range and have different socio-political contexts.

This research aimed at increasing the understanding of long-term fire regimes and rural landscape dynamics at both massifs. Various methodologies of geography were used to find that there were several pyrotransitions over time, each of them related to different dimensions of the landscape. We also found that landscape and fire were related and integrated components of a socio-ecological system. When this system was destabilized, the link between the landscape and fire changed, causing an increased risk of more and larger fires. Depending on the landscape's resilience, such an increase was different at each end of the Central Mountain System. In the Spanish sector -the Ayllón massif- data and knowledge have been added to the existing research line. In the Portuguese sector -the Estrela massif- we have contributed to promoting and fostering interest in this research development, whose goal is to inform policy development and contribute to managing landscapes toward more resilience to fire.

ID10

PO59 - MONTE CARLO SIMULATIONS FOR ESTIMATING FIRE PROBABILITY

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Fire spread models are strongly influenced by predictor variables. These variables vary along the day, hence may not represent the environmental conditions on the time a fire is being simulated. For example, wind as a strong determinant of fire behavior may undergo sudden changes in short time intervals, which are seldom detected by the available meteorological systems. An alternative to include these variations in fire predictions is the use of Monte Carlo simulations. By randomly varying the predictor variables (ignition sources, wind, vegetation moisture, and fuel-loads) within a given time-interval, one can simulate a range of fire propagation scenarios. To do so, we developed a set of Monte Carlo simulations for the Brazilian Cerrado biome. Values for predictors variables are drawn from a normal distribution centered on the average of observed values obtained from historical records of large fire events. This type of simulation has the advantage of generating a panorama of areas that most likely burn. The resulting probability maps are used to indicate the most prone areas to fires as a means to plan firebreaks aimed at protecting sensitive woodlands under an Integrated Fire Management Program of ICMBio. To validate the Monte Carlo simulations, we calculated the Area Under the Curve (AUC), comparing the probability values with the maps of the same selected fire events (six fire events). The fire spread probability from the Monte Carlo simulations showed a high predictive capacity (average AUC = 0.92). The highest AUC was 0.98 and the lowest of 0.87.

ID17

PO66 - COMPUTATIONALLY EFFICIENT BURN PROBABILITY APPROXIMATION USING A CONNECTIVITY INDEX

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Wildfire risks faced by future communities are influenced by management decisions made today. Managers make decisions from many options (when, where and how to treat the landscape, how to adapt alongside communities) with an uncertain future (changing land uses, demographics and climates). The combination of these factors results in many unique options and scenarios for managers to explore.

Our objective is to create an index that approximates burn probability mapping in a computationally efficient manner. This index will support temporally dynamic risk assessments, efficiently considering many different management options and scenarios. Questions explored with the index may include landscape treatment placement optimisation and future scenario exploration.

We introduce the index as a multi-scaled, process-informed spatial aggregation of wildfire hazard properties across a landscape. The index is calibrated on a case-study landscape using simulated and observed fire patterns. We validate the index using its ability to discern areas of historical wildfire occurrence and ability to approximate the relative magnitude of simulated burn probability results.

The index is highly correlated with simulated burn probability (Pearson correlation coefficient > 0.8). The proposed approach produces this approximation at a fraction of the computational cost of simulation models (0.2% of the runtime). The computationally efficient index increases our ability to explore wildfire risks under augmented landscapes, such as treatment optimisation or future land-use scenario analysis.

We foresee an opportunity to develop hybrid modelling approaches, where our index is used alongside simulation models. This multi-model approach will help manage future wildfire risks in novel multidisciplinary approaches.

ID25

PO82 - LINKS BETWEEN WILDLAND FIREFIGHTER PERFORMANCE AND WORKING CONDITIONS

Robin Verble[1], Rachel Granberg[2], Seth Pearson[2], Matt Thimgan[1]

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Wildland firefighters are a key element in wildland fire suppression and preparedness that are often unconsidered in fire management planning. The health and readiness of wildland firefighters correlates directly to the morale, workforce training, and cognitive preparedness of the population. Here, we present links between self-reported performance and preparedness and cognitive metrics for a population of wildland firefighters in the United States.

ID27

PO69 - CLIMATE CHANGE AND WILDFIRES: SEVERITY WAVES INDICATE THE AMAZON RAINFOREST'S POSSIBLE FUTURE

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Climate change may aggravate wildfire problems, even in rainforests. In the southern boundaries of the Amazonian biome (Upper Xingu), the rainforest is getting ever more flammable and the trees more sensible to fire. As a result, each wildfire creates intriguing waves of forest severity, cut out from the variations on the behavior of the wildfire during the day. These waves are visible both on the field and in satellite images, providing several important information about the effects of fire in Brazilian Amazon. During the firefighting operations of the great wildfires of 2019 to 2022, government experts (Ibama/Prevfogo) monitored the phenomena, through records of information on the field, monitoring overflights, satellite images analysis and vegetation indexes. The preliminary results indicate that these waves are important to comprehend the fire's dynamic in tropical rainforests, including to predict extreme behavior. The destruction associated to its formation, the difficulties faced in its combat and the speed with which they have been registered, including in other Brazilian protected areas, is alarming. Therefore, wildfire control in these areas is considered nowadays Brazilian experts' greatest challenge in the coming years.

ID35

PO160 - AUTHORIZED CONTROLLED BURNS AS A FIRE MANAGEMENT TOOL IN THE SERRA DA CANASTRA NATIONAL PARK/MINAS GERAIS /BRAZIL.

Bianca Zorzi Tizianel[1], Helder Marques, Carlos Bernardes, Fernando Tizianel

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The Serra da Canastra National Park is affected by wildfires that consume annually, since its creation, approximately 50% of its area. It was noticed that many of these events are burnings for pasture management executed by farmers in private areas, which happened without authorization despite the possibility of happening under the law. Thus, since 2018, managers encourage the request for authorizations to carry out controlled burns as a landscape management tool on private properties within the limits. After the success of the pilot experiment carried out in 2018 "Vão dos Cândidos" region, it was repeated in other locations such as "Barreiro" and "Chapadão do Deus mar". An annual meeting happens in each region, where interested farmers communicate the areas intended to burn during the year and receive authorization when they meet the legal requirements. Owners can request authorization to use the fire without participating in the meetings; however, they function as a facilitating factor. The occurrence of fire in these regions was previously considered a wildfire, and the use of fire was illegal because it happened without authorization. After these meetings, there was an increase in the number of owners requesting authorization and a significant decrease in the number of wildfires. There was also an approximation between the Park management and the residents, who became partners, informing about the occurrence of wildfires and collaborating with the fight when necessary. The right to use fire and the maintenance of local traditions are being respected and the Park's natural resources are better preserved.

ID36

PO74 - ECUADOR'S AMAZONÍA SIN FUEGO PROGRAMME: A STRATEGY FOR REDUCING FOREST FIRES

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Objectives

Implement integrated fire management (IFM) practices to contribute to environmental protection and quality of life for rural and indigenous communities in prioritized provinces of Ecuador's highland and coastal regions.

Methods

The integrated fire management (IFM) practices are implemented through the "Amazonia Sin Fuego Programme" (ASFP). This program does not fight forest fires but instead proposes sustainable development alternatives to manage landscapes at risk, recognizing fire as an element of nature that must be managed. ASFP is one of few initiatives in the country with a landscape vision that uses interventions based on community management, and that recognizes communities' key role in reducing uncontrolled fires.

Results

To reduce the harmful effects of fire, ASFP promotes actions and has important results based on five types of intervention. (i) developing national and local planning tools for IFM; (ii) continuous IFM training at the institutional and community level; (iii) promoting alternatives to the use of fire in rural areas; (iv) environmental education on forest fire prevention; and (v) building public policy.

Conclusions

ASFP has had important impacts on improving fire management in Ecuador, especially in protected areas of the State with greater risk of forest fires. One conclusion is that although forest fires cannot be prevented entirely, their frequency and impacts can be significantly reduced through IFM. In Ecuador, there is now an increased understanding of the need to learn to live with fire and to protect and manage landscapes at risk while improving livelihoods and the resilience of communities.

ID38

PP75 - VALIDATING A LANDSCAPE FUEL METRIC TO MAP EXPOSURE TO HAZARDOUS FUELS IN PORTUGAL

Sidra Ijaz Khan[1], Conceição Colaço[1], Francisco Castro Rego[1], **Jen Beverly**[2]

[1]*University of Lisbon,* [2]*University of Alberta*

Context This study applies a simple, time-saving approach to highlight high and low exposure zones that can help managers plan mitigation actions at national and sub-national scales, especially in the Wild Urban interface. Objectives The objectives of this study are to apply a landscape fuel metric (Beverly et al., 2010 and 2021) developed in Canada to map wildfire exposure in Portugal and to validate that approach by examining exposure ratings within subsequently burned areas in Portugal. Methods We mapped exposure to hazardous fuels in Portugal using a neighborhood analysis. The exposure is estimated by the proportion of neighborhood cells in a landscape grid that contains hazardous fuel types. The resulting exposure metric assesses the extent of land cover type in the vicinity of a location that either contributes to or resists fire transmission. Our assessment included the temporal change between 1995 and 2018 using Corrine land cover. Burned areas following the assessment year were overlaid to validate the exposure assessment. Results:The distribution of exposure levels has been remarkably stable over time. Burned areas occur preferentially in high-exposure areas. In all five assessment years, the majority of burned areas had pre-fire exposure ≥ 80%. WUI present in ≥ 60% exposure class rates communities at higher exposure to build community's capacity in terms of preparedness. Conclusions:Exposure to hazardous fuels aligns well with subsequent fires. It is a simple, cost-effective, and time-saving metric to locate the high-risk areas on the map that could be followed by a field survey for fuel reduction treatments.

ID50

PO51 - FOREST SOIL MANAGEMENT – A POST-FIRE SOIL EROSION ASSESSMENT BY COMPARISON OF LINEAR REGRESSION AND REVISED-MMF MODEL APPLICATION

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Climate projections indicate that wildfires frequency, recurrence, severity and dimensions are expected to increase (EEA, 2022), affecting ecosystems and especially soils. Moreover, such impacts when combined with inappropriate management practices on the long-term can lead to systematic land degradation. Therefore, predict soil losses after wildfire is decisive to identify high-risk areas, however, current soil erosion models do not include soil mobilization history.

The aim of this study is to compare post-fire soil losses predictions at slope scale, through a multi-model method, and identify potential key pre-fire management variables contributing to soil degradation after wildfire. Two models were applied: linear regression and revised-MMF (Morgan, 2001), being adapted to reflect temporal changes on soil cover, and soil physical and hydraulic properties, but also influence of pre-fire soil management operations (contour-plowing, downslope-plowing, unplowed).

Overall, both methods presented a better performance for contour-plowing and unplowed conditions, resulting in a satisfactory to very good model performance (NSE, Nash and Sutcliffe, 1970), respectively, for linear regression, and a very good performance for MMF (Moriasi et al., 2007). The impact of soil management in soil erosion is reinforced by both model results, suggesting the need for the development of specific soil erosion models for forest soils, instead of adapting models from agricultural conditions.

This modelling framework could enrich data analysis, since linear regression can fill gaps on temporal analysis, identify anomalous behaviors and highlight site particularities, while MMF allows parameters adaptations to include soil, cover and management local characteristics.

ID59

PP69 - IMPACTS AND SCALE-UP POTENTIALS OF INTEGRATED FIRE MANAGEMENT IN THE BRAZILIAN CERRADO

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Uncontrolled late season fires in the Brazilian Cerrado promote deforestation, produce greenhouse gases and are a major threat to the conservation of biodiversity in protected areas. Since 2014, governmental institutions implemented early dry season (EDS) prescribed burnings as part of Integrated Fire Management (IFM) in protected areas of the Cerrado, with the aim to reduce the area burned and severity of mid/late dry season (MDS/LDS) fires. The concept of reducing high intensity M/LDS fires through EDS prescribed burning poses a GHG mitigation potential that was already successfully demonstrated in other savannah ecosystems. The IFM activities in the Brazilian Cerrado offer a good case study on emission abatement potentials in regard to the net-zero pathways both at Governmental and corporate level. We here assessed the effectiveness of existing IFM activities in promoting emission abatement. Over a six-year period, protected areas with PM showed significant trends of increased EDS active fires of +207% with increased EDS burned areas from 6.3% to 30.0% of the total yearly burned areas. In the same period, MDS and LDS active fires were significantly reduced by -39% and -17%, respectively, with a reduction of M/LDS burned areas from 91.6% to 66.5% of the total yearly burned areas. By applying this observed shift in fire seasonality from observed IFM activities to all protected areas and to the whole Cerrado for the same period, an emission abatement potential of 924,719 and 2,713,279 tCO2e/y is estimated, respectively.

ID61

PO62 - REMAINS: A NEW FIRE-LANDSCAPE MODELLING PLATFORM TO SIMULATE INTEGRATED FIRE MANAGEMENT SCENARIOS

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Landscape dynamics models are fundamental tools that allow us to simulate different ecological processes and natural disturbances and thus anticipate the medium- and long-term effects of landscape-level management strategies. An integrated management of landscapes requires a deed understanding of territory, and its spatial interactions with the main driving forces, for being able to assess the effectiveness of management scenarios in abandoned mountain areas increasingly affected by wildfires. Herein, we present the model REMAINS, a new modelling platform to simulate the spatio-temporal interactions between fire (i.e., ignition, spread), vegetation dynamics (natural succession and pos-fire regeneration), fire management (i.e., fire-suppression and prescribed burning strategies) and land-use changes (e.g., agricultural conversion). The model quantifies the effects of fire and land-use management fire regime attributes (namely burned and suppressed area, fire recurrence) as well as landscape change composition. To illustrate the potential applications of REMAINS, we applied it to the Transboundary Biosphere Reserve Gerês-Xurés (ca. 276,000 ha), a representative mountain landscape of NW Iberian Peninsula. We run fire-landscape simulations under a wide range of fire-suppression and land-use scenarios. In addition, we set up specific managed areas with prescribed burning according to various scenario parameters (management strategy, amount of area to be treated, temporal resolution, type of land cover to be burned). The REMAINS model offers a new tool for decision-making that will help to better manage fire-prone ecosystems.

ID70

PO77 - A JOURNEY OF THE BUSHFIRE STRATEGY DEVELOPMENT IN VICTORIA, AUSTRALIA

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[1]Country Fire Authority

South-eastern Australia is regarded as being one of the worst for socially disastrous fires and climate change is exacerbating this risk with more extreme fire weather, resulting in increased numbers of fires and burned area.

Bushfire risk in Victoria is also increasing due to population growth and changing demographics, causing a greater number of people to be exposed to bushfire.

In 2007, Department of Environment, Land, Water and Planning (DELWP) and Country Fire Authority (CFA) started a development of a Bushfire Strategy called 'Living with Fire'. After 12 months of significant engagement, a new strategy was launched in December 2008. The Living with Bushfire strategy drew extensively on research to provide direction on increasing the area treated with fire to reduce fuel hazard, maintain ecosystems and manage fire risk.

In November 2017, The Victorian State Government released a new policy called 'Safer Together'. This policy has four main areas that collectively work towards the outcome of 'shared responsibility': Community first, Land and fire agencies working together, Measuring success and Better knowledge = better decision.

Post devastating fires of Black Summer (2019/20 fire season), DELWP and CFA have started a work on a new fire strategy. This strategy will be ready for extensive external consultations in the second part of 2023.

This paper will show the critical role of science in the planning and implementation of bushfire management in Victoria as well as cover the progress of the strategy development, policy implementation and their successes and challenges.

ID73

PO73 - THE FRAGMENTED LEGAL REGIME OF VELDFIRE MANAGEMENT IN SOUTH AFRICA.

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Objectives

The objectives of this poster seek to demonstrate the extent of this fragmentation and its effect on institutions, for example, provisionally demonstrate where reform is required.

Methods

This will be achieved through a qualitative study undertaking a theoretical, non-empirical, inductive thematic analysis comprising of critical content analysis. The content analysis will be based on a selected sample of international law and policy, domestic legislation, court decisions and other secondary data.

Results

The results have the potential to improve policy, practice, and further education within IFM.

Conclusion

Wildland fire has increased worldwide. Across the world, various efforts have been made, through the vehicle of Integrated Fire Management (IFM), to prevent, minimise or mitigate wildland fire from occurring or spreading. In South Africa, the meaning of the term 'veldfire' essentially the same as the meaning 'wildfire' or 'wildland fire'. This is true in the context of uncontrolled vegetation fires causing loss to human life or limb, damage to infrastructure or social, economic, and environmental damage. South Africa has adopted IFM in its veldfire legislative framework. However, the framework is fragmented. The argument by the authors is that legislative reform is required to improve IFM to optimise the benefits the latter provides.

ID86

PO38 - ANALYSIS OF LAND USE AND LAND COVER CHANGES ON THE FIRE EFFECT IN A PROTECTED AREA IN THE BRAZILIAN SEMIARID

Mariana de Aquino Aragão[1], Fernanda Moura Fonseca Lucas[1], Leonardo Duarte Biazatti[1], Rita de Cássia Freire Carvalho[1], Antônio Henrique Cordeiro Ramalho[2], Nilton Cesar Fiedler[1]

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Historically, fire has been a management tool. Although many ecosystems are adapted or dependent on them, human actions and climate change potentiate traditional regimes and maximize negative effects on the environment. Protected Areas (PA) are constantly affected by fires, causing preserved environments to have severe consequences in the face of high-intensity fires. Thus, the objective was to analyze the influence of fire on land use/land cover (LULC) in the Chapada Diamantina National Park (CDNP) and buffer zone (BZ), located in the Brazilian semiarid region. MapBiomas images of LULC (Collection 6.0) and fire scars (Collection 1.0) were used, between 2010 and 2020. These images were processed in QGIS 3.22.10, where LU was reclassified (10 classes) and annual burned areas were calculated. The studied area encompasses 299,490.84 ha, with a predominance of grassland, forest, and savannah formation. In the studied period, 30,670 ha were burned, emphasizing the year 2015, which concentrated about 60% of fires. Among the affected vegetation formations, the field was the most (80%), contributing to a 3% reduction in the formation in the PA. On the other hand, areas without vegetation, agriculture and pasture showed growth during the studied period. We conclude that the recurrence of fires in the area occurs concomitantly with the reduction of a characteristic phytophysiognomy of the region and an increase in anthropic activities. In addition, increase areas without vegetation indicate non-regeneration after fires, while the increase in agriculture and grazing indicate that greater human intervention may contribute to catastrophic fire episodes.

ID104

PO39 - HOW TO LEARN ABOUT WILDFIRES BY PROMOTING PRACTICAL KNOWLEDGE ABOUT LOCAL ENVIRONMENTAL MANAGEMENT.

Helena Ballart[1], Núria Prat[1], Jordi Vendrell[1], **Guillem Canaleta**[1], David Martin[1], Guillem Armengol[1], Míriam Arenas[2], Conceição Colaço[3], Finian Joyce[4], Israel Rodriguez[2], Catarina Sequeira[3], Iryna Skulska[3], Renata Martins Pacheco[3], Maria Cifre-Sabater[2]

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Learning must contemplate theory and practice in wildfires, necessary for a real and significant assimilation of the transmitted contents to be generated. In this way, in learning to face wildfires, it is not only intended to bring the cognitive dimension closer to the ethical dimension of the person, but also recommended the inclusion of different capacities through practical tasks in their environment, varied in their performance and explanation, and in which the students have the feeling that they are only playing. The game has a fundamental role as a vehicle for transmitting content. Mefitu project for primary school is based on this concept.

In higher stages such as secondary school, moments in which more mechanical tasks are carried out, challenges or open questions can be used that allow varied solutions in response, content and extension, by proposing activities to find environmental management solutions to real challenges. The most important thing in learning about wildfires is the approach of tasks that allow practical application of the contents learned theoretically and in real life situations. Experiences from the students' own context are required. EduFire Toolkit project (Erasmus +) is an example with Project Based Learning methodology.

When it comes to learn about wildfires, although the students can comprehend, understand and manage a series of contents, it is fundamental training students with values, skills and tools to face the wildfires of the future. For this, to invite the local community to participate in learning is essential: school, family, land managers and society.

ID107

PO64 - ARTICULATION OF THE BRIDAGES PROGRAM WITH STATE INSTITUIONS INTHE MANAGEMENT OF INTEGRATED FIRE MANAGEMENT ACTIONS

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[1]Ibama

This article proposes an analysis of the articulation of the Federal Brigades Program from Prevfogo/Ibama in the state of Pernambuco, in the context of the importance of integrated fire management actions for the conservation of regional biodiversity, through the study of fire prevention and forest fires combat activities, developed in partnership with state institutions.

From an exploratory nature, with an inductive method, the research stems from a methodology centered on the bibliographical review of publications and on the analysis of the data generated by INPE about the federal brigades in Pernambuco; on the number of institutions and people trained by Prevfogo in the state; on the number of hot spots registered in the regions where the brigades operate; and data referring to expanded combat operations carried out in Pernambuco from 2017 to 2022.

As a result, it is expected to strengthen the management model of the MIF's actions, as an adequate strategy to face the challenges of using fire in the priority acting areas of the brigades in Pernambuco, with capacity building of the institutions and reduction of hot spots and burned area.

The area covered by the Brigades Program in Pernambuco is located in the Caatinga Biome, which covers approximately 65,000 km. In order to reduce the incidence of forest fires and the environmental impacts, it is essential to promote articulation between federal and state institutions, which are responsible for carrying out integrated fire management actions, aiming an integrated management actions to prevent and combat forest fires.

ID116

PP74 - THE POSTFIRE ANALYSIS AS A METHODOLOGY FOR PREPAREDNESS IN WILDFIRE MANAGEMENT

Jose Luís Soriano Sancho[1], Miguel Angel Botella Martínez[1], Agustín Cervera Montero[1], Daniel Orozco Bagou[1], Ricardo García Post[2]

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Objective

In the field of wildfire strategic analysis, it is proposed to identify the lessons learned about the conditions that influence fire behaviour, and to use them to improve wildfire preparedness and management procedures through the elaboration of post-fire analysis reports.

Methodology

A protocol is defined for data collection and analysis of variables that influence fire behavior, such as topography, fuels, fire defense infrastructures and the presence of wildland-urban interface. Historical fires and their behavior are studied too. An exhaustive analysis of the meteorology before and during the fire is also carried out. Sequential perimeters of fire advance are identified, and their behavior is correlated to each of these variables. Finally, post-fire severity is calculated to associate the behavior with level of vegetation damage.

This analysis is reflected in a document with a standardized format and known by the entire organization, which allows to quickly identify each of the variables that affect fire behavior in each fire.

Results

The most important lessons learned from each fire have been identified, which represent an advance in the collective knowledge of the mechanisms that define fire behavior, including the sources of information to be analyzed to identify them, as in the case of convective behavior.

Conclusion

The results obtained are useful for the training and preparedness of fire prevention and firefighting organizations, especially the team of analysts, in all phases of integrated fire management, planning, fire defense and post-fire actions

ID132

PP73 - WILDFIRE IMPACT ANALYSIS OF PORTUGAL'S BUILT ENVIRONMENT CONSIDERING CLIMATE CHANGE SCENARIO

Luana Tesch[1], Hélder D. Craveiro[1], Helena Gervásio[1], Aldina Santiago[1]

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The Wildland-Urban Interface (WUI) has recently gained significant attention from wildfire policymakers and researchers. The proximity of human settlements to the wildland has brought harmful impacts to this area since humans cause the majority of fires. On top of that, climate change has been aggravating fire activity worldwide, like Portugal, which faces yearly dramatic wildfire seasons with uncountable material and human losses. Recently, in 2017, Portugal encountered one of the worse wildfire seasons in its history, which burned almost six percent of its territory. In this context, this study aims to compute wildfire hazards considering the 30-year weather prediction for Central Portugal and compare it with the impact caused by the 2017 wildfires in this region. The year 2017 was chosen because it represents an event with extreme meteorological circumstances that most assemble the future climate change scenario for this area. The methodology will consist in simulating the wildfire for future and past (2017) scenarios for the same location, using Wildfire Analyst. It will be collected the flame intensity, flame height, and fire arrival time for each building in the WUI zone and then estimate the overall impact. As a result, we expect that the comparison between the future and past scenarios can demonstrate a more realistic outcome of what the future will look like for Portugal and can assist in creating efficient management policies to mitigate the risks for the built environment in that area.

ID145

PP78 - IMPACTS OF CLIMATE CHANGE AND HUMAN POPULATION GROWTH ON WILDFIRE POTENTIAL IN THE TROPICS:THE TAIN II FOREST RESERVE IN GHANA.

Eric Osei-Kwarteng[1]

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The increase in human population pressure especially in forest fringe communities and the accelerated change of land use in tropical vegetations have led to an increase in the use of fire. The opening and fragmentation of tropical evergreen forests has increased the risk of wildfires and this has destructive impacts on biodiversity and sustainability of these forest ecosystems. Assessment of potential impacts of climate change on fire regimes in the Tain II Forest Reserve of Ghana was carried out using the GCMs and a GCM derived lightning model (Goldammer and Price, 1997). Impacts of human population increase on wildfire potential in and around the forest reserve was also undertaken through the use of primary and secondary data sources. Primary data was obtained through interviews of community members and other stakeholders with the use of semi-structured questionnaires, field observations and focus group discussions. Secondary data was also obtained from existing literature relevant to the study. Considering the potential impacts of climate change on fire regimes in the Tain II Forest Reserve, the study concluded that, there is a high degree of certainty that land use and climate features under conditions of a 2xCO2 atmosphere will influence fire regimes in the area. In terms of impacts of human population increase on forest fire potential, the study concluded that, the potential for fire to occur in and around the reserve is high due to increased farming and grazing impacts which leads to the formation of open and sparse vegetation cover increasing wildfire risk.

ID147

PO40 - WILDLAND FIRE MANAGEMENT NETWORK FOR BRAZILIAN WETLANDS LEARNINGS FROM SEASON 2022, APPLICATIONS FOR SEASON 2023.

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In 2020, a mega-fire of catastrophic proportions affected 26% of the Brazilian Wetlands - Pantanal (G1, 2021), one of UNESCO's major world biosphere reserves - and the largest tropical wetland area in the world, with an area of 150,355 km2 (UNESCO, 2020). 3.9 million hectares have been burned, 17 million vertebrates have died (G1, 2021), and about 115 million tons of CO2 have been emitted into the atmosphere (Aragão et al., 2021).

Soon after the mega-fire, a group formed by representatives from the public ministry, scientists and researchers, non-governmental organizations, and the private sector met to design a resilience plan and monitoring strategy for the Pantanal, with the aim of supporting local institutions that have historically fought fires in the biome.

From this collaborative effort was born the "Abrace o Pantanal" (Embrace Pantanal) project, with the holistic vision of monitoring and managing firefighting in real-time, in addition to protecting biodiversity.

The first phase of the project took place in the 2022 fire season and monitored 2.5 million hectares of fire-affected areas of the biome. Pantera FIre Management Platform, software developed by umgrauemeio integrates the foundations of fire fighting into technologies for prevention, early detection, and fast response, providing accessible impact data. The project was sponsored by the private sector and involved multiple local stakeholders.

Our goal is to share the learnings and results from the 2022 operational fire season and highlight the insights for season 2023 and how Embrace Pantanal can be a model to other global fire-affected nature reserves.

ID152

PO55 - OPTIMISATION METHODS FOR WILDFIRE SUPPRESSION RESPONSE PLANNING

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Wildfires are among the common forms of natural disasters, which can cause damage to ecosystems, human life, and property. The initial attack is the first response stage, triggered as soon as the fire is detected, and consists of dispatching resources to the burning landscape. However, the decisions involved are complex due to the dynamic behaviour of the flames, which is affected by the weather conditions, the landscape's topography, and the fuel present. The objective is to develop optimisation-based planning tools to assist fire management teams in dispatching existing resources to circumscribe and extinguish the fire at the earliest time or to minimise the required resources for a given protection task. The proposed tools consist of mathematical programming models and metaheuristics, which are integrated into databases containing the relevant information for fire suppression planning. Given an ignition node and the set of available resources, the models and algorithms must decide where to position them to achieve the desired objectives, considering the impact of the suppression resources on the fire propagation path. The proposed methodology is demonstrated for the Baião Territory in the district of Porto, Portugal, an area prone to fire occurrences. Besides delineating the initial attack, the impact of different resource levels on the suppression response is assessed. We conclude that planning tools can effectively support fire management teams' decisions.

This work is supported by FCT - Fundação para a Ciência e Tecnologia within project PCIF/GRF/0141/2019 "O3F - An Optimization Framework to reduce Forest Fire".

ID160

PO68 - EIGHTEEN YEARS OF MIOMBO FIRE-RELATED RESEARCH: LESSONS FOR WOODLANDS CONSERVATION AND RESTORATION

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Miombo woodlands are one of the largest and most important ecosystems of southern Africa, covering 1.9 million km2 over seven countries. Together with climate and soils, fires and other disturbances such as herbivory and human activities are the main driving factors of miombo ecology and dynamics. Niassa Special Reserve (NSR) is one of the largest (42 000 km2) and most pristine protected areas of Miombo worlwide. The reserve has a unique situation of well-conserved and highly diverse woodlands, where anthropogenic fires and herbivory play a major role in the ecosystem's ecology. Aiming at addressing the role of fire on vegetation, we have implemented an interdisciplinary research strategy that combines several socio-ecological approaches to monitor the ecosystem dynamics at different levels, from gene to the landscape. These include: social sciences and ecology field-based methods, remote sensing and landscape genomics. In this communication we will present an integration of various results at the different scale of analysis. Our results indicate that fire is in fact a driving ecological factor of the miombo woodlands in NSR. Our evidences indicate that miombo are adapted to fires but changed in fire regimes may have profound influences on ecosystem's structure and composition as well as its capacity to provide goods and services to local and global communities. Finally, our results are of utmost relevance in shaping fire management activities in this important protected area. The fire management plan that is being established for NSR should take into consideration the results of our long-term study.

ID187

PO83 - IMFIRE - AN INTELLIGENT WILDFIRE MANAGEMENT AND DECISION SUPPORT SYSTEM

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IMFire is a state-of-the-art wildfire management and Decision Support System (DSS) aimed at civil protection authorities, public or private land and infrastructure owners, for the management of fire in its multiple stages, including prevention, planning, and suppression.

This paper describes IMFire's novel approach and implementation, as well as use-case examples for validation.

From a preparedness perspective, IMFire estimates an accurate fire risk index for a particular region, allowing to timely act and apply the necessary preventive measures. Local weather conditions and wildfire historical records are processed automatically using clustering techniques to determine custom fire risk classes.

During a wildfire, our fire behavior simulator predicts the progression and intensity of the fire front, as well as smoke generation and dispersion, as a function of the fuel, fire, weather, and slope characteristics, allowing the planning and simulation of the most effective fire suppression strategy. The simulator relies on state-of-the-art fire behavior models, as well as Evolutionary Algorithms to tune the models' parameters to each particular scenario. Graph theory is used to determine where to deploy fire teams to effectively contain the fire.

Experiments performed with data from prescribed and real fires showed superior agreement between the simulated fire and the real fire behavior, using the proposed methodology as opposed to using traditional fire spread models.

IMFire combines expert knowledge in wildfires with the potential of artificial intelligence to offer a robust and meaningful tool to help protect lives, infrastructure, and resources with higher confidence than any other DSS on the market.

ID204

PO79 - A QUANTIFICATION OF LAND GOVERNANCE ROLE IN MITIGATING WILDFIRE IMPACTS IN ITALY

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Multiple biophysical and socio-economic factors drive fire disturbance in southern Europe. Governance strategies contribute in shaping fire spatial patterns. Fire-smart landscape management aims at mitigating fire impacts by integrating planned fuel management interventions (e.g. strategic fuel breaks) and active land uses with a regulatory effect on fire at the landscape scale (e.g. pastoral and agroforestry activities, nature conservation). However, studies on this regulatory effect on a large territorial scale are not available. Our hypothesis is that active land governance influenced fire spatial patterns in Italy between 2007 and 2017, mitigating wildfire impacts in terms of burned ecosystem services, forest area burned at high fire severity, and burned wild-urban interface. To test this hypothesis, we collected a set of proxies related to different land governance aspects (rural development, sustainable forestry, agro pastoral activities) using as spatial unit 766 agro-forest districts covering the entire Italy (i.e. groups of neighboring municipalities with similar agro-forestry characteristics). We factored out the variability explained by major fire drivers: climate, weather, flammability, socio-economic, and land cover changes. Random Forest algorithms highlighted that land governance has a significantly negative, albeit moderate, effect on wildfire impacts when compared to other drivers (e.g. climate). Thus, we found scientific evidence that land governance contributes in regulating fire spatial patterns in Italy. Our results support the strategic role of EU, national and regional policies (e.g. rural development program, LIFE+ programs, forest certification schemes, sustainable forestry) aiming at fostering fire resistant and resistant landscapes.

ID227

PO70 - EVACUATION IN RURAL FIRE SITUATION IN PORTUGAL - CABANÕES CASE STUDY

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Rural fires are growing in size, speed and intensity, and their hazards increase significantly near the urban areas. To protect people and ensure safety, especially in villages that are not operationally prepared to shelter their inhabitants safely mass evacuations are required.

Despite the existence of international reports of evacuations and exercises, as well as studies on evacuation modelling, there is little information and few studies of the Portuguese reality. In Portugal, evacuation in rural fires concern mainly isolated villages, with difficult access and inhabited by older people. Evacuation is usually carried out on foot, to a concentration point within the settlement for later evacuation to a shelter. Villages with these characteristics need timely and preventive evacuations, so as not to endanger their inhabitants and the rescue forces and avoiding last-minute escapes.

This paper reports a case study of a mass evacuation test carried out at a Portuguese village with high exposure to fire: Cabanões, Lousã. The study was organised in three steps, first a structural and demographic survey with a collection of historical data and the awareness of the inhabitants was made; secondly, their pedestrian speeds were tested, and at the end, a fire evacuation exercise was performed.

The spatial and temporal scales, the critical issues related to evacuation scenario and the means and procedures that best adapt to this village were obtained. The analysis of these results will help the policy makers for the development of safety guidance and recommendations for emergency management and evacuation planning.

ID244

PO80 - SUPPORTING EFFECTIVE FIRE MANAGEMENT IN UGANDA

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Most wildfires in Uganda occur in savanna parks and neighbouring forest reserves, and nearly all are human-caused. Increasing wildfire frequency hinders succession, degrades ecosystems and poses significant risks to biodiversity, and to adjacent communities and their livelihoods. High risk forests must be protected from wildfires, whereas fire plays an integral role in savanna ecosystems, so it is essential to better understand human use of fire for implementing best practices. Guidelines for all stakeholders must be developed that align with their respective management priorities, supported by the provision of the required skills and equipment. As the country moves forward to developing, adopting and implementing an effective fire management strategy, this study identified three overarching needs, to improve communication, collaboration, and coordination. Fire prevention greatly reduces the resources needed for fire suppression. Prevention programmes exist that only need to be rolled out, and existing guidelines for protected areas need to be operationlized. To do this, many disparate groups must come together and work on fire risk management planning and the preparation of a broad strategy and implementation guidelines. In addition, the fire management capacity and requirements of concerned authorities should be identified following a detailed gap analysis. Effective planning at local, landscape and national levels requires a holistic approach, rather than disjointed efforts, and there is an urgent need for effective coordination of wildfire management activities. This should come through a bottom-up approach, where stakeholders at landscape level come together under a common platform that should later transform into a national platform.

ID246

PO49 - ANALYSIS OF VILLAGES WHERE RECENT WILDFIRE MITIGATION INITIATIVES ARE BEING IMPLEMENTED IN PORTUGAL

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After the extreme wildfire events of 2017, several initiatives were created to increase the resilience and safety of local communities to wildfires in Portugal, namely the programs "Safe Villages" and "Safe People", coordinated by Portuguese Civil Protection (ANEPC), and "Condominium of Villages", coordinated by the Directorate General of the Territory (DGT). This study analyzes the conditions of the villages where these programs are being implemented. The analysis focuses on the area with high and very high structural hazard (critical area) and on fire-prone landcover types found in the 100m protection area around the villages, as defined by law. In addition, we also assess the exposure of the resident population. The location of the villages included in the Safe Villages (SV) and Condominium of Villages (CV) programs was retrieved via the geographic coordinates of a point that intersects the built-up area. The percentage of critical area and of forest-shrubland, was calculated for each 100 m buffer and the spatial distribution of these characteristics was assessed for the Algarve Region. In total, 135 SV were implemented in 9 municipalities and 8 CA were implemented in 3 municipalities, with 1 village having the implementation of both programs, in Silves. Alcoutim has the highest implementation of SV (84), and Silves is the municipality with the most CA (5). The efficiency of this programs and the protection of local communities can be improved by selecting the villages that need measures related to fuel management (CA) or measures focuses on self-protection of residents (SV).

ID247

PO57 - FIELD OBSERVATION SHEETS TO IDENTIFY RESILIENCE TO FOREST FIRES IN CHILEAN MEDITERRANEAN LANDSCAPES

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Due to global anthropogenic and climatic pressures, landscapes lose more and more elements that make them resistant to disturbances, however, what makes a landscape effectively resistant is currently not so well defined. Therefore, for this work, a resilient landscape will be understood as one that is capable of preserving its various components (biogeographic and/or human) based on the lessons learned and the ability to self-organize after repeated disruptive events.

The general objective was to evaluate the landscapes of the urban-rural interface areas in the Metropolitan Area of Concepción (AMC) in Chile from the perspective of landscape studies with the purpose of advancing toward the construction of more resilient physical-human landscapes to the fire.

This qualitative work presents a field worksheet that was applied in urban-rural interfaces to identify elements of fire-resistant landscapes, which stands out for being accessible to stakeholders and researchers. Likewise, the main findings of the application of the field worksheet are presented, where 5 clusters and two landscape typologies were identified.

ID272

PO61 - FIRE-SPOTTING RISK FOR EMERGENCY PLANNING: THE ROLE OF MESO- AND MACRO- SCALE FACTORS

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Fire managers are adapting to novel fire regimes and behaviors caused by climate change and large fuel availability by planning preventative and risk mitigation actions (e.g., fuel treatments at the wildland-urban interface) and contingency measures (e.g., prompt evacuations and community fire-shelters). Successful evacuations depend on many factors, the most relevant are pre-planned safe evacuation routes and timely evacuation orders. Extreme fire behavior could dramatically shorten the useful time to evacuate especially when wildfire spread is driven by fire-spotting and local emergency plans are based on the evaluation of such time of fire arrival to sensitive targets. Fire-spotting is a random process occurring when fire-brands are transported far ahead of the fire front by advection phenomena (i.e., wind, convective column, etc.) resulting in much greater overall rate of spread by the ignition of secondary fires. In the planning phase, a good forecast of the risk associated to fire-spotting must pass through a statistical parametrization and the study of involved meso- and macro- scale factors. In addition, this parametrization must be implemented in an operational wildfire simulator in order to provide a reliable emergency plans. In this work we have implemented the physical parametrization of fire spotting Random-Front in the operational wildfire spread simulator PROPAGATOR. Moreover, we have compared the results against those predicted by previous fire-spotting models over a case of study scenario. This methodology could be useful for fire managers to plan the most effective contingency measure (leave or stay) in case of extreme fire behavior.

ID279

PP71 - CALIFORNIA FUEL BREAKS: ALTERNATIVE METRICS OF SUCCESS

Candidate Andrew Johnson[1], Brandon Collins[1]

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Linear fuel breaks are constructed to decrease fire risk to human and natural resources by providing firefighters with a tactically selected pre-treated with reduced fuels, from which they can successfully engage with and control the fire's edge. However, there are multiple co-benefits to fuel break placement that result from fire behavior modification and firefighter intervention. The objectives of this study are to determine these co-benefits or "alternative metrics" of fuel break success by consulting with and surveying fire managers across the state of California. To this end, we constructed an online survey using input from the literature and managers to measure practitioner perceptions of fuel break effectiveness. The survey was distributed using a snowball sampling method, yielding 48 unique responses (n=48) from fire managers employed by various management agencies in California. Survey results were analyzed to determine operational predictors of perceived alternative metrics of fuel break success. These metrics include, but are not limited to increased time for evacuations and improved aircraft effectiveness. Predictors include, but are not limited to whether the fuel break was used during firing operations and whether ground resources were assigned to the fuel break, respectively. Spatial data of these fuel break-wildfire encounters is currently being analyzed to determine construction predictors of alternative metrics of success including width, topographic position, and fuel type. Results demonstrate that fuel breaks are viewed by managers as multiple-purpose tools that can assist in the accomplishment of various objectives during operations.

ID285

PP81 - EXPLORING WILDFIRE SUSCEPTIBILITY MODELS FOR AGRICULTURAL LAND USE AREAS IN PORTUGAL

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Wildfire susceptibility models for agricultural lands could help to create more reliable and dynamic fuel type mapping for Portugal, specially to classify unburned fuels, which is crucial for simulating fire behavior across the landscape. Spatial modeling of the agricultural areas prone to fires or susceptible to burn is inherently complex, and requires the analysis of various conditioning factors. This work presents a model to predict monthly wildfire occurrence probability in agricultural land use areas in mainland of Portugal. For modeling purposes, a Geographical Information System (GIS) database was built, including three predictors (distance to artificialized territories, slope and drought conditions based on Normalized Difference Moisture Index (NDMI) from Sentinel 2 time series), the agricultural land use data of the COS18 (Carta de Ocupação do Solo) and COSSim2020 and data of burned area perimeters from the Portuguese Forest Service from 2017 to 2021 extracted for the main summer fire season. The results showed that the predictive ability of the Random Forest (RF) model were slightly better than other benchmark models as classification trees and logistic models. RF performance yielded overall accuracies that varied between 55% and 76% by agricultural class and by month. The models could facilitate a better attribution of the fuel model in agricultural areas. These results are also instrumental to quantify the uncertainty of fuelmaps in fire behavior simulators.

ID294

PO41 - EVALUATION OF COLORS FOR UNIFORM USED IN FIGHTING FOREST FIRE BASED ON THE PERCEPTION OF MILITARY FIRE FIGHTERS IN PARANÁ

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In order to fight forest fires, it is necessary to use personal protective equipment (PPE) in order to protect and provide visibility to combatants during operations. This research aimed to evaluate, according to the perception of forest fighters, the best fabric colorations to be used in occurrences of forest fires, as well as to evaluate the color of clothing of forest fighters from other institutions involved with the activity. We also sought to evaluate other positive characteristics of the uniforms used by the military firefighters of Paraná State. To carry out the study, a questionnaire was used as a research method, which was distributed to 60 military firefighters from Paraná who worked in Forest Fire Fighting in the years 2019 and 2020 in two Brazilian states, Pará and Mato Grosso do Sul respectively. As a result, it was verified that several public and private bodies use orange and yellow colors on the upper part of the uniform and these colors, through the perception of the combatants, provide better visualization in a forest environment. Among other features, the reflective strip was considered a positive factor as it also allows the visualization and consequently the location of combatants at night. Thus, it is concluded that orange and yellow are PPE colors with high visibility and ideal for making clothing for forest fighters, and the uniform used by the Paraná Fire Department, in Forest Fire Fighting, presents itself as a standard very efficient Personal Protective Equipment for combatants, both visually and functionally.

ID303

PP83 - 2022 WILDFIRE OPERATION IN BRAZIL'S XERENTE AND FUNIL INDIGENOUS LAND BY PREVFOGO/IBAMA

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[1]*PREVFOGO/IBAMA*

The purpouse of this abstract is to show the amount of prescribed burn areas and wildfire burned areas in Xerente and Funil a indigenous land in 2022.

The National Center for Wildfire Prevention and Suppression (Prevfogo), a specialized department of the Brazilian Institute for the Environment and Renewable Natural Resources (Ibama), acts in the indigenous land of Xerente/Funil under the local coordination of the state of Tocantins. In 2022, the Xerente indigenous federal brigade was formed by 55 men, most of them indigenous. They were hired through a public selection process and trained to work with wildfire prevention and suppression.

The local coordination of Tocantins initiated the production of fuel load maps, separating green vegetation from dry vegetation in all of Apinayé's territory in May 2022, which is the end of the rainy season.

The brigade, owning those maps, started the annual operational season with the execution of Prescribed Burn Plans, followed by wildfire incident suppression.

The results reached by the brigade, in terms of executed prescribed burns between May 10 and July 26, from 399 Prescribed Burns Plans, totaled almost 67,204 hectares of managed area. As for the wildfire suppression, there were 58 Wildfire Occurrence Registers, with a total of 44,417 hectares burned.

Those results indicate the need for a major comprehension of the traditional use of fire dynamics by the indigenous people, as well as a big attention to the establishment and fulfillment of the annual use of fire calendar.

ID304

PO43 - LEARNING TO LIVE WITH FIRE - PRIORITIZED WILDFIRE EVACUATION CHECKLIST

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Objectives

Given a warmer and drier climate, human settlements across the globe are increasingly faced with wildfire. When it comes time to evacuate due to wildfire, there is often little time to contemplate what to take and what to leave. Not only is this scenario stressful, but also potentially life threatening. As such, it becomes difficult to make rational and thoughtful decisions in the face of fear, uncertainty and haste. The objective of our publication is to change the likelihood of positive outcomes when evacuating from wildfire.

Methods

Our publication provides a prioritized checklist to be used when evacuating due to wildfire (or other natural disasters). By following the prioritized checklist, individuals are systematically guided through a list of items thereby facilitating critical decisions (i.e., people, prescriptions, and phone) as well as calming nerves (i.e., pets, photos, and "priceless" items). Secondarily, our publication is designed to provide a proactive planning guide as a means to further reduce panicked behavior while also minimizing painful loss outcomes.

Results

Unfortunately but inevitably, numerous individuals have utilized our prioritized checklist. Analysis of results indicated individuals felt a greater sense of control and reduced panic when following the prioritized list.

Conclusions

Across the globe, we have developed a complex relationship with wildfire that is indeed a "wicked problem," especially when there is loss of life and property. This unique prioritized checklist (not seen elsewhere in the literature) along with our proactive planning guide is part of an integrated approach to learning to live with wildfire.

ID313

PP80 - EFFICIENT STRATEGIES TO PREVENT LARGE FOREST FIRES IMPLEMENTED A BRAZILIAN INDIGENOUS LAND

Francinete Correa Pacheco, Rodrigo Falleiro

The Brazilian Indigenous Lands are protected by the Federal Brigades-BRIFs Program of the Prevfogo Center, linked to Ibama. Despite investments in financial, human and material resources, large fires still persist in tropical forests, driven by climate change. One of the most critical areas is the Araribóia Indigenous Land in the state of Maranhão, with a vast history of complex and costly combat operations. The area has high ethnoenvironmental importance, due to the presence of the Awá-Guajá, the most threatened ethnic group in the world. In disagreement with the experts' forecasts, the Araribóia IT has not suffered any major fires in the last two years. By analyzing the management differences implemented recently, we found that success is directly related to prevention and preparation activities focused on the improvement of indigenous brigades and the approximation with communities. The performance of various environmental education activities, the continuous training of brigadists and constant monitoring resulted in the reduction of risks and response time, ensuring the rapid control of fires. The valorization of indigenous peoples also involves stimulating the development of self-esteem and empowerment, in order to assume fire management in an efficient, effective and effective way. We conclude that strategies focused on the human being are still a bottleneck of the programs carried out with these communities. The success of this program demonstrates that these strategies are more important and efficient than the high investments in equipment and technology, recommended by many technicians who work in the protection of forest fires.

ID315

PO78 - GEOLOCATION OF RESERVOIRS/WATERSHEDS FROM SATELLITE

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Portugal's geographic location, type of vegetation and global climatic condition dictated a new era with regard to environmental and social catastrophes, particularly forest fires, which makes efficient planning and management of available water resources indispensable. At this stage, it is necessary to have accurate and constantly updated geographical information about surface water storage, that can be extremely useful in fighting fires. The digital processing of images obtained through remote sensing allows a quick and rigorous update of the surface storage inventory. The satellite navigation systems currently available allow the integration of various types of information, in addition to geolocation, which allows a huge advantage in emergency situations, in which it is necessary to decide in real time where to supply vehicles and aerial means. These geographic information systems provide the user with the locations of the reservoirs closest to their area of intervention, their metric area and water availability. Through digital processing techniques and using medium-resolution satellite imagery from the European Copernicus Program, a technology has been tested and operationalized in the forest areas of the District of Faro, to perform the automatic delimitation of artificial reservoirs and natural water bodies existing in a given region and time, calculate their capacity and depths automatically, store these data in a GIS system and make them available to authorities. The satellite revisit period of 5 days, allows a quick update of geographic information, essential for planning strategies in places where water reservoirs in hot seasons are consumed in a few weeks.

ID329

PP76 - INTEGRATIVE FIRE MANAGEMENT FOR THE WORLD'S LARGEST CONTINUOUS TROPICAL WETLAND IS URGENTLY NEED FOR THE PANTANAL BIODIVERSITY AND HUMAN POPULATION

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Record-breaking wildfires over 40,000 km2 (affecting 30% percent of the biome) in 2020 reached the Pantanal, a vast and well-preserved tropical wetland, shared between Brazil, Bolivia, and Paraguay. While fires have been occurring in the Pantanal for millennia, their area has increased by 376% since 2000 compared to the annual average of the area burnt annually in the last two decades. Moreover, 43% of the area affected in 2020 (over 17,200 km2) had not been burnt previously in the last two decades. Worsening climatic conditions, including drought (severe drought decreased water levels) with the presence of dry fuel along riverbeds (the fire corridor was in the Paraguay River flood zone); constraints on firefighters due to COVID-19 and budget cuts; lack of fire prevention strategy; and land use changes all contributed to this increase. Wildfires are currently tackled in an ad-hoc fashion, and we advocate for socio-ecologically sensitive Integrative Fire Management involving permanent fire brigades, including indigenous members for conducting year-round fire management and communities cooperating to create a collaborative network for wildfire prevention. The local and national response regarding the wildfires was considerable. During the disastrous wildfires, several new research networks were organised and plan integrated actions on preventing fire disasters with training manage fire brigades at key locations throughout the Pantanal. After these mega-fires it was clear that prioritization for fire management and restoration of fire-sensitive species of key areas is urgent as well as financial investment over time to prevent this catastrophe from happening again.

ID334

PO54- BIOMASS BURNING EMISSIONS DURING THE 2020 PANTANAL BURNING CRISIS: THE NEED FOR A FIRE MANAGEMENT POLICY

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The fire-prone Pantanal biome, the world largest tropical wetland located in the center of South America, faced an extreme drought event in 2020. The reduced annual precipitation, 26% below the 1982-2020 period, led to record-breaking burnings. Active fires detected by the Moderate Resolution Imaging Spectroradiometer (MODIS) sensors during this year were 123% higher than the 2002–2020 average. Assessing the emissions associated with this burning crisis is still required. In this work, we estimated the Particulate Matter with diameter less than 2.5 micrometers (PM2.5) emissions associated with biomass burning during the 2020 Pantanal burning crisis. To this end, we used the Brazilian Biomass Burning Emission Model with Fire Radiative Power (3BEM_FRP) model implemented on the PREP-CHEM-SRC emissions preprocessing tool version 1.8.3. Biomass burning was the only activated emission source on PREP-CHEM-SRC, and MODIS active fires products (MOD14 and MYD14) were used as inputs in the 3BEM_FRP model. Our estimation is that more than 400,000 Mg of PM2.5 were emitted during the 2020 Pantanal burning crisis. This value is the highest recorded during the MODIS era, 242% above the 2002-2020 annual average emission in the Pantanal. Since severe and prolonged drought events are expected to increase in the Pantanal during the upcoming years, urgent policies are required to mitigate extreme burnings in this fire-prone biome. This includes well-established fire management practices such as the promotion of integrated fire management (IFM) techniques, involving prescribed burnings during the early dry season, that can potentially prevent megafires in the Pantanal.

ID341

PO56 - FIRE MANAGEMENT DECISIONS UNDER CLIMATE CHANGE CONTEXT: RESPONSE OF SUB-ADULT TREES TO FIRE SEASONS IN GUINEAN SAVANNA (WEST AFRICA)

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Mesic savannas worldwide experience frequent fires, almost all set by humans. Management fires are set to reduce or enhance tree cover. Success depends greatly on responses of sub-adult trees to fires. In a 6-year experimental field study in Guinean savannas, we monitored annually the heights and responses of 1,765 permanently tagged sub-adult trees under annual fires set in different periods of the long dry season: early-dry season (EDS), mid-dry season (MDS) and late-dry season (LDS). Annual EDS and MDS fires are the common local management protocols of Guinean savannas. Overall, the proportion of sub-adults that resisted being top-killed differed across fire seasons. Furthermore, resisting one fire gave a better chance of resisting the next. Only sub-adult that were able to resist direct damage for 3 successive EDS and MDS fires reached sufficient height to be recruited to the adult stage. Recruitment height was 3 m for EDS and 3.3 m for MDS fires. No height was great enough for sub-adult to be recruited in LDS fire. These seasons of fire could be used to maintain the desired tree density in Guinean savannas (successive EDS & MDS fires enhance tree density and LDS fires reduce tree density) and may inform fire management in other mesic savannas. In areas with heavy bush encroachment, LDS could be used alone for many years, or biennially. This study also provides relevant information for comparative studies on the mechanisms of recruitment of sub-adult trees to an adult stage, a process that ultimately determines savanna physiognom.

ID356

PO53 - INTEGRATING FOREST AND FIRE MANAGEMENT THROUGH A NOVELSIMULATION-BASED OPTIMIZATION APPROACH

Filipe Alvelos, **Isabel Martins**, Susete Marques

We propose to integrate forest management for timber production and the use of wildfire scenarios to bring wildfire resistance into plans. A novel simulation-based optimization approach in which the forest management is iteratively guided by the feedback of a fire spread simulation is developed.

The forest management problem consists of selecting one alternative prescription for each stand, subject to restrictions, such that the net present value is maximum. For each stand, there are alternative prescriptions with non-premature harvests and prescriptions with premature and non-premature harvests, both encompassing the projection of forest conditions and outcomes with species-specific growth and yield models, combined with different fuel treatment scenarios. In each iteration of the approach, the optimization problem is solved. Fire travel times between adjacent points in a grid representing the landscape are calculated, according to the fuel models of the selected prescriptions and other conditions as wind characteristics and slopes. Then, the fire spread is simulated for all potential ignitions. Paths with a fire travel speed greater than a given threshold (unacceptable paths) are identified and, to exclude their associated prescriptions to be jointly selected, constraints are added to the forestry problem. This problem is re-optimized and the whole process is resumed until there are no unacceptable paths or the stands to be used as fire breaks are identified. Promising results were obtained with a Portuguese forest.

This work is supported by FCT - Fundação para a Ciência e Tecnologia, within project PCIF/GRF/0141/2019 "O3F - An optimization framework to reduce forest fire".

ID358

PO63 - EXPERIENCE FROM STRUCTURING A FEDERAL STRATEGY FOR VOLUNTEERING IN INTEGRATED FIRE MANAGEMENT IN BRAZIL

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The objective is to report the experience of structuring a Federal Strategy for Volunteering in the Integrated Fire Management (IFM) in Brazil, which began in 2022, from the institutional articulation of the Ministry of the Environment, IBAMA and ICMBio (main implementers of actions aimed at the IFM in federally protected areas), IPÊ and GIZ. From the establishment of an inter-institutional working group, a project was generated, which began in October 2022 and has the following steps: I. survey of international and national experiences related to volunteering at IFM; II. identification and mapping of the role of volunteers in the IFM in Brazil; III. holding workshops with representatives of government institutions and civil society to discuss guidelines for a federal volunteering strategy in the IFM; IV. regulatory proposal; V. elaboration of support instruments for the strategy including a legal and economic study, a communication plan and a pedagogical plan. The project is currently in the stage of gathering information and organizing the first workshop, which will take place in March 2023. This initiative responds to a demand from Brazilian society for voluntary participation in preventing and fighting fires, providing guidelines and regulating the activities of these groups. Thus, it is possible to increase the effectiveness of the actions carried out and the safety of those involved. Complementarily, it will assist in the implementation of public policies to protect biodiversity and reduce greenhouse gas emissions, given that the occurrence of large forest fires has intensified in the country.

ID362

PO81 - ROLE OF A CIVIL SOCIETY ORGANISATION IN WILDFIRE RISK AWARENESS AND PREPAREDNESS WITHIN FOREIGN COMMUNITIES AND VISITORS

David Thomas

The devastating wildfires that occurred in Portugal in 2017, illustrated the need for greater risk awareness amongst the population, improving community preparedness and during major events, providing timely and clear communication to residents and tourists in a language they understand. Given overseas experiences where tourists and foreign residents have been victims, it is essential to ensure that those impacted are aware of this outreach.

Objectives

With an increasing foreign and tourist population, the attraction of Portugal's rural areas is growing. The objectives, within these communities, were to a) promote importance of land cleaning adopting appropriate safety precautions b) improve risk perception and c) encourage the adoption of appropriate self-protection measures.

Methods

Our association Safe Communities Portugal, forged close interaction with AGIF, ANEPC, civil protection agents, Tourism authorities and Coimbra University; undertook training, attended civil protection exercises, gained qualification as a Civil Protection Volunteer Organisation qualification, and through research, learned the causes of wildfires, how they spread, and self-protection measures communities should adopt. This knowledge was promulgated within the foreign community and tourism industry through: radio, social media, newsletter, multi lingual information/leaflets, printed media and community gatherings, questionnaires and creating a comprehensive website.

Results

There is a far greater compliance of land cleaning, understanding the causes of ignitions and how they can be avoided and adoption of self-protection measures among foreign community and visitors.

Conclusion

Study illustrates the value of involving foreign community in consultation process and multi-lingual public communication during major incidents, thereby ensuring equality, diversity and inclusivity.

ID363

PO65 - FIRE EFFECTS ON THE FLOWERING OF ENDEMIC SPECIES IN THE BRAZILIAN RUPESTRIAN GRASSLANDS

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Fire is used for vegetation management by traditional peoples in savannas and grasslands around the world, and the outcomes vary according to the burning regime (eg., season, frequency) applied. In the Brazilian rupestrian grasslands, collectors of the "everlasting flowers" (Eriocaulaceae, Xyridaceae) use fire to stimulate their flowering. These plants are endemic to that environment and many are threatened with extinction, requiring studies on the system sustainability. We conducted prescribed burns at the beginning (May= QP) and end (September= QT) of the dry season, in two areas containing 8 plots (50 X 50m) each, in the Sempre-Vivas National Park (PNSV, Espinhaço Sierra) to verify the influence of fire and of each burning regime on flowering. We used high-resolution photographs to monitor flowering. Both fire regimes affected the richness and abundance of the flowering species. After 26 months of monitoring, flowering species richness in QP was in average 12% higher than in unburned areas, and in QT it was 22% lower. Considering only the first year after fire, the unburned plots exhibited on average 27% more flowered everlasting species than the burned plots, however, the pattern reversed in the second year after fire, and the burned plots had 62% more flowered species than the unburned ones. The flowering species abundance was always higher in burned plots compared to the unburned, on average 12% in QP and 46% in QT. Therefore, fire does increase the flowering of everlasting-flower species in the second year after its occurrence, and QP stimulated more species to flower.

ID371

PO67 - OBSTACLES AND SOLUTIONS TO INCREASING PRESCRIBED BURNING ON CALIFORNIA'S CENTRAL COAST RANGELANDS

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Needs assessments of my clientele (primarily ranchers, land management organizations, and groups that support them) indicated that they have a strong desire to conduct prescribed burns on lands they manage. Objectives identified for burning included reducing their own risk and vulnerability to wildfire, making adjacent communities safer, cultural burning objectives, improving livestock forage, and improving habitat for native species. The University of California Cooperative Extension (UCCE) and the Resource Conservation District of Monterey County received two grants from the California Department of Forestry and Fire Protection to develop and expand the capacity of the Central Coast Prescribed Burn Association (CCPBA). Through the CCPBA we have developed a network of more than 600 people who want to learn about and implement prescribed burns. The CCPBA has conducted numerous prescribed fire trainings; implemented two prescribed burns; developed an apprenticeship program for local tribes; and is developing burn plans and conducting environmental compliance for eight additional prescribed burns. As a result of this process, we have encountered multiple obstacles that have limited our ability to scale-up prescribed burning. Those obstacles include expensive and time-consuming environmental compliance; limited capacity of local people who are qualified to write burn plans, conduct environmental compliance, and lead prescribed burns; and availability of long-term funding. Finding solutions and overcoming these obstacles on California's Central Coast will require developing relationships and working with individuals, educational institutions, agencies, organizations, and legislators at the local, regional, and state-wide level.

ID377

PO45 - LONG-TERM ECOLOGICAL RESEARCH ON FIRE IN PANTANAL WETLAND: A SUBSIDY TO INTEGRATED FIRE MANAGEMENT.

Geraldo Alves Damasceno Junior[1], Arnildo Pott[1], Ieda Maria Bortolotto[1], Danilo Bandini Ribeiro[1], Edna Scremin-Dias[1], Alexandre de Matos Martins Pereira[1,3], Maxwell Oliveira[2], Rosa Helena da Silva[1], Tamires Yule[1], Francielli Bao[1], Fábio de Oliveira Roque[1]

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Fire in floodable areas poses two opposite extreme phenomena acting alternately. The Pantanal is one of the world's most extensive tropical continuous wetlands, subject to seasonal flooding and pluriannual fire. The consequences of the interaction of fire with inundation on the biota are little understood. We established a Long-Term Ecological Research aiming to evaluate the effect of recurrent fire and inundation on the dynamics of the biota, the landscape, and ecosystem services in the Pantanal. The project has been carried out in areas with the highest incidences of fire. Using satellite images from the last 20 years, we mapped the burned areas to establish the fire history. After this, we established permanent plots in different physiognomies to verify long-term variations in the structure and functional diversity of several groups of organisms. We are also performing controlled burning experiments to evaluate fire's effects on the dynamics of natural grasslands (native pastures). We are using four treatments of fire: Fire at the beginning of the dry season, middle of the dry season, begging of the rainy season, and control. We also used two treatments of inundation: high and low inundation plots. We selected ten plant species among the most abundant to study the secondary compounds' variation related to inundation and fire. The project also aims to evaluate the traditional knowledge of riverside populations, ranchers, and Indigenous populations concerning fire management. At the landscape level, we will also study the characteristics of the landscapes with the highest recurrent fire history.

ID379

PO44 - FIRE, FLOOD AND PANTANAL VEGETATION

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Fire in seasonally inundated floodplains sounds like a contradictory issue. Nevertheless, many tropical and subtropical wetlands, such as Pantanal, are fire-prone. Fire can interact with inundation in these systems determining variation in their vegetation structure, functioning, and composition. This study aims to describe the Pantanal floodplain's fire regime and review the available literature on the present knowledge about the effects of fire combined with flooding on its vegetation. For that, we searched the number of heat points in Brazilian Pantanal using satellite images from 1999 to 2020. We also searched for published papers and books dealing with the fire in the Pantanal vegetation. All subregions burned in that period. The periodicity of fire is nearly every second year. The most extensive fire occurred in 2020. The most fire-prone zone in the Pantanal is also among the most floodable areas. This area we named "the corridor of fire and flood." Fire can be considered an ecological filter in the region. We present information on 805 species that have some relation to fire. The most common relationship is to resprout after the fire because of adaptations such as underground systems. Many species are resistant because of their corky bark. Fire combined with inundation can promote species richness, abundance, and composition changes. Fire can change the tendencies of these parameters along the flooding gradient. We verified that fire is part of the landscape in the Pantanal and has an essential role in determining its open and savanna physiognomy, mainly when combined with inundation.

ID383

PP72 - DEVELOPING A HOLISTIC, RISK-WISE STRATEGY FOR EUROPEAN WILDFIRE MANAGEMENT – PRELIMINARY RESULTS OF FIREURISK RESEARCH

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FirEUrisk was designed to improve the protection of citizens exposed to wildfires, specifically extreme forest fires. FirEUrisk will develop a science-based and risk-wise strategy, which integrates forest fire prevention, suppression and restoration practices and policies in a holistic conceptual framework.

In the risk assessment studies, models and data were developed to estimate fire weather parameters as well the moisture content of different layers of vegetation, and are being tested using both satellite and ground data. A general fuel type classification methodology was proposed and a vegetation map of Europe with a resolution of 1 km2 was produced. Standard fuel models were assigned to each fuel type and are being improved and tested in pilot sites across Europe using satellite and historical fire data.

Vulnerability is estimated by considering the main variables affected by fire, including socio-economic values, ecosystem and ecological values. Landscape and social resilience to fire is estimated by developing a model that considers their coping capacity and regeneration potential. Exposure is considered, including both the location of the urban-wildland interface and smoke dispersion.

Other tasks of the project include the analysis of drivers leading to fire risk reduction, including different fuel reduction strategies and landscape management, as well as scenarios for future fire risk conditions, using both climate and land use change models. The project favours a close interaction with different users, managers and scientists through dedicated boards, as well as with other EU funded projects related to fire research. It considers cascading effects and policy recommendations.

ID399

PP79 - FIRE AS A TOOL IN THE MANAGEMENT OF THE GUAPORÉ BIOLOGICAL RESERVE, A CONSERVATION UNIT IN THE BRAZILIAN AMAZON.

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The Biological Reserve (REBio) of Guaporé is a conservation unit (UC) created with the objective of conserving the transition environments between the Cerrado and Amazon biome, a mosaic of environments with different responses to forest fires. The UC is hit annually by anthropic and natural forest fires that end up reaching sensitive areas to fire, such as riparian forests and buritizais. Considering this scenario, the present work aimed to elaborate an integrated fire management plan (PMIF) for REBio Guaporé, aiming at reducing the occurrence of severe fires and the environmental damage they cause. For the preparation of the PMIF, the knowledge of the local population through community meetings, mapping of areas affected by fires in the last 11 years, the response to fire in different environments, accessibility of the affected area and objectives for the use of fire were considered. The PMIF generated a zoning of the unit according to the relationship between the environment and fire and defined the management actions for each zone. An activation protocol for fire-fighting actions was prepared and the need to train community members for good practices in the use of fire was identified. From the PMIF, fire should be used as a management tool to restore degraded areas, create mosaics in the landscape, manage the volume of combustible material, protect sensitive areas, and reconcile the conservation of biodiversity and the presence of existing traditional populations within the UC.

ID407

PP82 - A GLOBAL PERSPECTIVE ON THE WILDLAND-URBAN INTERFACE (WUI) WILDFIRE TOPIC

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A primary focus of integrated fire management is to reduce the impacts of wildfires on people. Communities in fire-prone areas must be aware of the impacts wildfires may have on lives, livelihoods, properties and infrastructure to reduce risks, prepare for, respond to, and recover from wildfires.

This study aims to assess the profile of the WUI wildfire topic in European Union (EU) and non-EU countries characterised by dry vegetation environments. It analysed different fire-prone areas worldwide to assess similarities and differences in the number of wildfires affecting human settlements, the intensity of the wildfires at the WUI and the types of built-up areas affected by them.

The work used the datasets on built-up areas provided by the European JRC GHSL - Global Human Settlement Layer and the datasets on wildfires provided by the JRC GWIS - Global Wildfire Information System. The analyses were run using the GHSL Data Package datasets for the period 2017 – 2020, which adopt a 10m spatial resolution and the INSPIRE definitions of building, allowing the research to be inclusive to rural domain settlements and temporary settlements as associated with informal settlements, rapid migratory patterns, or people displaced by natural disasters.

Framing the impacts of WUI wildfires in different fire-prone areas allows for evaluating the global perspective of the WUI wildfires topic and facilitates the identification of common solutions to increase awareness, preparedness and mitigation capacity in local authorities and communities.

ID411

PO72 - THE CHALLENGE OF WILDFIRE MANAGEMENT THROUGH SPATIAL PLANNING: LESSONS ACROSS THE WORLD

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Objectives

Wildfire management based on the spatial planning approach is crucial, especially in countries with high exposure to wildfires, such as Portugal.

Given the herculean effort that the current Portuguese Integrated Management System for Rural Fires (IMSRF in English; SGIFR in Portuguese) has made in order to articulate these two policies, the present communication aims to benchmark the best practices across the world in order to help the IMSRF to effectively address the utmost needs regarding the wildfire management through spatial planning.

Methods

The research to find the best practices worldwide, using several case studies insights (Australia, Chile, USA, Canada) that may be applicable to the Portuguese case, was done through the legal document analysis regarding the alignment of wildfire management and spatial planning, namely focused on defensible space dimension and on building permit constraints in respect to the wildfire hazard.

Results

In this context, the great challenge of the Portuguese system is to address the need for adaptive management, where these case studies can contribute to assist its implementation by IMSRF.

Conclusions

Since it was legislated that the Portuguese wildfire management system and spatial plans must be reviewed in the light of their full alignment, this communication presents lessons and recommendations that constitute cosmopolitan opportunities for the congruent implementation of this alignment.

ID420

PO42 - THE INFLUENCE OF EXTREME FIRE EXPERIENCE ON COMPANIES' PREPAREDNESS IN PORTUGAL

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In 2017, the most tragic wildfire season in Portugal so far beyond the high casualties toll, more than five hundred companies' buildings were affected with different impacts on business continuity. In 2022 companies' buildings were again affected by fires. Most of the affected companies were in the industrial-forestry interface zone. For this work, a research question was created, "is experience an important factor in the adoption of prevention and preparedness measures by companies?" with the aim of understanding if the companies that experienced extreme fires in 2017 and 2022 implement measures to improve preparedness for future events. Two research hypotheses were created: i) Direct experience with extreme fires has significantly increased the adoption of preparedness measures, and ii) The experience factor is diluted in time. A survey was prepared to be implemented in companies in Arouca, Castelo de Paiva, Oliveira de Frades and Oliveira do Hospital affected by the 2017 fires and in Oliveira de Azeméis and Albergaria à Velha affected in 2022. The questionnaire is composed of close-ended questions where the Likert scale was used to assess the adoption of preparedness measures before 2017 and 2022, assess whether the events of 2017 have indirectly influenced the adoption of preparedness measures by companies affected in 2022, and assess how direct experience influences preparedness for fires in the future. The data collection is being carried out, but testimonies show that different experiences directly affect the adoption of prevention and preparedness measures. The reasons that explain different attitudes are identified.

ID425

PP68 - WILDFIRE HAZARD MAPPING IN THE MEDITERRANEAN: A HARMONIZED APPROACH.

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Wildfires are a natural hazard which is growing in intensity and spreading in range across all planet's ecosystems with impacts on the environment, human population, and infrastructures. To strengthen prevention activities, land use planning and resource allocation, a thorough understanding of territorial features determining hazardous wildfires is crucial in fire management and Civil Protection activities. The proposed approach learns from wildfire synoptic data in order to obtain susceptibility, intensity and hazard static maps. A Machine Learning approach is adopted to construct susceptibility maps, crossing the wildfire database with the predisposing factors (geographical, climatic and anthropic features). Potential intensity of wildfire, in turn, is built using the vegetation type as a proxy. Hazard is built via an expert-based contingency matrix crossing susceptibility and potential wildfire intensity classes for each analyzed pixel. This mapping approach leads to the detection of the areas which are more likely to experience hazardous and impactful wildfires. The case study is applied to sixteen countries of the Mediterranean Basin, producing output maps at 500m resolution, relying on open data as input layers. The susceptibility assessment allows for Explainable AI procedures, identifying the main drivers of wildfire occurrence at continental level. The results will be compared to the ones obtained in the previous studies at national level.

ID439

PO58 - CARBON STOCK AND GREENHOUSE GAS EMISSIONS CAUSED BY WILDFIRES IN MONODOMINANT STANDS OF COPERNICIA ALBA IN THE PANTANAL WETLAND.

Maxwell Oliveira[1], Rosa Helena da Silva[2], Francielli Bao[2], Alexandre de Matos Martins Pereira[2], José Marcato Junior[2], Arnildo Pott[2], Geraldo Alves Damasceno Junior[2]

[1]Universidade Federal De Minas Gerais, [2]Universiade Federal de Mato Grosso do Sul

Wildfires are essential features linked to greenhouse gas emissions (GHG). For this reason, they have been used in management's public policies to neutralize these emissions. However, there are still significant gaps in information that permeate not only GHG emissions but also carbon dynamics in different biomes. One interesting point is understanding the relationship between carbon dynamics and wildfires in fire-prone environments. We aimed in this study to evaluate the amount of carbon in monodominant stands of Copernicia alba in Brazilian Pantanal and their GHG emissions during the fire events. Copernicia alba is a species that has many adaptations for fire-prone environments, such as permanent leaf sheaths and improved germinations after a fire. We found that this species has occupied circa 476,000 ha in Pantanal with a carbon stock of 24.6 Mt. Most of these areas is submitted to fire events every five years, burning a mean of 51,000 ha a year. In a scenario of a low-intensity fire (30% of biomass consumption), we estimate the emission of 6,800 Gg/y of carbon. In a scenario of a high-intensity fire (90% of biomass consumption), we estimate 20,000 Gg/y of carbon emission. This species is highly resilient to fire and can recover all lost biomass in about two years. These results indicate that despite these monodominant stands being burned yearly, they can represent neutral environments in carbon balance or work as carbon-sinking environments.

ID443

PO76 - PROJECTING FUTURE WILDFIRE SPREAD POTENTIAL IN BRITISH COLUMBIA, CANADA

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Objectives

Wildfires that occur during extreme fire weather events are more likely to escape initial attack by fire management agencies and threaten human lives, infrastructure, and economies. Due to the strong relationships between temperature and fuel moisture, research suggests that western North America will experience more frequent and severe extreme fire weather events under climate change. The present study investigates trends in extreme fire weather events over time in the Wells Gray Provincial Park area of British Columbia, Canada.

Methods

We investigate trends in the annual extreme values (95th percentile) of the Canadian Fire Weather Index (FWI) System, as well as the frequency of weather-based potential spread days (PSDs) as a proxy for extreme fire weather events. Past weather data is generated using ERA 5-Land climate reanalysis, and future weather data is generated using an ensemble of general circulation models. Weather data is then converted to FWI values, and PSDs are defined as days in which threshold values of ISI > 8.7 are reached. The distribution of PSDs and extreme values in the past (1961-2021) are compared to the future (2030-2100) to provide an indication of how patterns in fire weather will be affected by climate change.

Conclusions

This research is intended to contribute to the understanding of climate change impacts in British Columbia, demonstrating the need for local governments, communities, and fire management agencies to prepare for increased fire activity in the future.

ID461

PO60 - DO TREE DOMINANCES DEFINE DIFFERENT FUEL BEDS AT THE LOCAL SCALE?

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Tree dominances influence forest fuel loads. This study aimed to identify whether tree dominances of the Monarch Butterfly Biosphere Reserve correspond to different fuel beds. The fuel loads of three tree dominances were quantified, and then we used the Fuel Fire Tool software to obtain the fire potential. In addition, we burned the litter layer to determine surface fire behavior. We found a higher fuel load in areas dominated by fir-oyamel with a high fuel load of 1000 h. The litter layer fuel load was higher in sites dominated by pine-oak, while the fuel load of the fermentation layer was higher in areas with pine-fir. We obtained different fire potentials for each tree dominance. The burning of the litter layer also showed differences in fire behavior between the three tree dominance. The litter load correlated positively with the height and length of the flame and the fire index in pine-oyamel. Fuel loads in the evaluated tree dominances differed, resulting in different fire potentials and surface fire behavior. Therefore, at a local scale, tree dominances must be identified and considered as separate fuel beds to plan the integral management of fire.

ID466

PO46 - FIRE DYNAMICS IN THE AMAZON-CERRADO TRANSITION ZONE OF MARANHÃO STATE, BRAZIL

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Maranhão State is located in the Amazon-Cerrado transition zone, and is powerfully shaped by human-induced disturbances such as fires. The areas of agricultural expansion and management depend on the use of fire, which often escapes to natural vegetation formations [NVF]. In the case of amazonian forests, these events lead to negative environmental services impacts. At the cerrado, although it is a fire-dependent system, the increase in its frequency has been leading to its degradation. Here, we evaluated the natural vegetation formations in Maranhão that did not undergo land-use conversion since 1985 and we focused on the 2013-2020 time series. Land-use information was based on the MapBiomas annual maps, while burned area information was derived from the GWIS/JRC product. Between 2013 and 2020, we identified more than 150,000 km burned in Maranhão, where 39.6% of this total occurred in savannas, 16.3% in old-growth forest and 0.34% in wetlands. Approximately 49,000km of NVF burned once, about 44% twice, 22% three times, 13% from 4 to 8 times during the studied period. Despite burning more than 92% of the savanna area annually, the size of this natural formation decreased by only 6.4%, similar to the 6% conversion of primary forest to other land uses, which burned on average 34.7% annually. Understanding the fire dynamics and offering this information in alert platforms is key to developing public policies for preventing major fire events.

ID469

PO50 - AUSTRIA FIRE FUTURES - NOVEL AND INTEGRATED WILDFIRE HOT SPOT MAPPING

Florian Kraxner[1], Andrey Krasovskiy[1], Charlotte Kottusch[1], **Shelby Corning**[1], Dmitry Schepaschenko[1], Harald Vacik[2], Mathias Neumann[2], Mortimer M. Müller[2], Arne Arnberger[2], Herbert Formayer[2], David Leidinger[2], Tobias Schadauer[3], Susanne Karel[3], Christoph Bauerhansl[3]

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The main objective of this Austria Fire Futures study is to develop a unique and innovative concept containing new sets of fire risk hotspot maps at highest spatial resolution under various climate change scenarios and integrate novel insights on local fuel types into forest and forest fire risk models, including new variables such as morphology and recreational activities. To generate such maps on a local scale, fire hazard modeling is necessary to identify endangered forest types in combination with topographic effects. Furthermore, recent fire events in the Austrian Alps show that social aspects, particularly the hiking tourism, are paid too little attention to.

Based on the above motivation, we believe that an innovative and improved fire risk hotspot mapping is the fundament for all further forest- and wildfire prevention and hence needs to be seen as an indispensable tool for an integrated fire management (prevention, suppression, post fire measures) while substantially contributing to mitigating climate change as well as minimizing damage to ecosystems, their services, and people.

The study will improve our understanding of fire-vulnerable forest areas that may shift over time and space given the underlying climate and fuel assumptions. This will allow experts, practitioners, and the interested public to take a look into the future in order to comprehend and derive solid short-/medium-/and long-term recommendations for fire resilient and sustainable forest management and fire emergency planning.

ID486

PP77 - LONG-TERM STRENGTHENING OF COMMUNITY-SCALE FIRE MANAGEMENT IN MÉXICO

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The aim of this article is to report on a 20-year experience of supporting fire management activities and to present the institutional mechanisms for the development of fire management capacities in Mexico.

The article will report on the calls for proposals, technical achievements, and results of the systematization of the Fire Management Initiative (FMI) of the Mexican Fund for the Conservation of Nature, which has operated since 1999.

The article will describe mechanisms for generating funds for long-term, financial schemes for transferring resources to local organizations, forms of coordination with the government, and capacity-building schemes for community brigades and specialized technicians. In qualitative terms, some indicators of progress will be included, such as hectares covered, number of people trained, and number of natural protected areas participating over time.

In addition to the technical information, the article will include a summary of the opinions of relevant actors from the federal government, subnational governments, and project executors who have been involved in the design and operation of the FMI.

By way of conclusion, the article will highlight the characteristics of the FMI that have made it a unique model in Mexico and Latin America in terms of permanence, financial strength, funding tools, advances in local participation and governmental entities, international cooperation; as well as the construction of a learning community to achieve capacity building and exchange between technical and community groups.

ID504

PO52 - THE EVOLUTIONARY LEAP OF ENVIRONMENTAL EDUCATION FROM THE ZERO FIRE POLICY TO THE PERSPECTIVE OF INTEGRATED FIRE MANAGEMENT.

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Trace an analysis of the performance trajectory of Environmental Education as a prevention strategy by the National Center for the Prevention and Combat of Forest Fire - Prevfogo. This trajectory unfolds from a matrix of causes and consequences of forest fire, which sheds light on the issue of Global Warming, also acting under the umbrella of participatory action, where the workshops resulted in the making of action plans to be developed in partnership between brigades and communities. Thus, through the conceptual advances on the problem of forest fires with the advent of Integrated Fire Management, a new look was given to the perspective of Fire Management at that time in traditional communities, in view of the definition of performance of the federal environmental agency, through Complementary Law 140/2011. This brought to light a more dialogic perspective on the Culture of Fire, which is one of the edges proclaimed in the Integrated Fire Management Triangle. In this sense, the research effort intends to shed light on the methodological, conceptual and practical evolutions of environmental education within the Prevfogo Federal Brigades Program, which envision a potentialization of the protagonism of the brigade members, community members, leaders and potential partners in the process of surveying the knowledge and actions related to the Integrated Fire Management and its consequences in the environmental and territorial management of these communities served, raising a sharper perception of good fire and bad fire.

ID511

PO47 - DSS FOR PRIORITIZING INTERVENTIONS AND INSPECTIONS OF FUEL MANAGEMENT BANDS IN THE WUI

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After the 2003 and 2005 large wildfires, the need to create fuel management measures arises, to maintain the safety and protection of populations. Decree-Law nº 124/2006 from 28th June, currently revoked by Decree-Law nº82/2021 from 13th of October, is created, making mandatory fuel management in the wildland-urban interface. Given the vastness of the Portuguese territory, it is necessary to prioritize the areas to intervene and oversee, to optimize the available resources. This work developed and explored a decision support system to respond to this need. With a simple and flexible methodology, to be compatible with each municipality's needs, this DSS uses geographical data mandatory to all municipalities, which guarantees the uniformity of the results, wherever it may be used.

ID519

PO48 - IMPORTANCE OF INTEGRATED PLANNING IN PRACTICE ON RISK GOVERNANCE OF WILDFIRE MANAGEMENT

Maria João Gomes[1], Mario Monteiro, João Verde

[1]*Agif*

Objectives

Wildfires in Portugal have considerable socio-economic and environmental impacts and is safe to say that these fires are a result from failure in the risk governance and not being addressed as a systemic risk that they are.

The Portuguese National Action Plan 20-30 is under execution to tackle the issue.

The paper will identify the impact of integrated planning on wildfire risk governance and integrated fire management effectiveness. Will test the methodology created of bottom-up planning involving stakeholders towards an impact-driven approach incorporating risk perception, assessment, and evaluation with negotiation and communication as key cross-cutting elements.

Methods

Evaluate the explicit compromises achieved during planning and effectiveness of negotiation platforms; Cross-check of roles and responsibilities in place and investigate if the monitoring and reporting instruments are tools of assisted accountability; Explore the relation between the results from planning implementation and the System functioning leading to sustainable risk governance.

Results

In fact, NAP implementation is showing a consistent improvement of key indicators. The first conclusion leads to a clear relation between this trend and projects implementation with involvement of most stakeholders. The second conclusion shows that these indicators are not stabilised. Main bottlenecks reside in public policies not adapted to risk governance, not promoting change processes in a cross-sectorial institutional model.

Conclusions

Integrated planning, departing from a bottom-up perspective with regular monitoring and reporting and sharp impact assessments contributes to the risk governance of the System of integrated fire management, where all sectors implement and are engaged and accountable.

ID521

PP70 - SCENARIO PLANNING TO SUPPORT THE NATIONAL FUEL MANAGEMENT PLAN IN PORTUGAL

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Like many other countries, Portugal faces an escalating wildland fire problem that has motivated policymakers to expand existing fuel management plans to reduce national wildfire risk. The Portuguese plan sets highly ambitious goals, including to decrease the annual burned area and proportion of large fires (> 500 ha) by approximately one half. One of the cornerstones of the plan is the implementation of a linear fuel break network combined with strategic landscape treatments that are expected to significantly slow the spread of wildfires and enhance suppression effectiveness. However, national-scale decision support tools to prioritize and schedule treatments and allocate budgets among districts and municipalities are lacking. In this talk we will describe our efforts to couple wildfire simulation and scenario planning models to analyse alternative investment allocation strategies and build implementation scenarios. The overall approach mirrors the process used by the authors to identify priority landscapes as part of the 2020 US Forest Service Wildfire Crisis Strategy. In prior work in Portugal, we used the MTT fire simulation model and Corrine fuels data to generate national scale spatial data on burn probability, fire intensity, and fire transmission to municipalities. We used these and other spatial data sets as input to the ForSys scenario planning model, explored multiple prioritization strategies and investigated both the amount of treated area and cost required to meet the national objectives. The results of the study can help guide fuel management planning at multiple scales in Portugal and align local priorities with national strategic goals.

ID24

PP95 - MEDIUM-TERM RESULTS OF PRESCRIBED BURNING MANAGEMENT IN BRAZILIAN INDIGENOUS LANDS

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Indigenous communities have been managing savannas with fire for thousands of years. This management was suppressed by governmental environmental agencies, following the trend of implementing zero fire policies. The disastrous consequences of zero fire policies in Brazilian tropical savannas led to the implementation of integrated fire management, through prescribed burning. Between 2015 and 2022, Prevfogo/Ibama carried out 15,356 prescribed burnings in 49 Indigenous Lands, where 86,671 indigenous people from 50 different ethnic groups live. They cover an area of 117,801.7 Km2, where 67,403.7 Km2 are fire-dependent savannas, of which about 10,041.3 Km2 were burned by prescription in 2021. During three years, the brigades responsible for the fires collected data on fruit species important to the communities, evaluating mortality rates, severity, reproduction rate and fruit productivity, in addition to the frequency of the fauna. The treatments involved areas under fire exclusion, affected by wildfires or managed with prescribed burning at different times. The results were statistically analyzed and showed that prescribed burning, especially when carried out at the beginning of the dry season, reduces mortality, presents low severity, increases reproduction rates and results in high fruit production in native trees. The frequency of the different species of fauna varied between the areas managed or under fire exclusion, but none of them chose the areas affected by the fires. We conclude that prescribed burning results in lower severity in native Cerrado fruit trees, higher rates of fruit production and benefits both native fauna and local indigenous communities.

ID37

PO97 - CFD MODELLING OF LABORATORY-SCALE EXPERIMENTS REPRODUCING THE FIRE BEHAVIOUR OF LIVE VEGETATION AT WILDLAND URBAN INTERFACE (WUI)

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Objectives

In order to reduce fire intensity and propagation at the Wildland-Urban Interface (WUI), brush clearing in the last tens of meters of a building has proven to be very efficient. This fuel management is mandatory in France and can be extended up to 100 m in specific terrain conditions. Numerical tools trying to replicate this efficiency shall be able to model fire behaviour on either dead but also live vegetation met in real conditions. However, very few models have shown this ability under conditions of high fuel moisture content (FMC, for values> 70%).

Methods

The study uses the Fire Dynamic Simulator model (FDS), that enables a temporal 3D fire simulation, which is particularly important at the WUI, in order to assess the fire propagation in complex terrain, through ornamental vegetation, and reaching buildings. In this study, FDS ienhanced with a a recent live vegetation thermal decomposition module is investigated on different laboratory scale experiments.

Results

The reproduction of the different laboratory scale experiments with this enhanced model shows encouraging results. A fictious 5m high tree with high realistic FMC will be also tested in this study under brush-cleared vs no-brush-cleared conditions.

Conclusions

The fire behaviour at WUI is highly dependent on the fuel moisture content and the model has proven efficient to take into account this important feature. Next steps will to reproduce historical fires with realistic FMC.

ID43

PO112 - FUEL MANAGEMENT IN THE SERRA DA CANASTRA NATIONAL PARK/MINAS GERAIS/BRAZIL AS A STRATEGY TO CONTAIN LARGE FIRES;

Bianca Zorzi Tizianel[1], Fernando Tizianel, Carlos Bernardes, Helder Marques, Guilherme Silva Pinto

[1]*Icmbio*

The Serra da Canastra National Park is annually affected by wildfires that burn large areas (up to 62.000 acres in a single event) and spread rapidly (32.000 acres recorded in 12 hours), mainly because to the homogeneity of predominant vegetation (extensive continuous areas native grasslands) and the lack of barriers to contain fire. Aiming to create mosaics of areas with different burning ages, which function as barriers against wildfires and as protection of conservation targets, since 2018 prescribed early burnings have been carried out in its priority area (Chapadão da Canastra). Controlled fire is used during the rainy season, in areas previously chosen based on the fuel accumulation, in areas affected by wildfires in previous years, in the recurrence of fire and in managerial factors (such as inspections and expropriations) that may interfere with the fire management. The strategy is proving successful. Annually, burned areas fragment Chapadão da Canasta, facilitating fights, and preventing the spread of wildfires. In 2020, of the 8 wildfires that happened in this area, 6 were contained (at least on one of its sides) by the prescribed burnings. Similarly, in 2022, all 6 wildfires that broke out in this area were contained (at least on one of its sides) by prescribed burns. The size of each area affected by wildfire in these years was smaller than historically. It is important to highlight that the burnings have social support from the region, which historically uses fire as an agrosilvopastoral tool.

ID47

PP99 - ANALYSIS AND EVALUATION OF FOREST FIRE VIDEO MONITORING AND SURVEILLANCE EFFECTS- CASE STUDY OF CROATIAN FIRE DETECT AI

Ljiljana Šerić[1], Stipe Pletikosić[1], Selena Knežić Buhovac[1]

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Croatian wildfire video monitoring and surveillance system (FireDetect AI) is operatively used in four Croatian coastal counties since 2018. The Fire Detect AI is an information system based on a network of video cameras used for early fire detection and fire surveillance. The benefits of the technical system have been stressed out in numerous situations, keeping the fire casualties low despite the fact that we are witnessing novel fire regimes due to climate and socio economic changes. However, the system efficiency has only been studied in terms of fire detection accuracy, but never in terms of objective efficiency evaluation.

In this paper we are proposing and demonstrating a methodology for evaluation of the video monitoring and surveillance system efficiency with respect to cascading effects of early response, preparedness and information availability.

To objectively evaluate the efficiency of video surveillance in both early fire detection and conducting efficient operative procedure we created a dataset achieved by cohesion of archive data of fire ignitions, fire interventions, fire regime description and burned areas in counties with and without fire surveillance installed. We analyze economic losses in terms of efforts in fire suppressing and burned areas and damages.

With comparison of variance in economical loss from archived data before the installment of the system we qualitatively and quantitatively determine the Fire Detect AI effects.

Cross comparison of ignition data and economical loss data shows the evident effect the video system has on decreasing the burned areas, casualties and effort required for fire suppression.

ID58

PO92 - INTEGRATED FIRE MANAGEMENT IN RESERVA NATURAL SERRA DO TOMBADOR - BRAZILIAN SAVANNA.

André Luís dos Santos Zecchin[1], Paulo Eliardo Morais de Lima[1]

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Objectives

Reduce the recurrence of large wildfires

Methods

The Reserva Natural Serra do Tombador, created in 2007 by Fundação Grupo Boticário, covers 8,730 hectares of Cerrado (Brazilian Savanna). The mains objectives are the biodiversity protection and scientific research.

The monitoring of wildfires suggests that every three years the Reserve is vulnerable to large wildfires. In 2011 it was burned 5,251 hectares, in 2014 1,983 hectares and in 2017 7,438 hectares.

The Integrated Fire Management, adopted since 2020, including the implementation of firebreaks and prescribed burning in places with high accumulation of biomass. It is important to highlight that this management is carried out based on the fire risk zone map and on the results of a long-term research that has been developing in the last 10 years in Reserve.

Results

Since 2020, when prescribed burning and firebreaks began to be adopted, there was a significant reduction in the burned area by wildfires. The reduction was in 90% comparing the average of last 12 years. In addition, the results of the research demonstrated that fire management is necessary not only to control the biomass, but to maintain the diversity of plant species and stimulate the flowering of most species of the herbaceous, mainly grasses. Mass flowering after fire attracts pollinators and other insects

Conclusions

The Integrated Fire Management has been proving effective to avoid the large wildfires that used to burn the Reserve, as well supports the maintenance of biodiversity in Cerrado.

ID83

PO90 - VOLUNTEER BRIGADES, INTEGRATED FIRE MANAGEMENT IN CONSERVATION UNITS AND THE RELEVANCE OF ORGANIZED CIVIL SOCIETY PARTICIPATION

Anderson De Freitas E Silva, José Eugênio Cortes Figueira, Alexandre França Tetto, Giovana Bomfim de Alcantara

[1]*Brigada 1*

Protected areas (UC) are areas protected by law. Every year some of these UCs are affected by forest fires (IF), causing negatives impacts. The fire has two sides, the bad of the wildfire and the good of the integration fire management (MIF). And knowing the Environmental conservation is everyone's responsibility, it is understood that the action of voluntary brigades (BV) is becomes increasingly important. This work aims to demonstrate that BVs can support MIF and assess whether programmed MIF activities would facilitate they participation. It was made a semi structured research on 54 UCs and 20 BVs in MG, with the participation of 37 of the UCs and 14 brigades. 37 UCs consider the participation of BVs in actions related to the IF to be important, 32 BV UCs organized, eight activities have the MIF, four support by BVs. The research pointed out that programmed MIF actions can facilitate the voluntary participation. Concluded that need more training related to the MIF for the voluntary brigades and this should make it clear that the MIF has several activities in addition to the prescribed burning. The brigades have proven significant participation in combat, but still don't have an evaluation of their strategic participation in the MIF, the work of the brigades needs to be more researched, detailed and recorded because they can foster the knowledge and involvement of civil society, helping to demystify the use of fire, expand the qualification of the teams, to reduce costs, vulnerability, and discontinuity of the work.

ID88

PP91 - REDUCING HUMAN-CAUSED WILDFIRE IGNITIONS: USING SOCIAL SCIENCE TO UNDERSTAND RISK MANAGEMENT PREFERENCES IN THE U.S. SOUTHWEST

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The size and frequency of human-caused large wildfires continue to increase across the U.S. Southwest due to an array of shifting social and ecological conditions, resulting in increased infrastructural and ecological damage. Evidence-based prevention strategies are urgently needed, but foundational research that bridges geospatial and social data to inform these efforts is scarce. Our objective is to assess the current state of public and manager knowledge about human-caused large wildfire prevention strategies and their effectiveness in order to inform future management strategies on public lands. We are using a mixed-method approach consisting of three initial phases: (1) mapping of human ignition clusters in Arizona and New Mexico using GIS; (2) intercept surveys with public land users on the Coconino, Santa Fe, and Carson National Forests during the summer of 2022 (n = 710), and semi-structured interviews with fire prevention specialists (currently in progress). This poster shares an overview of our research framework for social science-oriented investigation around wildfire ignition prevention strategies, with the intent to introduce discussion on the transferability of our methods to non-U.S. contexts. This includes an overview of our use of a practitioner advisory board to guide research, effectively creating a science-management partnership driven by on-the-ground needs. We also provide key findings related to survey and interview data, with a focus on identifying transferrable lessons learned that can help elevate science and management of human-caused wildfires around the world.

ID95

PO105 - THE ROLE OF INTEGRATED FIRE MANAGEMENT ON CLIMATE CHANGE ADAPTATION FOR ECOSYSTEM SERVICES IN TROPICAL AND SUBTROPICAL REGIONS

Núria Prat-Guitart[1], Imma Oliveras[2], Mariona Borras[1], Helena Ballart[1], Ariadna Goenaga[1], Lucía de la Riva[1], Juan Caamaño Azcárate[1], David Martin[1], Guillem Canaleta[1], Guillem Armengol[1], Jordi Vendrell Flotats[1]

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Integrated Fire Management (IFM or sustainable fire management) has been identified by the international fire community as one of the key solutions to address the problem of more extreme wildfires spreading across the globe, requiring an interdisciplinary approach. IFM includes sets of actions aimed at reducing the extent and severity of undesired wildfires while maintaining (or improving) biodiversity, ecosystem services and human wellbeing.

In 2022 the FIRE-ADAPT project was funded by the European Commission to set up a network of scientists and practitioners to expand the knowledge on IFM in tropical and sub-tropical regions. During the next four years FIRE-ADAPT will bring together expertise from across regions from the Mediterranean Basin and Latin America for the purpose of improving the understanding of the role of IFM for wildfire prevention and for enhancing natural and cultural ecosystem services. In particular, FIRE-ADAPT focuses on those IFM practices that can enhance carbon abatement and nature-based solution potential, as well as wildfire risk mitigation, in culturally just and meaningful ways.

We will introduce the FIRE-ADAPT approach, as well as the opportunities for networking for the international community.

ID118

PO95 - PREVENTION AND PROTECTION OF FIRES IN RURAL URBAN AREAS

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Objectives

The main objectives of this work are to establish which are the strategies that have offered the best results historically in the prevention and protection of rural urban areas against fire.

Methods

The methods used have been to collect the existing data in the literature and available databases, processing and analysing them to obtain results that allow conclusions to be drawn

Results

The results obtained allow us to establish that the risks of fires for rural environments come mainly from:

a.- Inadequate grazing and agricultural activities.
b.- Uncontrolled burning.
c.- Do not beware about the climatic situation in certain activities, especially high temperatures and strong winds.
d.- Rural depopulation.
e.- Lack of protections in the vicinity of vehicle circulation routes and railways.

Conclusions

The conclusions obtained are:

a.- It is imperative to inform and educate the rural population in terms of protection against forest and rural fires.

b.- Rural development is a tool of the first order in the prevention of forest and rural fires.
c.- Fire monitoring is a developing area that using new technologies such as unmanned vehicles, robotics, infrared and satellite photography, can severely reduce the incidence of forest and rural fires.

ID128

PP96 - LINEAR FIREBREAK INFRASTRUCTURES IN THE VALENCIAN COMMUNITY. UPDATING OF THE WIDTH CALCULATION METHODOLOGY.

Miguel Angel Botella Martínez[1], Mª Jesús Barberà Bisbal[1], Ricardo García Post[2], Jose Luís Soriano Sancho[1], Agustín Cervera Montero[1], Daniel Orozco Bagou[1], Miguel Estéfano Olaiz[1], Juan Luis Arribas Cobo[3], Francisco Navarro Baixauli[3], Gracia Sapiña Salom[3]

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Objectives

To update the methodology for calculating the width of firebreaks in the Valencian Community, defining them as active infrastructures in which land firefighting means can work safely while optimizing the investment in their execution and maintenance.

Methodology

The methodology was based on the concept of safety distance. For this calculation, a solid flame front that emits energy radiation uniformly over its entire surface was assumed. The mathematical expression results in an incident heat flux value that depends, among other factors, on the distance to the element receiving the radiation. By applying a maximum radiation threshold for the personnel, the minimum working distance can be obtained and, therefore, the width of the infrastructure. The calculation required simulations with the BehavePlus software (USDA Forest Service), for which the necessary meteorological parameters were obtained from the ERA-5 climate database (ECMWF), together with the analysis of historical fires to define the most suitable scenarios.

Results

Differentiated results have been obtained for the 11 meteorological zones into which the Valencian Community is divided, based on the climatological differences calculated for each of them and the scenarios obtained from the analysis of historical fires. The safety distances have been calculated for the fuel models present in the territory, and for different slope intervals.

Conclusions

It has been possible to optimize the calculation of the widths of the firebreaks in the Valencian Community based on the concept of safe working distance from a maximum threshold of heat flow, together with the climatological and historical fire analysis.

ID171

PP94 - NATIONAL WILDFIRE PREPAREDNESS PROGRAM: A FORWARD-LOOKING INITIATIVE FOR INTERAGENCY COORDINATION

Elena Hernández Paredes[1], Ángela Iglesias Rodrigo[1], Ignacio Bustamante López-Chicheri[2]

[1]Ministry For The Ecological Transition And Demographic Challenge, [2]TRAGSATEC

The projected climate change scenarios foresee an increase in the complexity of wildfire suppression. It is difficult and inefficient to dimension resources and personnel with these extreme episodes in mind, making collaboration between the agencies involved the best option.

It is clear, as stated many times at national and international forums, the need for a better coordination between agencies, to ensure a safe and effective exchange of resources and wildfire operations. Based on this, the National Wildfire Preparedness Program has been pioneered in Spain.

This program represents an advance in the improvement of preparedness and therefore of the response. It consist of a) joint exercises, focused on complex scenarios that affect several jurisdictions and require the implementation of a Unified Command; b) exchange of experts, to capitalize knowledge and experience of all the organizations involved; and c) the Forest Fires Assessment and Advisory Team (FAST), to promote national and international support on wildfires.

The ultimate goal of the Program, as a national preparedness strategy, is to advance in the coordination and interoperability of the intervening resources, promoting the convergence of procedures and protocols.

ID181

PO96 - DEVELOPMENT OF A FIRE RISK INFORMATION SYSTEM (SIRI) FOR CONSERVATION UNITS IN THE CERRADO BIOME TO SUPPORT DECISION-MAKING

Henrique Luis Godinho Cassol[1], Andeise Cerqueira Dutra[1], Tânia B Hoffmann[1], Egidio Arai[1], Valdete Duarte[1], Cesare Di Girolamo Neto[2], Yosio Edemir Shimabukuro[1]

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Integrated Fire Management started at Conservation Units in the Brazilian Savannah (Cerrado Biome) a decade ago. That was an initiative to conciliate fire risk reduction and prevention in a highly susceptible fire environment. Therefore, we are developing a Fire Risk Information System (SIRI) to support decision-making which consists of mapping burned areas, fire recurrence, and dry biomass accumulation at three National Parks in Cerrado. The method uses remote sensing images and local knowledge from firefighters and fire managers to upload updated data in a platform for preventing and planning prescribed fires for the following year. The platform was developed in Google Earth Engine as well as all stepping methods and contains the history of burned areas, recurrence, and dry biomass map at each place. The platform is provisorily hosted at: https://dutraandeise.users.earthengine.app/view/siri (Portuguese only). It is worth mentioning that this initiative was entirely built horizontally, i.e., we generated and published an integrated database adapted to the needs of the analyzed conservation units and the fire managers. Therefore, the product and platform updates are based on user experiences and information collected in field campaigns. In this manner, this platform aims to support decision-making and guide fire prevention actions in a useful, free, and user-friendly interface.

ID182

PO93 - EVALUATION OF THE FÓRMULA DE MONTE ALEGRE FOREST FIRE DANGER INDEX IN THE EAST REGION OF PARANÁ, BRAZIL

Heitor Ferreira[1], **Antônio Carlos Batista Antônio Carlos Batista**[1], Alexandre França Tetto[1], Daniela Biondi[1]

[1]*Federal University of Paraná*

Fire danger indexes are important tools for determining forest fire alert situations, enabling the planning of prevention and combat activities more efficiently and economically. The present study aimed to evaluate the effectiveness of the Fórmula de Monte Alegre (FMA) fire danger index for 17 municipalities in the metropolitan region of Curitiba, located in the state of Paraná, Brazil. Obtained records of forest fires from the Fire Department of the Military Police of Paraná, relative humidity, and daily rainfall for the period from 2011 to 2016. An analysis was carried out of the degree of fire danger daily values, the number of days with fire, and the number of records according to the FMA in the analyzed period. Also, efficiency was verified using a contingency table to obtain the skill score (SS) and percentage of success (PS). The results showed the values of correctness in the fire occurrence at 65.8% and correctness in the fire non-occurrence at 80.2%. The SS (0.42) and PS (70.9) values were higher than the other ten compared studies. Through a joint analysis of the results obtained, it was verified that the behavior of the FMA for the study area was satisfactory, however with the need to carry out adjustments in the intervals of the danger degree to present greater effectiveness.

ID193

PO110 - FOREST AND LAND FIRE PREVENTION THROUGH ZERO-BURNING PRACTICES BY RURAL COMMUNITIES IN INDONESIA

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The increase in greenhouse gas emissions due to forest and land fires still haunts by developed, developing and under-developed countries, including Indonesia. It is, therefore, critical to effectively address the one of key causes of fires in developing countries such as slash and burning practices. It should be kept to a minimum in fire burning practices in land clearing and agriculture production practices, which can be started from prevention activities in the real sense. The land preparation using fire by the community is done because it is part of their culture that has been passed down for generations, besides being easy, cheap and fast, and recently it has also been used by companies to gain illegal economic benefits. The objective of the research is to reduce greenhouse gas emissions that was carried out at several planting locations, especially for agricultural planting activities in Java and Sumatra, Indonesia. The results showed that land preparation without burning, even with minimum tillage, actually increased production by more than 30% and with less negative impact than as usual being conducted. It can be concluded that minimum tillage and no burning activities can reduce greenhouse gas emissions significantly, so these activities need to be implemented and applied specially to land that often uses fire in land preparation.

ID210

PP84 - FIRE PROGRESSION IN NORTHWEST EUROPE : REMOTELY SENSED REGIME AND DRIVERS

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Greater fires have recently been recorded in Northwest Europe. Knowing the status of fire in this area is critical because several climate projections show that fire activity will increase in this temperate area in the future. Unknowns regarding the fire regime in northwest Europe are revealed by this study by characterizing key aspects of fire behavior: The Rate of spread and other indicators of fire progression, using an innovative approach to cluster VIIRS hotspots into fire perimeter isochrones. At this scale, we identified 102 landscapes fires that occurred between 2012 and 2022. We evaluated the seasonality of fires as well as relationships between ROS and Burned Area. We also looked for environmental drivers such as land cover and climate. The results show significant differences in land cover, with ROS and burned area clearly peaking in March and April. The median ROS during these peak months is approximately 0.09 km/hr., and 66% of the burned area occurs during this spring period. This peak decreases in February and May, indicating the length of the main fire season. Fires with higher ROS tend to have a larger burned area. Where these fires occurred, an increase in extreme events of the variables associated with FWI could be observed over time. There was also a strong correlation between the occurrence of these larger-scale fires and the FFMC. Accurate ROS data is critical for determining elevated fire risk periods, the effectiveness of available suppression techniques, and appropriate land and fuel management strategies.

ID212

PO94 - A FIELD EXPERIMENTAL TEST ON A MOCKUP OF STEEL SANDWICH PANELS SUBJECTED TO SHRUB FIRE

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In this investigation a typical wildland-urban interface (WUI) scenario was reproduced in a full scale real wildfire test. The experiment site, characterized by lightly hilly terrain, is in the central region of Portugal. Referring to the natural fuel, the vegetation is mostly made up of medium-low shrubs. The purpose of the experiment was to assess and quantify the thermal attack from a wildfire to a small obstruction comprising a set of sandwich panels, representative of a typical industrial building. The main objectives were: to measure the temperature field distribution in the panels considering both the instrumentation used (Type-K thermocouples in the exposed surface of the sandwich panels) and thermal imaging, the rate of spread and flame height. To this purpose, the structure has been previously prepared in the laboratory to be monitored for collecting data during the fire attack. The structure was a self-supporting panel composed of two profiled metal sheets joined by rigid polyurethane foam. The sandwich panels were joined together and propped off the ground. The behaviour of the fire front was observed, and the thermal attack monitored. During the test the ignition potential of such constructive solutions was observed. Under direct exposure the core of the sandwich panel ignited and burned completely. The experimental data collected will contribute to the validation of high-end Computational Fluid Dynamics models using Fire Dynamics Simulator to reproduce and investigate realistic fire scenarios in the WUI.

ID236

PO99 - EARLY WILDFIRE DETECTION AND GEO REFERENCING SYSTEM BASED ON OPTICAL VIDEO SURVEILLANCE CAMERAS

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Wildfires cause significant economic damage and have quite devastating effect on environment all over the world. Early fire detection and quick and appropriate intervention are of vital importance for wildfire damage minimization. Early fire detection is traditionally based on human wildfire surveillance, realized by 24 hours observation of human observers located on selected monitoring spots. Traditional human surveillance is useful for early fire detection, but it does not provide sufficient additional information about fire. Modern Information-Communication Technology (ICT) could solve this problem. Technically and functionally better wildfire monitoring system could be implemented as video cameras based human wildfire surveillance and monitoring. In this case remotely controlled video cameras are installed on various monitoring spot and the human observers are located in the observation center. Such a system could be used not only for early fire detection, but also for distant video presence.

Automated video surveillance-based monitoring – the most efficient and cost-effective solution for early detection and monitoring of wildfire. It allows detecting and pinpointing on the map coordinates of fire, therefore minimizing damage caused by fire.

There are PTZ (pan-tilt-zoom) surveillance cameras installed on high-rise structures, usually masts of cellular communication operators, controlled by specialized software for early wildfire detection. Radius of monitoring is up to 35 km.

All cameras installed, based on analysis of coverage efficiency, including height of installation structures, digital model of terrain, danger of wildfire and other factors.

ID248

PO111 - ASSESSING THE FIRE DANGER IN THE WILDLAND-URBAN INTERFACE OF AN ALPINE ENVIRONMENT

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[1]*University of Natural Resources and Life Sciences*

The development of urban areas and the close proximity of settlements to forest areas leads to a increasing threat globally. The large destruction of infrastructure and homes by forest fires in the wildland-urban interface is asking for advanced fire risk assessment and fire management planning, to reduce the probability of potential damages and safe human lives. This study explores different spatial analysis approaches to assess the probability for fire ignition in an alpine environment. The natural and anthropogenic causes for fire ignition, the meteorological factors (fire weather indices) and the vegetation structure (fuel type) was evaluated with a high resolution (100m x 100m). Additionally, the exposure of settlements and the critical infrastructure (mobile towers, wind mills, roads) was calculated by various data layers. The single fire danger maps have been combined with an expert based weighting for each factor. The final danger map was classified by 5 intensity levels in order to provide detailed information for the fire brigades, municipalities and forest authorities when assessing the wildland-urban interface. Current results show that approximately 4% of municipalities concentrated on southeast region in Austria, are considered to be in very high-risk zone of forest fires due to the combination of a highly flammable vegetation and the exposure of infrastructure and settlements in this area. Considering the increasing relevance of wildfires in WUI, interdisciplinary cooperation and approach are needed to prevent and reduce the risk of wildfires.

ID256

PP86 - WEATHER-BASED INDICATORS OF FIRE RISK PERCEPTION ACROSS PORTUGAL HIGHLIGHT POSITIVE CHANGES AND IMPROVE PREVENTION PLANNING AT REGIONAL TO LOCAL SCALES.

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Wildfires in Portugal have considerable socio-economic and environmental impacts, and a National Action Plan for 2020-30 is under execution to tackle the issue. Most fires – including the most devastating - are caused by people: agro-pastoral fires, accidental ignitions, and arson, with substantial variability across the country.

This study aims to develop observation-derived analysis as an essential complement to public surveys to gain an in-depth understanding of public fire risk perception and support the design of future actions – including targeted awareness campaigns.

Methods

-Develop robust metrics linking fire-related activities to fire-weather indices.

-Analyze those metrics in space and time to evaluate changes in risk perception and identify areas/topics that require more communication efforts.

-Evaluate how recent prevention actions contributed to change people's response to risk.

Overall, we observe improvements in risk perception in the agro-pastoral sector, with fire-use shifting from high to medium hazard days. We relate this trend to projects initiated 3 years ago: a national awareness campaign, and a public platform to request fire-use authorization based on weather predictions. We also see less arson in summer, but little success in preventing accidental fires, and discuss potential motives.

Importantly, our approach clearly identifies specific regions departing from these national trends. We then leverage this new, spatially explicit diagnostic with communication managers to optimize future actions and their impacts.

The integration of these metrics in decision making is a powerful approach to define, monitor and pro-actively adjust the content and spatial focus of awareness campaigns and fire prevention strategies.

ID258

PP97 - INTEGRATED FIRE MANAGEMENT (IFM) IMPLEMENTATION AND OUTCOMES IN THE INDIGENOUS LAND OF PARQUE DO ARAGUAIA

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The goal of this work is to present the methodology and results related to the decrease of wildfire incidents with the adoption of IFM during the past seven years in the indigenous land of Parque do Araguaia. This territory has a 13,970 km2 area, 73% of which is Bananal Island, the largest fluvial island in the world.

For the methodology, we will show how the prescribed burns were conducted over the last 7 years of IFM. The findings will be presented and compared to the occurrence of wildfire incidents over a 14-year period, allowing us to compare data before and after (the last 7 years) the implementation of IFM.

The satellite used for daily hot spot acquisition was the referential satellite used by the National Institute of Spatial Research (INPE). Those data were used to compose a temporal series throughout the years, which allowed us to analyze the tendency of the total number of hot spots in a determined region over a period of time. From 1999 to 2007, it was used the NOAA-12 satellite, and since then, AQUA_M-T.

As a result, after Integrated Fire Management was put in place, there were fewer wildfire events in Parque do Araguaia.

Although it is simple to identify those findings, more scientific study is required to determine the effects on fauna and flora.

ID271

PP87 - CONTRIBUTION OF PRESCRIBED FIRE TO WILDFIRE PREVENTION IN THE TROPICAL SAVANNAS OF CAMPOS AMAZÔNICOS NATIONAL PARK, AMAZON REGION, BRAZIL.

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The Campos Amazônicos National Park (CANP) covers 47% (2,030 km) of the largest enclave of tropical savanna ecosystems (Cerrado) in the south of Brazilian Amazon, helping to conserve biodiversity in a region that has historically been affected by severe wildfires linked to human presence and lightning. This work aims to analyse information from prescribed fire carried out by the CANP management team in recent years, evaluating their effects in reducing wildfires. A total of 226 prescribed fire were carried out between May and July 2018 to 2022, which were monitored using the following parameters: total burned area in relation to the planned area, type of extinction, wind speed, air temperature and relative humidity. The burned areas exceeded 700 km (average of 142 per year – 7% of the total area of tropical savannas inside CANP) and corresponded to 88% of the total area planned for the fires, and fire extinction occurred naturally in 98% of the cases. The wind speed, air temperature and relative humidity records at the beginning of each burn showed averages of 3.75 km/h, 32.14°C and 63.4%, respectively. Preliminary data indicate trends of reduction in the wildfire recurrence, reaching a reduction of 58% in areas covered by wildfires in the comparison between the periods of 2010-2015 and 2016-2022. The systematization of records helps to better understand the behaviour of fire and its effects on the landscape and contributes to the optimization of future management strategies that consider the use of prescribed fire to reduce large wildfires.

ID273

PP98 - IMPROVING AN INTEGRATED FIRE DANGER ASSESSMENT WITH HIGH RESOLUTION VEGETATION PARAMETERS

Harald Vacik[1], Mortimer M. Müller, Markus Immitzer, Gergö Dioszegi, Clement Atzberger, Markus Hollaus, Ruxandra-Maria Zotta, Wouter Arnoud Dorigo

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In the face of climate change, the European Alps experience higher temperatures, more heatwaves, and severe wildfires in recent years. Improved fire danger assessments become therefore a key element of fire management strategies. The integrated fire danger assessment system www.waldbrand.at was designed for the Alpine country of Austria considering i) daily fire weather index data, ii) a hazard map for fire ignition by human activities and lightning and iii) information about fuels, mainly regarding forest types. An expert-driven modelling approach was implemented as an online Web-GIS prototype, which produces daily forecasts of fire danger with a spatial resolution of 100 m x 100 m. To improve the information base about the fuel data, additional vegetation parameters were derived in context of the CONFIRM project by analysing high-resolution LiDAR-data and Sentinel images (optical and microwaves). This helped to improve the estimation of fire ignition danger, fire spread and fire intensity. Four data layers were added to the system: a map of forest gaps, a solar irradiance map, a layer on fire ladders and a classification of tree species to improve the fuel information. These layers were combined to improve the prediction of ignition danger, fire spread and expected fire intensity for two case study areas in Austria comprising more than 1mio ha of forests. In this contribution we demonstrate, how the inclusion of these new vegetation traits in combination with topographical information and meteorological conditions can improve the daily fire danger assessment in mountainous areas.

ID288

PP93 - NEW CLASSIFICATION METHODS FOR THE FWI SYSTEM

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Objectives

The Fire Weather Index (FWI) System provides a set of six indices derived from weather observations, each indicative of different aspects of potential fire activity. This basic design and simple inputs has made the System a popular choice for adaptation in other regions, but its application often focuses only on the final FWI index, therefore limiting its full application for wildland fire preparedness. This presentation will review examples of how all six of the indicators are used in operational fire management planning in Canada, and present new methods to determine the adjective classes commonly used to communicate them (i.e. low, moderate, high, extreme).

Methods

A new approach to updating the FWI System adjective classes was developed. For each class a single physically defined process was selected (i.e. ignition potential or depth of burn). Physically meaningful thresholds were then chosen based on a reanalysis of Canadian Forest Service experimental fire behavior datasets, small scale test fire ignition studies and a selection of relevant information reports and papers.

Results

The methodology resulted in a new set of adjective classes that was based on a single physically meaningful process. Therefore, the classes should have more interpretive power and linkage to the processes they were intended to describe.

Conclusions

While there is no set recipe for adaptation of the FWI System to a new region this new methodology should help improve understanding of what each element of the wildland fire environment the FWI System outputs are designed to track; a critical first step.

ID300

PP92 - OPERATIONAL CLASSIFICATION OF SMOKE PLUMES FOR EARLY WARNING: START OF WILDFIRE OR FALSE ALARM?

Stefano Macrelli[1]

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This study aims at increasing the preparedness for efficient and immediate intervention by proposing an analysis framework useful at the very beginning of a fire in order to discriminate real starts of wildfires from false alarms.

During high fire danger periods the transition from a start of fire to a raging wildfire can occur in a time scale of minutes. Timely alarm and response often rely on networks of fire lookouts to spot any start of fire by identifying smoke plumes as a first sign. However, not every smoke is generated by a growing wildfire, nor could it always be originated by biomass combustion. In addition, during high fire danger periods agricultural fires and camp fires can still occur despite the fire ban, consequently distracting fire resources for onsite verification. Therefore, the analytical skills of lookouts are fundamental in the early minutes of a start of fire to provide sufficient, high-quality, reliable and continuous information to the command center which can then dispatch additional resources to the more likely start of wildfire, especially when simultaneous smoke events are reported.

The analysis framework is made operational by adopting a customized checklist to assess and classify smoke plumes generated from not directly visible fire events. Such complementary information can integrate the data used by analysts to assess the risk of fire propagation for resource dispatch and initial attack. This methodology has been adopted by lookouts within the Civil Protection Volunteers in Rimini province (Italy) and its validation is underway.

ID321

PP88 - THE ROLE OF CIVIL SOCIETY ORGANIZATIONS TO REDUCE WILDFIRES IN BRAZIL: THE EXAMPLE OF PANTANAL BRIGADES PROGRAM

Ananda Andrade[1,2], Leonardo Gomes[1], João Scremin Dias[1,2]

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Brazil has important fire policies to combat and prevent wildfires. In recent years, however, fire rates have become predominant in Brazilian wetlands, the Pantanal biome. When 26% of this biome was burned in 2020, the Pantanal Brigades Program - BPAN was created as a social initiative led by the SOS Pantanal institution. Based on the paradigm of integrated fire management, the Program trains, structures, and helps communities fire brigades for a prompt response and prevention of actions in the most vulnerable areas to burn. In order to analyze the contribution of BPAN in the period of 2020 to 2022, the areas affected by fire were evaluated based on VIIRS active fires, ALARMES burned area, and MapBiomas Project land use and occupation. The results showed a reduction of, approximately 98% in fire detection in the community areas, which also resulted in a decrease of fire incidence in the phytophysiognomies forest (-98%), grass land and savanna (-95%), and wetlands (-99%). Moreover, the BPAN has good results to integrate and work with farmers, to empower women as combatants, and to engage young people in raising environmental awareness in their respective communities. The creation and implementation of BPAN were important for the conservation of the Pantanal. The intention for the coming years is to guarantee and strengthen support for the same communities, and structure prevention actions based on local public policies.

ID369

PO107 - CATTLE GRAZING REDUCES FUEL LOADS ENOUGH TO LESSEN FIRE HAZARDS IN MANY GRAZED AREAS

Felix Ratcliff[1], **Devii Rao**[2], Sheila Barry[3], Shane Dewees[4], Luke Macaulay[5], Royce Larsen[6], Matthew Shapero[7], Rowan Peterson[8], Max Moritz[4], Larry Forero[9]

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We set out to estimate the amount of forage (fine fuels) consumed by cattle grazing on rangelands in California and to understand how this forage removal by cattle can influence wildfire behavior. We used statewide cattle inventory, brand inspection, and land use data to estimate forage consumed. To determine how these reductions in forage could influence wildfire behavior (flame length), we built custom models using the BehavePlus 6 fire behavior model application. Our results showed that cattle consumed 11.6 billion pounds (5.3 billion kg) of herbaceous vegetation in 2017. The total amount removed varied by region. Results from this project indicate that without cattle grazing, there would be hundreds or potentially thousands more kilograms per acre of fine fuel on California rangelands. Our fire behavior modeling indicated that these fuel reductions reduce flame lengths. The level of flame length reduction varied based on fuel load, percent slope, dead fuel moisture, and wind speed. Grazing reduces fine fuels enough in some areas to lead to more manageable wildfire behavior. Targeted grazing is a tool that can be used to not only achieve natural resources objectives, but also to reduce fine fuels with the goal of making our communities safer.

ID386

PO102 - FIRE HAZARD DIFFERENCES BETWEEN CONTIGUOUS FORESTS IN CENTRAL PORTUGAL

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Fire hazard is mostly determined by the type of vegetation cover, which in turn determines the fuel characteristics. However, in the case of forests, each forest type may also influence the meteorology beneath the canopies, therefore influencing fire behavior. To assess this effect in three contrasting forest types of Central Portugal, we assessed weather parameters and characterized the structure of surface and canopy fuels in contiguous forests. This assessment was performed for two summer periods in paired samples of contiguous stands of: Maritime pine (P), Broadleaves (B) and Eucalyptus (E), with 10 replications for each possible pair (PB, PE and BE). We identified a high canopy cover in B (on average, 41% higher than for P and E), which likely contributed to the important differences in weather data. Wind speed changed according to B<E<P, and fuel moisture changed according to B>E>P. As to relative humidity and solar radiation, they were 1.5 times higher and 7.0 times lower in B relative to P and E respectively, these latter not presenting significant differences among themselves. Fuel characteristics were also very different among the three forest types, with 1hr fuel loads being about 50% lower in B than in E and C. These differences in weather and fuel data have strongly influenced the surface fire behavior in the three forest types, with B forests representing the lowest fire hazard. These results reinforce the importance of promoting the expansion of broadleaf forests for fire hazard mitigation in Central Portugal and elsewhere.

ID406

PO98 - ASSESSMENT OF FUEL TREATMENT DYNAMICS UNDER ELECTRIC POWER TRANSMISSION LINES

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Understanding the dynamics of the type, quantity and arrangement of fuel under electric power lines is essential to make these infrastructures resistant to wildland fire and reduce intervention costs and potential damage. The present study aims to contribute to the safeguard of electric power infrastructures through more effective fuel management. Fuel structure and fuel load were evaluated non-destructively in fuelbreaks under medium and high voltage electric power lines in a number of locations over mainland Portugal, representative of the variation in time since treatment and technique used, as well as in main forest cover types, climate and lithology. Fuels were point-sampled at each location based in three transepts, placed at right angles to the fuelbreak axis and spaced 10-m apart; eight equidistant points were defined within the fuelbreak, plus two outside points on either side of the fuelbreak. The presence/absence of fuel strata (litter, non-woody vegetation, shrubs, slash) and their respective depth or height and % of dead fuel were evaluated at each point, and fuel hazard was scored. Subsequently, each stratum fuel load was estimated. The results obtained allow to describe fuel hazard and fire behaviour dynamics under fuel-treated electric power lines, thus providing relevant information to improve and optimize fuel-treatment planning, namely in terms of periodicity.

ID409

PO104 - THE ROLE OF VEGETATION IN FOREST FIRE DANGER RATING SYSTEMS: RISICO EXPERIENCE IN ITALY

Nicolò Perello[1,2], Andrea Trucchia[2], Mirko D'Andrea[2], Giorgio Meschi[2], Silvia Degli Esposti[2], Paolo Fiorucci[2]

[1]University of Genova, [2]CIMA Research Foundation

In recent decades, several Forest Fire Danger Rating (FFDR) models have been proposed, mainly based on weather conditions to assess wildfire danger but often without considering vegetation types. However, the scientific community is increasingly aware that considering vegetation types provides a more accurate description of wildfire danger.

The Liguria Region (Italy) and the Italian Civil Protection, have conducted independent research programs that led in 2003 to the development of the FFDR model RISICO. The model integrates vegetation types with weather conditions, differentiating them both in the dynamics of fine fuel moisture content and in the different potential rate of spread and intensity of wildfires. A susceptibility map, produced with ML techniques considering vegetation type and continuity, is also introduced into the model as static input. Furthermore, recently the use of NDWI from satellite has been tested to take into account moisture conditions of the canopy according to the different vegetation types. The use of vegetation type information within the model components is discussed. A recent calibration procedure of the fine fuel moisture content component on the basis of fuel stick measurements is then presented. Moreover, a validation procedure of the RISICO model is proposed, showing a good performance of RISICO to discriminate fire-prone conditions. The operational use of RISICO as decision-support tool by Italian civil protection systems at national and regional levels has revealed how the use of vegetation type information can help in better discriminating wildfire danger focusing on extreme wildfire events addressing efficient prevention and preparedness activities.

ID421

PO85 - TWENTY ONE YEARS OF PRESCRIBED FIRE ON THE ISLAND OF "GRAN CANARIA" (CANARY ISLANDS, SPAIN) AND ITS INFLUENCE ON WILDFIRES

EDUARDO BALGUERÍAS[1], Federico Grillo[1,2], Rubén Rodríguez[1], Domingo Molina[3]

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During the last 21 years (2001-2022) numerous prescribed fires have been carried out in the island of "Gran Canaria" most of them under canopy. The objectives were diverse among them the wildfire prevention and the habitat management or restoration. This paper aims to review and characterize this work, evaluating the influence of these treatments on the largest wildfires that have occured on the island in recent decades.

To identify all the prescribed burns carried out during the study period a large amount of unpublished data owned by the "Cabildo de Gran Canaria" has been reviewed. This information has been subsequently compared with the records of the most important wildfires of the last decades (2004, 2007, 2013, 2017, 2019 and 2020), in order to evaluate the fire behaviour in the treated areas.

The results show that during these 21 years more than 400 prescribed fires have been carried out on the island of "Gran Canaria" equivalent to an area of about 1,000 hectares corresponding in many cases to areas where the fires have shown superficial behavior and less virulence.

The treatment of strategic areas through prescibed fires allows low-cost maintenance of low-burden areas that represent opportunity zones allowing uncontrolled fires to become extinguishable and affected areas to be much less damaged. Last but not least, prescribed fire is a powerful training tool providing the fire supression teams with greater extinguishing capabilities and therefore greater robustness.

ID427

PP85 - INSIGHTS FROM THE FIRESMART PROJECT: A SUMMARY FOR POLICYMAKERS

Adrián Regos[1], Judit Lecina-Diaz, João C. Campos, Silvana Pais, Claudia Car

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In this communication, I will present a brief summary for policy makers and local stakeholders of the main findings obtained through the development of the FirESmart (https://firesmartproject.wordpress.com), a 4-year project funded by the FCT since 2019 in response to the dramatic wildfires that took placed in Portugal in 2017. Our research demonstrated how an effective implementation of European agricultural policies could benefit biodiversity while providing further fire-suppression opportunities, generating societal benefits in the form of savings in fire suppression costs. Our results showed that large-scale forest conversions to more fire-resistant forests would not be on their own the most economically effective solutions to reduce potential burned area and consequently suppression costs. However, when integrated with HNVf policies to jointly reduce fire hazards, this strategy generates the smallest net cost to society. This generates the lowest net suppression cost and wildfire ecosystem services damages. In this sense, the new European Common Agricultural Policy (CAP) offers an excellent opportunity to incorporate 'fire-smartness' into renewed EU agricultural policies that would contribute to wildfire cost mitigation. It also goes beyond the business-as-usual scenarios and provides plausible future pathways wherein climate-smart strategies (such as rewilding modulated by fire suppression, and afforestation programs carefully planned) can emerge as nature-based solutions if the new CAP continues to fail at reversing rural abandonment trends in mountain landscapes of North of Portugal. Overall, the FirESmart project illustrates the benefits of integrating fire hazard control, ecosystem service supply and biodiversity conservation to inform decision-making in mountain landscapes of Southern Europe.

ID432

PO106 - MANAGING POST-HARVEST RESIDUES IN EUCALYPT PLANTATIONS WITH PRESCRIBED FIRE – FIRSTS EFFECTS IN TOPSOIL AND STUMP SURVIVAL

Ana Quintela[1], Mariana Lima[2], Paula Maia[2], Oscar Pelayo[3], Cláudio Teixeira[1], Sérgio Fabres[1], Jacob Keizer[2], **Sofia Corticeiro**[2]

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This study intends to assess short-term effects of prescribed fire in topsoil and viability of Eucalyptus globulus stumps.

The study area was established in a 10 years-old stand in North Center of Portugal harvested during September 2021. The area has a Mediterranean-type climate. The predominant soil is a Humic Epileptic Regosol with silt loam texture over schist greywacke bedrock. Two blocks were divided into control and prescribed fire treatments. Prescribe fire was performed on December 2021, with a duff moisture code of 3.

Soil burn severity was class 1, meaning that mineral and organic layers were unaffected, without or with low presence of ashes. No significant differences were recorded in topsoil physical parameters and organic matter content between pre and post-fire monitoring. However, pH and nutrient availability increased in the post-fire samples. Stump resprouting and stem growth were similar between treatments, showing after trial implementation new green shoots in over 90% of the stumps.

First results suggest that prescribed fire can be an alternative technique for post-harvesting biomass management under specific conditions, with low impacts in topsoil and trees. An increase in soil nutrient availability was noticed which may be benefic to plant nutrition. At least one expressive rainy event occurred days after prescribed fire establishment without noticeable exportation of nutrients from site which may also be related with the proper soil tillage of the plantation.

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ID442

PO86 - UNGULATES AS ECOSYSTEM SERVICE MEDIATORS IN MEDITERRANEAN ECOSYSTEMS: WILDFIRE PREVENTION AND CARBON STORAGE

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Through their foraging behaviour domestic and wild ungulates can decrease the amount of plant biomass available on the ground and therefore affect wildfire hazard and carbon storage. A recent literature review shows that in the Mediterranean fire prone regions of the world both domesticated and wild ungulates have been investigated as tools for wildfire prevention and carbon storage management. However, the number of studies addressing domesticated ungulates far exceeds those addressing wild ungulates. Here we review two examples, in Portugal, on the effects of ungulates on the trade-offs between carbon and wildfire hazard as well as biodiversity. In one case, a grazing excluding experiment in a Mediterranean shrub-grassland matrix, using domesticated goats shows that grazing can reduce plant biomass decreasing modelled flame length, the surface rate of fire spread and fireline intensity without affecting plant diversity, although decreasing habitat conservation value. In another example, browsing by wild deer in a Mediterranean oak woodland was able to retard ecological succession and shrub encroachment, significantly reducing modelled wildfire hazard and above-ground carbon storage. Wild and domestic ungulates mediate ecosystem services such as wildfire prevention carbon storage and biodiversity conservation. Such group of animals needs to be considered when addressing ecosystem management, namely potential trade-offs among ecosystem services and among management aims.

ID447

PO88 - NUMERICAL MODELLING OF WILDFIRE PROPAGATION IN WILDLAND URBAN INTERFACE AREAS, WITH FUEL MANAGEMENT TRACKS

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In this work, it is the main goal to apply a forest fire simulation methodology, to access the efficiency of the use of fuel treatment tracks to protect residential and industrial áreas.

Not only the combat, but also the organization of the forest, including its compartmentation, are essential for a better resilience of the populations to extreme events that can cause very high material and human damages.

The methodology for this task is to gather territorial and meteorological data, to simulate the propagation of forest fires, in the vicinity of urban áreas. Then, diferent configurations of fuel treatment tracks will be tested, in order to evaluate its efficiency in preventing the fire to reach the urban áreas. The simulations will be carried out encompassing all the relevant aspects for its propagation, which are studied based on FLAMMAP fire propagation simulation software.

The results to be obtained will be usefull to allow na adequate planning for the prevention of the fire damage on urban areas, coming from the forest. It is nowadays concluded that in countries like Portugal and in the mediterranean área, the forests pose na importante threat to urban areas, due to the high risk of wildfire propagation.

The conclusions of this research will help the decision makers, in defining a strategy supported by a scientific methodology to protect the residential areas most prone to wildfire hazards.

ID453

PO89 - A STATISTICAL MODEL TO ASSESS THE IMPACT OF POLICIES OF IGNITION LIMITATION IN PORTUGAL

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Portugal is recurrently affected by large wildfires with strong impacts at the social, economic, and environmental levels. A large fraction of fires is anthropogenic, related to negligence or arson, raising the question of adopting policy measures to reduce the number of ignitions.

We present a tool that allows assessing the impact of policies on the reduction of intense wildfires that are responsible for a large proportion of burned area. First, a database is organized that combines measurements of Fire Radiative Power (FRP) by MODIS with historical records of fire ignitions from the Portuguese authority for forest preservation (ICNF) and fire weather conditions as rated by the Fire Weather Index (FWI) provided by Copernicus. We fit a statistical model of log(FRP) that combines a truncated lognormal distribution central body with a lower and an upper tail, both consisting of Generalized Pareto (GP) distributions, and incorporates FWI as a covariate of model parameters.

The model allows generating synthetic samples of FRP using values of FWI for all or part of ignitions according to specified limitation policies. The expected impacts of each policy are assessed by comparing probabilities of exceedance of given thresholds of FRP for the different samples generated.

Results obtained for four regions with different fire regimes for the period 2000-2020 indicate that the probability of exceedance between 100 and 1000 MW in FRP may be reduced by 60 to 80% by reducing ignitions in 50% when FWI is between 30 and 40, and in 90% when FWI is above 40.

ID457

PO103 - FIRE BEHAVIOR IN THE LITTER LAYER IN PINE-OYAMEL AND PINE-OAK FORESTS

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Fuel load, topography, and fuel moisture influence fire behavior. The relationship between these three factors allows us to identify the behavior of the fire according to the tree dominance. Furthermore, it would enable defining whether they are different fuel beds. This information, in turn, would guide fuel management actions according to tree dominance. This work aimed to identify whether fir behavior in the litter layer of pine-fir and pine-oak in the Monarch Butterfly Biosphere Reserve, Mexico defines them as different fuel beds, in addition to adjusting models in the propagation and intensity of the fire. We burned 1 m2 of the litter layer on a metal platform at 0, 10, and 20° slope. We found that the tree dominances presented different fire behaviors. The slope influenced the flame's length, height, and inclination, increasing the speed of propagation and rate of fire. The litter load correlated positively with the flame's height and length and fire index only in pine-oyamel. The adjustment of models indicated that according to the flame's length, the fire's intensity increases exponentially and logistically in the propagation. The heterogeneous behavior of fire between these two tree dominances and slope suggests that these should be considered as different fuel beds at a local scale.

ID494

PP90 - SLEEP QUALITY ASSESSMENT OF PROFESSIONAL FIREFIGHTERS FROM NORTHEAST OF PORTUGAL

Sara Alves[1,2], Filipa Esteves[3,4,5], Francisca Silva[6], Felisbina Queiroga[6], Solange Costa[7,8,9], Klara Slezakova[9], Maria José Alves[11,12], Maria Carmo Pereira, João Teixeira[5,6,8], Simone Morais[10], Josiana Vaz[1,11,12], Adilia Fernandes[1,13]

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Aim

The aim of this study was to evaluate and describe the overall sleep quality of firefighters.

Methods

Application of the Portuguese version of the Pittsburgh Sleep Quality Index (PSQI) to firefighters, from the Northeast of Portugal, who accepted to participate in the study. Data collected between June 2021 and July 2022.

Results

The PSQI global score classified participants as 36,9% of participants as poor sleepers, although 73,9% of firefighters reported a subjective quality of sleep of “very good” or “good”, with 9,1% recording a “bad” quality of sleep. In particular, among the 273 total of participants, 35,8% of firefighter’s assumed sleeping more than 7 hours, whilst 59,7% have a sleep efficiency of 85%. Nevertheless, 7% of individuals stated difficulties staying awake on some occasions, and/or some degree of unwillingness to carry out daily activities, in addition, 26 participants (9,5% of the cohort) stated ever took medicine to help them sleep over the past month. Results revealed a global PSQI score ranged from 0 to 19, being higher scores indicative of worse quality of sleep. The mean score was 4.6 and the median score was 4, being scores >5 considered as a significant sleep disturbance.

Conclusion

The analytical results of this study reveal the presence of concerns related to the quality of sleep in firefighters, although they have a contrary perception, which can compromise their health and well-being. Thus, it is necessary to develop more research and appropriate interventions to optimize firefighters' sleep and reduce subsequent risks.

ID496

PO100 - ENHANCE THE KNOWLEDGE OF WILDFIRE IGNITION CAUSES AND MOTIVATIONS IN PORTUGAL AND SPAIN: PATH DEVELOPMENT, TRENDS AND NEEDS

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Understanding the reasons why wildfires start is fundamental to reducing the number of occurrences since this knowledge allows for the creation of prevention measures suited to the needs of each territory.

Overly simplistic explanations of wildfires encourage decision-makers to consider firefighting the main solution to harmful wildfires. Most of the research has been focused on the statistical exploitation of the wildfire causes data from the official wildfire databases without questioning the validity of the causes and motivations there identified that are supposed and not real.

This study aims to understand the recent trends and characteristics of the causes and the main problems in the investigation of the causes in both Portugal and Spain and the recent progress. Firstly, the national wildfire databases are analyzed using several statistical methods. Secondly, interviews with ten experts from both countries with activity in the investigation of the causes for several years.

Both countries adopt different classifications of ignition causes. The impact of these different options is evaluated in the sense to help each other country to improve their policies. Apparently different information (data described properly in a certain frame of reference) support different forms of knowledge (driven by experience, values, contextual understanding of the specific situations, application, intuition, and beliefs). The aim is to find the best-shared knowledge to make good decisions.

The acceptance of fire as a fundamental part of the environment in both countries and the traditional ecological knowledge must be accommodated in the investigation of the causes framework this research presents.

ID513

PO91 - FUEL MANAGEMENT OF FIRE-ADAPTED INVASIVE SPECIES – ONE SIZE DOES NOT FIT ALL

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Areas invaded by fire-adapted species are usually associated with increased fire hazard. Fuel management in these areas may be challenging given the feedback loop that develops between disturbances and invasions. We studied the two-way relationships between fire and two ecologically distinct, invasive woody species of Australian origin (Hakea sericea and Acacia dealbata) occurring in Portugal, aiming at: a) assessing the changes in fire hazard in invaded areas and b) testing the use of prescribed fire treatments for their control. Hakea sericea strongly increases fire hazard when compared to the most hazardous native vegetation, as shown by fire behaviour simulations. In A. dealbata there is a considerable difference between young and adult stands, with the latter showing lower fire hazard compared to most native vegetation, due to the compacted litter and the suppression of understorey. Fuel management techniques were tested through eight experimental blocks of treatments for each of the two species. Each block featured slash, burn and slash-and-burn treatment plots, together with a control plot. Plots were monitored over three years to record survival, resprouting, seed dispersal and germination. All treatments applied to A. dealbata revealed to be ineffective due to strong germination and resprouting, but H. sericea stands were successfully eradicated by applying slash-and-burn treatments associated with a high residence time. Therefore, the two invasive species revealed very distinct fire-related characteristics, and our results show that a one-size-fits-all approach is far from being appropriate in the fire management of invaded areas.

ID514

PO108 - ANALYSIS OF THE IMPACTS OF WILDFIRES ON THE WAY OF LIFE OF THE INDIGENOUS POPULATIONS OF XINGU

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The intensification of climate changes is a reality and has a great impact on the way of life of different communities around the world, wildfires being one of the main challenges that humanity will have to face in the incoming years.

In this scenario, a large increase in the number of wildfires was observed in the last 3 years in the Xingu Indigenous Park. Most of these wildfires come from traditional burnings of subsistence farms, a striking feature of indigenous culture. These fires have been directly affecting the way of life of the native peoples of Xingu, taking as an example the decrease in the availability of raw materials for building houses, such as imbira and sapê, as well as traditional medicines made from roots and barks.

This study's goal is the analysis of the occurrence and cause of wildfires in Xingu in the last 3 years, as well as the impacts of the fires on the way of life of the native peoples. The methodology involved interviews with inhabitants of different ethnic groups and with representatives of the public power present in the Xingu region. Together, data from the public authorities regarding operations to combat wildfires within the territory in the proposed period were systematized.

The results indicate ways of mitigating these impacts, by strengthening the Xingu community, reinforcing its role in the management of the territory, integrated with the public power, providing tools such as training and technical data to support community planning and management.

ID515

PO109 - EFFECTS OF TWO TRAINING PROGRAMS ON IMPROVING THE WILDLAND FIREFIGHTERS' PHYSICAL FITNESS

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The aim of this study was to analyze the effect of two training programs on improving the wildland firefighters' physical fitness. Two programs based on circuit training were performed, one based on high intensity (HICT) and the other on submaximal intensity (SICT). Forty-six applicants to forest firefighters were randomly assigned to each of the experimental groups: HICT (n=22) and SICT (n=24). In both programs the subjects trained 2 days a week for 8 weeks. The programs were composed of the same exercises, the only thing that varied was the intensity of the exercises and their duration. At the beginning and the end of the training programs, the subjects' physical fitness was assessed through different tests. After 8 weeks of training subjects improved significantly ($p<0.05$) their vertical jump, abdominal, lumbar, and upper limb strength. In addition, the employment competency performance was improved. The improvements analyzed in the vertical jump (8.3 ± 5.3 vs. 3.1 ± 6.7%) and in the employment competency (7.5 ± 5.9 vs. 2.5 ± 4.7%) were higher ($p<0.05$) in HICT than in SICT. In conclusion, the results of this study show that an 8-week high-intensity circuit training program is more effective on improving the wildland firefighters' physical fitness than a submaximal training program.

ID531

PO84 - THE JUDEAN MOUNTAINS FIRE – 2021 (2): NEW INSIGHTS ON FOREST MANAGEMENT AND FIRE PREVENTION

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In the summer of 2021, 1,100 ha of forest area were burnt by a wildfire in the Judean Mountains region of Israel. The area was mainly consisted of mixed pine-oak, multifunctional forests managed by the Israeli Forest Service – KKL. The fire caused severe damage to human properties and infrastructures as well as to natural, heritage, landscape, and recreation assets. This talk presents new insights coming from the Judean Mountains fire and offers updated guidelines for planning and managing future forests' structure and reducing fire hazard. Differently from previous mega-fires in Israel where the extreme fire intensity was attributed mainly to weather conditions (i.e., "weather driven"), the intensity of this mega-fire was mainly related to fuel characteristics (i.e., "fuel driven"). Based on this understanding, we recognized both forest dynamics and climate change as key drivers of increasing wildfires risk. Hence, updated forest-management guidelines refer to the following: a) further improvement of fuel-breaks and consideration of novel fuel-break structures, b) better integration of fuel-breaks as part of the fire-fighting strategy, c) fuel treatments within human settlements and along their access roads, c) fire-safe forest vegetation design in recreation areas, d) landscape planning to break the continuity of dangerously flammable forest structures. We stress, however, the need to keep the right balance between reducing fire hazard vs. enabling the variety of ecosystem services provided by the forests.

ID114

PP 135 - A MATHEMATICAL TOOL FOR DECISION MAKING IN WILDFIRE SUPPRESSION

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The decision-making process regarding fire suppression requires advanced tools to support it. In this regard, operations research provides models that not only simulate how the fire is going to behave, leaving the dispatching decisions to the wildfires' manager, but also optimize the available resources in order to contain the fire as soon as possible.

This kind of tools are likewise able to consider the interaction between fire expansion and suppression, developing a more realistic strategy, not leading to an overestimation of the necessary resources, and supplying the fire managers with a good support decision tool that may help them make better decisions, combining it with their experience.

In this work, a model is presented for determining which points of a landscape should be treated once a fire has started, in order to stop its spread. The model considers the time windows provided by the fire behaviour for taking actions, which in turn are affected by the fire suppression strategy itself.

ID115

PP132 - JUST IN TIME - PROPOSAL FOR LOGISTICS OF QUICK ALLOCATION OF BRIGADISTS FOR FLOREST FIRE FIGHTING

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Objectives

The just in time model, especially its logistical approach of "delivering on time" can be a practical approach and, using the best of its tools, become an effective logistical method of allocating brigade members to field, which is therefore the main objective of this article: it is expected that this proposal is viable, applicable and practical, flexible enough to adapt to variations in demand within the expected complexities of typical large forest fires.

Methodology

Research in a bibliographic review, field research was carried out to collect information together with those responsible for the management of PARNA Serra do Cipó/BRASIL, as well as interviews with firefighter commanders who were in charge of the fires in the season.

Results

After correct dimensioning of the florest fire (via information by phone calls, radio or via satellite) at the Command Post, the response coordination must plan the employment in the number of available brigade members and activate those who are in the advanced bases closest to the fire outbreaks, gaining in response time, less wear and tear on vehicles and brigade members and greater chances of catching fire in its initial stage.

Conclusions

It is expected that the logistics of employment of brigade members in dispersed bases, but always previously planned and allocated, with the proper communication capacity, will be an important point of improvement in response time and allocation of resources, reducing travel time and presenting practical gain in the preservation of our environment.

ID131

PP129 - STORMS AND EXTREME BEHAVIOR IN WILDFIRES. RECENT CASES IN THE VALENCIAN COMMUNITY, SPAIN

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Objectives

Reducing the uncertainty generated by the presence of storms in the area of influence of the fire, caused by the possibility of sudden spreads that may result in risky situations for the operation, through the identification of these scenarios

Methods

Several recent cases of wildfires with associated storm phenomena that have taken place in the Valencian Community, Spain (Llutxent 2018, Atzeneta del Maestrat 2020 and Soneja 2021) have been selected. These wildfires have undergone drastic changes in the spread of the fire, generating risky situations for the firefighters.

A detailed study of the evolution of each fire and the variables that have influenced its spread has been carried out, with special emphasis on the meteorological variables that accompany the storm episodes.

Results

The analysis of the particularities of these fires has allowed relating fire behavior to the influence of storms, resulting in the elaboration of storm monitoring protocols, identification of warning flags and risk information to the operative.

Conclusions

Being able to identify fire scenarios with associated storm phenomena, through the analysis of recent cases where a notable change in fire behavior has been observed, is essential to reduce the uncertainty generated in these situations, avoiding that sudden spreads result in risky situations for the operation.

ID206

PP130 - SIXTHSENSE: SMART INTEGRATED EXTREME ENVIRONMENT HEALTH MONITOR WITH SENSORY FEEDBACK FOR ENHANCED SITUATION AWARENESS

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The work of wildland firefighters is characterized by being carried out in conditions that imply intense physical effort, in extreme environments and where the inherent nature of the job often involves exposure to changing and dangerous working conditions. In such scenarios, physiological and mental stress increases and can rapidly deteriorate the health or operational capabilities of the personnel involved. Consequently, a system that monitors their actions and provides real-time and actionable information without obstructing their operational capability is needed. The EU–funded Project SIXTHSENSE aims to develop a wearable device for real-time monitoring of wildland firefighters' physical and cognitive status and provide information through tactile biofeedback. The system will allow the early detection of those risk factors that could lead to a rapid deterioration of health or operational capabilities by implementing predictive measures based on physiological parameters. This innovative wearable health monitoring system data enables first responders to detect risk factors early on and allows real-time monitoring of all deployed wildland firefighters. This paper is an introduction to the overall concept of the project and details the current version of the SixthSense system.

ID241

PP134 - A NEW MODEL TO PREDICT WILDLAND FIREFIGHTERS' THERMOPHYSIOLOGICAL STRAIN: THE APPROACH OF THE SIXTHSENSE PROJECT

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[1]University Of León, [2]University Of León

The thermophysiological strain is a risk of concern in wildland firefighting. In these scenarios, physiological monitoring has been proposed to assess the physiological status and prevent injury. The physiological strain index (PSI) combines heart rate and core temperature into a numerical value and has been widely adopted for modelling thermal strain. However, measuring core temperature is challenging in the field. Therefore, using skin instead of core temperature has been proposed to calculate the PSI in the so-called modified PSI (mPSI). This study aimed to analyse the performance of the mPSI versus the original PSI. Ten wildland firefighters performed a field test in the heat (WBGT= 25.6±1.8 ºC), consisting of a circuit of four tasks (i.e., walking up and down a slope carrying a 20 kg backpack, fire-swattering and charged hose advance), interpersed by 90 s recovery. After a break of 10 min, the 4 exercises were repeated. Heart rate, core temperature and chest skin temperature were continuously monitored throughout the trials. Physiological variables were averaged every 1 min for analysis. Agreement between PSI and mPSI was assessed through standardised mean bias (BIAS), root mean squared error (RMSE), Pearson correlation (r), and limits of agreement (LoA). The mean PSI and mPSI were similar (5.8±0.9 versus 5.6±0.5) and highly correlated (R=0.8±0.2). BIAS, RMSE, and LoA were 0.2±0.8, 1.1±0.2, and 1.5±0.6, respectively. The moderate agreement found suggests that mPSI could be used to track the global thermophysiological status on-field. Future studies should further analyse the sources of variability found between mPSI and PSI.

ID338

PP133 - EXTERNAL SUPPORTING BRIGADES IN FIRE SUPPRESSION IN EXTREME AND SIMULTANEOUS WILDLAND FIRES EPISODES

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The present wildland fires scenarios show and foresee an increase in the need to improve the external support when an extreme fire or a simultaneity of them hit a zone. This means the necessary improvement of the preparedness phase, deployment procedures, coordination and interoperability of the supporting teams and resources to the requesting part (it is an external, and not always neighboring: administration, region or country)

Even when it is not new, in 2022 there has been several episodes of simultaneity of wildland fires (some of them bigger than 3.000ha) all along Spain. That is why the request of support from the regions to the national level has been extraordinarily numerous and needed to be as fast, effective and efficient as possible.

Specifically, the supporting helitracked fire brigades (BRIF) in the Peninsula have been deployed at 100% of their capacity for some periods during 2022 summer, which has represented a real challenge mainly in a) fire triage; b) deployment criteria (when and how); c) deployment planning; d) coordination; e) cooperation; f) interoperability; g) self-sufficiency; h) logistics; and i) demobilization.

A lot has been learnt from the experience and those lessons learnt could be useful for other countries or regions: supporting or requesting support, concerning extraordinary severe wildland fires episodes.

ID342

PP128 - CHEMICALLY SPEAKING: WHY USFS, FIRE MANAGEMENT AGENCIES RELY ON PHOSPHATE-BASED FIRE RETARDANTS

Jean Luc Kassabian[1], Edward Goldberg

[1]*Perimeter Solutions*

In 1963, phosphate-based fire retardant became the first to be approved by the United States Forest Service for use in aerial wildfire attack. Over the next 60 years, phosphates have proven to be effective in helping the USFS and other fire management agencies around the world to protect property and save lives.

But, why phosphate? In this presentation, Jean-Luc Kassabian with Perimeter Solutions, will review the history of aerial wildfire suppression and discuss the science behind what makes phosphate the most effective fire retardant chemical available today. During the presentation, he will analyze the results of fire retardant tests dating back more than 80 years that compare the efficacy of phosphate against numerous other chemicals, including borate, magnesium chloride, phosphoric acid, and half a dozen others. Kassabian will highlight what researchers found in each of these studies, discuss the benefits and drawbacks of the tested chemicals, and explain how the results from these various tests led to phosphate becoming the industry standard for fire retardant production for decades.

Today's phosphate-based fire retardants continue to help firefighters prevent the spread of wildfires. Kassabian will discuss current fire retardant technology and take a look into the future to educate attendees on how we can improve all aspects of wildland firefighting, helping the audience to understand what we need to do to ensure future success with wildfire prevention, protection and suppression efforts, as climate change and other factors continue to intensify the dangers presented by wildfires.

ID446

PP131 - MODELLING THE COMBAT OF WILDFIRES WITH THE SOFTWARE FLAMMAP

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Recent wildfire events in Portugal have proven that it is not possible to continue fighting fires in the same way. The management of aerial means, the use of manpower on the ground, and the opening of fire tracks with tracked machines must be studied in detail.

A new fire fighting methodology is necessary, encompassing all these aspects, based on the fire propagation simulation software FLAMMAP. In this software, digital terrain models, fuel models and meteorological data such as temperature, air humidity, wind intensities and directions will be used, so that, based on the evolution of a real fire, it is possible to decide for the best strategy of combat and consequently the suppression methods to be applied, allowing to evaluate the integration of this software as decision support tools, refining its application before the evolution of the fire and as an influential factor in the dispatch of operational means. I this study, a real case of a wildfire in the municipality of Coimbra.according to what has really happened in the fire event.

The results to be obtained with this software will allow to draw important conclusions about the effectiveness of the combat means in a real fire. They can be very usefull, in the future to allow an adequate planning for the combat in real wildfires

The conclusions of this research will help the decision makers, in defining a strategy supported by a scientific methodology to combat wildfires, and increase the fire safety in rural areas.

ID6

PP126 - DETERMINING BURN SEVERITY AND ITS IMPACT ON POST-FIRE REGENERATION IN THE NOTHOFAGUS FORESTS OF TIERRA DEL FUEGO, ARGENTINA

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In Tierra del Fuego, southern Argentina, recent wildfires in Nothofagus (southern beech) forests have produced post-fire conditions commonly associated with high burn severities (high mortality and deep ground-layer consumption). Still, burn severity has not been systematically categorized for fires in the region. In two recent wildfires (2008, 2019), we established 80 burned and 16 unburned plots in N. pumilio and N. antarctica forests in which we visually estimated burn severity, measured live tree basal area, estimated bare-soil abundance, and tallied seedlings (≤30cm). Visual estimations classified 71% of post-fire plots as having burned at high severity (>90% overstory mortality, >50% bare-mineral soil) and 29% at low severity. Average live basal area increased from 0 m2ha-1 in high-severity burn plots, to 5 m2ha-1 in low-severity plots, and 41 m2ha-1 in controls. Bare-soil dominated microsites represented 29% of all microsties in high-severity plots, 18% in low-severity plots, and 1% in controls. Seedling density was negatively correlated with both visual estimates of burn severity ($r=-0.43$, $p<0.0001$) and bare-ground abundance ($r=-0.19$, $p=0.06$), and was positively associated with live basal area ($r=0.48$, $p<0.0001$). Bare-soil thresholds for burn severity categories need to be adjusted based on our results and burn-severity classifications will be confirmed using remote-sensing and soil sample data. Still, studied wildfires were likely dominated by high-severity burn patches associated with low seedling densities. To maximize limited restoration resources, visual estimates of burn severity should be used to inform planting decisions. Areas with high mortality, dominated by bare-soil, should be prioritized in post-fire restoration efforts.

ID7

PP114 - EXPERIMENTAL POST-FIRE RESTORATION OF NOTHOFAGUS PUMILIO AND N. ANTARCTICA FORESTS IN TIERRA DEL FUEGO, ARGENTINA

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Wildfires in the native Nothofagus forests of Tierra del Fuego, southern Argentina, impede post-fire regeneration of N. pumilio and N. antarctica. Regeneration densities are lowest in the interior of burned areas where microsites are dominated by grasses and forbs rather than leaflitter. To develop strategies to improve regeneration in the interior of burned areas, we established a restoration experiment in forests that burned at different points in time over the last century. In April, 2022, we collected approximately 19,000 N. pumilio and 36,000 N. antarctica seeds from different provenance sources. We tested the viability of these seeds and selected the fullest individuals for sowing. In May, 2022, at burned plots located 30m and 270m from the unburned forest edge, and in unburned controls (n=96), we selected 5 microsites per plot (grass/forb, leaflitter, bare-soil, bush, and woody-debris-dominated), and within a 20cm2 subplot at each microsite we removed naturally deposited seeds and sowed 30 previously selected seeds. Leaflitter from unburned forests was used to create leaflitter-dominated microsites when they were not naturally present. Seed germination and average seedling height will be recorded in December, 2022, and survival and height growth will be measured in March, 2023. We expect that seeds sown in leaflitter will have higher germination rates, and improved survival and height growth compared to those sown in other microsites. This outcome would give local land managers an additional resource through which to improve post-fire restoration efforts and mitigate the negative impacts of wildfire on N. pumilio and N. antarctica.

ID40

PP118 - WILDFIRE IMPACTS ON ECOSYSTEM SERVICES IN PORTUGAL: A TRIANGULATION OF RESEARCH FINDINGS, GOVERNMENTAL REPORTS, AND SPECIALISTS' PERCEPTIONS

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Wildfires significantly impact forest ecosystems, especially in Mediterranean countries such as Portugal, which displays the highest number of wildfires and the second largest burned area. Following major wildfires, the Portuguese Institute for Nature Conservation and Forests (ICNF) assesses the major environmental impacts and proposes emergency stabilization measures. This study aims to improve such assessments through a data triangulation approach to characterize the wildfire impacts on ecosystem services in Portugal. First, a systematic review is conducted to identify the research that addresses the issue and analyse its findings. Next, a document analysis of all technical reports and emergency stabilization reports available on ICNF's website is presented. Finally, a survey of specialists' perceptions on the topic closes the analysis. The ecosystem services defined by The Economics of Ecosystems and Biodiversity were employed to compare the impacts identified using the different methods. The identified implications for Portugal's current wildfire and environmental regulations are contrasted. The results suggest that the experts perceive wildfires to significantly impact all ecosystem services, even though the literature has so far focused on 12 of them, and ICNF currently has only focused on seven in its reports. The possible underlying motives are discussed. Some important impacts identified in the literature, as is the case of Climate regulation, a topic of the highest priority in the European environmental agenda, have not so far been a topic of focus in ICNF's reports, which suggests relevant opportunities for enhancing its reporting process and research in the future.

ID51

PP124 - LOCAL ASSESSMENT OF TECHNICAL FORESTRY AWARENESS ON SOIL EROSION AFTER WILDFIRE – THE CASE STUDY OF CENTRAL PORTUGAL REGION

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Recurrently affected by wildfires, and with a high erosion risk (Parente et al., 2022), the central region of Portugal is used as a case study to assess local technical procedures and tools, identify gaps at decision-making level, and propose improved approaches to it.

A questionnaire survey was conducted between 14 September and 14 October, in which 100 municipalities and 8 inter-municipal communities were invited to participate. Was structured into three main sections: i) entity general characterization; ii) its relation to forest soil management and erosion mitigation after wildfires, and iii) used data and technical tools. Questionnaire draft combined closed and open questions. Of 78 responses, 51 were considered valid for analysis.

Results point to a general high concern with soil erosion. However, the local focus targets the impact on biodiversity, abandonment and degradation of the burned areas and the increase in soil losses as major concerns. In 51% of valid answers, respondents identify that, at some point, implemented or have knowledge on the implementation of mitigation measures mainly represented by organic barriers application and interventions on water bodies. Around 43% of valid responses recognize the use of technical tools for erosion control and rehabilitation, frequently ArcGis/Qgis and scientific studies, being mainly used for planning.

According to respondents' perspectives, two key inferences can be taken on how promote local soil conservation: i) local empowerment to act on emergency stabilization/rehabilitation and support forest owners, and ii) strengthening awareness to local stakeholders.

ID56

PP120 - USE OF REMOTE SENSING TO EVALUATE EFFECTS OF POSTFIRE EMERGENCY STABILIZATION ON OAK FORESTS RECOVERY

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In Portugal, large burned areas are associated with a small number of fire events that are able to reach large magnitudes. Postfire emergency stabilization is a restoration practice to minimize fire impacts in soil and vegetation in the short-term. In this study, we aim to assess how emergency stabilization measures affect the postfire recovery of deciduous oak forests.

We selected 292 polygons with deciduous oak forests where emergency stabilization treatments were implemented after 2016 and 2017 fires. Additionally, we selected areas with deciduous oak forests without treatments surrounding each polygon, which were used as control. Based on those polygons, we generated 1364 random points.

For each random point, we quantified several spectral indices for a period of 48 months after fire using Google Earth Engine and satellite imagery, namely: the differenced Normalized Burn Ratio (dNBR), the Normalized Difference Vegetation Index (NDVI), and the Modified Soil Adjusted Vegetation Index 2 (MSAVI2). Furthermore, each point was also characterized with additional variables such as slope, aspect and monthly precipitation. The rate of recovery was assessed with postfire NDVI and MSAVI2 as proxies of recovery using the Theil-Sen estimator and a generalized additive model.

We observed a significant difference in oak forest recovery rate between areas with postfire treatments and control areas, being recovery higher inside control areas.

Our results suggest that emergency stabilization measures may have a negative effect on the recovery of deciduous oaks in the short term. Additional studies are necessary to better understand such effects at medium and long term.

ID163

PP123 - POST-FIRE NATURAL REGENERATION IN ATLANTIC FOREST IN SOUTHEASTERN BRAZIL

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Forest fires are sources of disturbance, especially in tropical forests, where fire is not a structuring agent of the community. Thus, natural regeneration is one of the mechanisms that aid in the recomposition of the disturbed area, seeking the gradual enrichment of the species. Thus, we aimed to evaluate the floristic similarity of the natural regeneration of a post-fire fragment in a Montane Dense Ombrophilous Forest, located in Serra do Valentim, Iúna, Espírito Santo, southeastern Brazil. We evaluated two areas, an area with fires for four years and a reference forest, each area with 10 plots (5 m x 10 m = 50 m). We counted individuals with diameter the height of the breast less than 2.5 m and minimum height of 60 cm. Species identification was performed using the Angiosperm Phylogeny Group IV system. We performed the non-metric multidimensional scale analysis (NMDS) using the Jaccard Index (qualitative, presence-absence of species). We used multivariate permutation analysis of variance (PERMANOVA, 9,999 permutations) to determine differences in species composition between areas. The analyses were performed using the vegan package in the R software. NMDS revealed the formation of two groups with greater similarity of species, being confirmed by similarity analysis. The species composition of the two areas varied significantly between them (PERMANOVA: F(1,19)= 3.3582, p= 0.001). Therefore, forest fires influence the floristic composition of natural regeneration species, and understand how this post-fire regeneration in forests happens is fundamental to support conservation strategies and ecological restoration.

ID186

PO125 - USING THE FEMME TOOL FOR PLANNING EMERGENCY STABILIZATION IN A SPECIFIC BURNT AREA

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Objectives

The objective of this study is to test how well the FEMME tool - i.e. the application of the Morgan, Morgan and Finney (MMF) model proposed by Parente et al. (2022) for mapping post-fire soil erosion risk for mainland Portugal - predicts erosion rates measured in a specific burnt area.

Methods

The study area is located in the Aveiro District, north-central Portugal, and was burnt by a wildfire during September 2020. Within this “Penouços burnt area”, the erosion during the first post-fire year was measured at both the plot and swale scale, by the LIFE REFOREST and SUDOE EPyRIS projects, respectively. This was done using three replicate measurement areas per scale, all of which were covered by young Maritime Pine.

The observed erosion rates are being used to test the predictions of the MMF model using various model input data sets, ranging from a data set similar to that Parente et al. (2022) - i.e. based on existing (map) information - to a data set taking full stock of in-situ measurements.

Expected results

The in-situ data set is expected to provide more accurate predictions of the observed erosion rates than the existing-information-based data set. UAV-based topographic information and local rainfall data are expected to be the most crucial in this respect. Even so, the latter, FEMME-tool predictions are expectedly sufficiently accurate for a first identification of hillslopes that potentially have an elevated post-fire erosion risk and, therefore, should be a first priority for in-situ verification.

ID211

PO129 - THE EFFECT OF FIRE ON PHYSICAL AND CHEMICAL PROPERTIES SOIL OF ZAGROS FORESTS(CASE STUDY: SARVABAD CITY, KURDISTAN PROVINCE)

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Forest fires cause major changes in soil characteristics, but there is little information about the durability period of these changes during the post-burning yearsIn the present study, the effect of fire on some physical and chemical characteristics of top-soil (0-5 cm) and sub-surface (5-15 cm) in western forests of the country in the city of Sarvabad (Kurdistan), where was twice exposure to fire (first time in 2003 and seconed time in 2013) were investigated in 2015..In this research, burnt and control (no-burnt) masses with four hectares and the same environmental conditions and vegetation community were selected and networked and in the form of 40 pieces, in a total of 160 soil samples collected and physical and chemical properties of soil were measured. The findings indicated that the organic carbon content of soil in both surface and bottom depths and the amount of phosphorus and apparent specific weight in the surface horizons were significantly lower in the burnt area than the control area. Also, there was a significant difference between the levels in the surface horizons to the lower horizons for EC, organic carbon and apparent specific weight in both control and fire areas, and this ratio was not significant for the soil texture variables. Generally,the results of this study indicated that the fire had significant effect on the physical and chemical of soil and this effect was more effective for top-surface than sub-surface.

Key words: fire, Iranian oak (Quercus brantii), forest dynamics, Kurdistan, physical and chemical properties of soil.

ID221

PP112 - LAND MANAGEMENT OPTIONS IN RECENTLY BURNED AREAS: A MODELLING APPROACH TO EVALUATE THE IMPACTS OF POST-FIRE INTERVENTIONS

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After a forest fire, the lack of vegetation leaves the soil exposed, promoting runoff and erosion, which can further jeopardize the downstream waterbodies. If left unmanaged, vegetation will eventually recover, restoring the natural hydrological cycle. However, post-fire erosion mitigation treatments such as mulching, widely applied in the United States and Northwestern Spain, can be used to accelerate ecosystem recovery. In Portugal, this practice is still not widespread, especially compared to terraces construction that was commonly used for reforestation of burned areas on steep slopes.

In this study, the impacts of three different post-fire management interventions (i.e. spontaneous vegetation recovery, mulching, and terrace construction) on water availability and quality were evaluated. The widely used hydrological model SWAT (Soil and Water Assessment Tool) was applied to a small burned catchment (Ermida) in Central Portugal, which was turned into a eucalyptus forest plantation area about 7 months after the fire. Besides the actual interventions taking place on site, two alternative management options were designed, one simulating the spontaneous recovery of the ecosystem and the second recreating the implementation of mulching.

Terracing and mulching reduced soil losses and the amount of sediments transported downstream compared to spontaneous recovery. Higher water flow volumes and phosphorous exports were predicted under terrace conditions, likely due to the increased water infiltration capacity and accelerated leaching processes.

These findings can be important for forest managers to understand the potential negative impacts and uncertainties of different post-fire practices, improving the management of burned areas.

ID237

PP127 - COMBINED RESTORATION STRATEGIES CAN ESTABLISH FIRE-RESILIENT AND FUNCTIONAL LANDSCAPES

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Wildfires are pervasive disturbances, shaping the structure and functioning of many ecosystems worldwide. After fire, Mediterranean forests can regenerate as either dense homogenous pine stands or shrub-dominated seeder species, both present low-functioning and high vulnerability. To improve ecosystem functioning and reduce fire hazards, several management actions have been tested at stand scale, but their effectiveness in creating functional and fire-resistant landscapes is unknown. Here we assess at stand and landscape scale, how different management combinations determine the provision of multiple ecosystem services (biodiversity conservation, carbon sequestration, food production, disturbance regulation, and supporting services) in two post-fire ecosystems after Pinus halepensis forests were burned (overstocked pine forests and dense shrublands). We evaluate, up to 30 years after treatments´ application, the effectiveness of resprouting species plantation (e.g., Pistacia lentiscus, Quercus faginea) in combination with tree thinning in overstocked pine forests, and clearing or prescribed burning in dense shrublands, compared to the unmanaged (control) and unburned (reference) ecosystems. Also, we created and analyzed artificial landscapes to find which combinations of management types deliver the highest levels of landscape functionality. At stand scale, thinning and clearing combined with the plantation of resprouting species improve biodiversity conservation, carbon sequestration, disturbance regulation. Prescribed burning enhanced services related to food production and reduced fire risk. At landscape scale, a suitable combination of the different treatments in specific proportions can establish landscapes that maximize the supply of ecosystem services. Our study provides insights to land-managers that help restore degraded Mediterranean ecosystems towards less vulnerable and more functional landscapes.

ID263

PP115 - COMBATING FOREST FIRES IN THE PANTANAL THROUGH FIRE PREVENTION AND RESTORATION

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This study identifies priority areas for wildfire prevention and degraded areas by fire for restoration in the Brazilian Pantanal. Proposing restoration strategies to mitigate fire damage, considering the natural regeneration potential of the sites and the cost of actions. It was necessary to assess the areas that would have a high risk of fire through meteorological data on fire risk tendency for the period 1980-2020, fire intensity, last year with fire, fire recurrence of fires for the period 2003-2020 and remaining areas of natural forest vegetation around watercourses. We identified areas of high fire risk (246 km) encompassing regions with the occurrence of fire-sensitive plant species. It was observed that areas with high or medium potential for natural regeneration (179 km) and low potential (66 km) required active restoration. Areas of more than 3,120 km were severely degraded by recent fires, with 93% of these areas presenting a high or medium potential for natural regeneration, using passive restoration and Integrated Fire Management as ways of combating it. It is estimated that between 28 and 151 million USD are needed to restore areas with low potential for natural regeneration through the cultivation of seedlings or enrichment planting, while for areas with high and medium regeneration potential the cost is 123 million USD. It is expected that priority areas should be recovered according to their natural regeneration potential and available resources.

ID297

PP113 - A SIMPLE TOOL TO MAP EROSION HOTSPOTS AFTER WILDFIRES

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Fires can destroy vegetation cover and enhance hydrological and erosion processes. This can lead to soil degradation in burnt areas, as well as water quality contamination with ashes and fine sediments. Emergency intervention can limit these problems, but the most important intervention spots should be identified shortly after the fire.

Existing models can identify these erosion risk "hotspots", but they are limited by high data demands and long computation times. An alternative is use simple spatially-distributed indices expressing the potential for water and sediment flow in different parts of a catchment.

This study addresses the question: Do these alternative approaches identify post-fire sediment mobilization hotspots? To achieve this, we test two tools which are easy to apply and have low data requirements (topography, vegetation cover and burn severity): (i) the Borselli index of connectivity (IC) and (ii) the InVest Sediment Export index (SE). We assess their capacity to predict the location of erosion hotspots predicted by the more complex Landscape Evolution Model (LAPSUS model) for 4 years with large burnt areas in the Águeda watershed, Portugal.

Our results show that IC and SE are suitable for identifying areas where the erosion rates are above the 90th percentile in recently burnt areas; differences between their performance are minor.

These tools can be useful for post-fire and water contamination risk management because they can be rapidly applied using information which can be quickly obtained after a fire, thus allowing for a fast prioritization of areas for emergency post-fire intervention.

ID394

PP119 - USING REMOTE SENSING TO ASSESS FIRE IMPACTS ON TROPICAL DRY FORESTS IN MADAGASCAR

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Dense dry forests constitute a remarkable tropical forest ecosystem that characterizes large areas in western part of Madagascar. Although plant species diversity is not as high as in the eastern rainforests, levels of endemism are higher. Unfortunately, fire is one of the main drivers of vegetation loss and threat to the Malagasy rural landscapes, particularly in this specific ecosystem. Effective fire management remains a major challenge for natural resource management in the country as Malagasy protected areas are increasingly impacted by anthropogenic fires. A big step has already been taken for the quantitative assessment of fires in Madagascar through systematic burnt areas monitoring at national level. However, there is a gap on post-fire understanding of damage severity and vegetation behavior. Therefore, this study was carried out and presents the results of the assessment of several spectral indices to assess the burn severity of fires at Ankarafantsika National Park during the fires of October 2021. First, the differenced Normalized Burn Ratio (dNBR), the Relative differenced Normalized Burn Ratio (RdNBR), and the Relativized Burn Ratio (RBR) were calculated before and after the observed fire. Then, a twelve-months monitoring was conducted on specific areas with different severity classes, using Normalized Difference Vegetation Index (NDVI) to investigate the short-term vegetation dynamics of the burned forest. The information gathered by this post-fire assessment can be used for mitigation strategies planning and implementation such as ecological restoration of burned areas.

ID396

PO124 - MOLECULAR CHARACTERISATION OF FIRE-AFFECTED SOIL ORGANIC MATTER BY A 5TH GENERATION WILDFIRE IN SW-PORTUGAL

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Wildfires are recurrent in the Mediterranean basin inducing soil organic matter (SOM) molecular changes and environmental consequences [1]. SOM is of paramount importance as soil health indicator [1]. Fire-induced changes include the alteration of existing chemical structures and the accumulation of newly formed ones, affecting the complex balance between the different C-types [1,2]. Therefore, understanding SOM molecular composition, before and after fire, is fundamental to monitor soil health and its natural or man-mediated recovery [2,3]. Our aim was to assess the molecular composition of organic matter in fire-affected leptosols, at two depths under different vegetations in southwestern Portugal (Aljezur, Algarve). SOM characterization was conducted by Py-GC/MS aided by graphical-statistical methods. The technique is suitable for the structural characterization of complex matrices and provided detailed SOM fingerprintings usefull to monitor SOM changes produced by fire [2,3].

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ID414

PP116 - ASSESSING POST-FIRE SOIL EROSION AND ASH TRANSPORT RISK WITH WEPPCLOUD-WATAR-EU AFTER THE EXTREME 2022 FOREST FIRE IN CENTRAL EUROPE

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During a period of unprecedented fire weather, a wildfire in Central Europe burnt approx. 1200 ha of the Bohemian and Saxon Switzerland National Parks. The fire potentially affected the landscapes' erosion response and left behind a layer of ash, a material rich in nutrients and potential pollutants. As part of the post-fire risk assessment, we evaluated the risk of soil erosion, and of ash and contaminant transport with the WEPPcloud-WATAR-EU model. To our knowledge, this is the first time that this model is applied to a European post-fire scenario. Since hillslope runoff and erosion data was not available, we calibrated and validated the model for runoff and erosion using streamflow data from before (6 years) and after (6 months) the fire, in combination with ash contaminant content data. Subsequent model simulations provided estimates for post-fire risk of soil erosion, ash transport and pollutant concentrations across the burned area, as well as likely contaminant transfers of concern to water bodies. The simulations were also used to spatially locate the hillslopes that where the main sources of runoff, erosion and ash and contaminant transport, which can be used to prioritize areas for the application of mitigation treatments. These results can be used to support managers in assessing post-fire risks and in designing mitigation measures. With further increases in extreme fire weather predicted for Central and Northern Europe, our findings suggest that the WEPPcloud-WATAR-EU model is a useful tool to predict and mitigate soil erosion and water contamination impacts of burnt catchments.

ID465

PO127 - FIRE AS A TOOL FOR LAND USE CONVERSION IN THE ATLANTIC FOREST

Fernanda Moura Fonseca Lucas[1], Rita de Cássia Freire Carvalho[1], Mariana de Aquino Aragão[1], Leonardo Duarte Biazatti[1], Antônio Henrique Cordeiro Ramalho[2], Nilton Cesar Fiedler[1]

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Tropical forests have been drastically burned in several regions. Fires mainly threaten small forest remnants (< 100 ha) and environments with more widely spaced canopies. The fragmentation of tropical forests has made them more inflammable, and most of their vegetation is highly sensitive to the passage of fire. Under natural conditions, these forests have the potential to significantly retard fire behavior due to the microclimate, dense canopy, and high humidity of the combustible material. But in Brazil, there is a growing concern about losses of ecosystem services due to forest conversion to other forms of land use and occupation. We analyze in this research, land cover changes comprising burned Atlantic Forest formations between the years 2010 and 2021 in the state of Espírito Santo, Brazil. We used MapBiomas collection 7 and verified the changes using the GIS software TerrSet. The results show that most of the burned forests (172 hectares), were converted to mosaic uses. Other conversion classes include: 48 ha became pasture, 40 ha became rock outcrops, 26 ha became forestry, and 16 hectares that became savanna formations. Maintaining the remnants of this rich biome has been a challenge for conservationists in a region marked by permanent pressure for economic development. The occurrence of forest fires in this environment is one of the biggest challenges to the success of natural regeneration management and due to the low post-fire resilience, these events end up acting as drivers for the loss of habitats, species, and for its savannization.

ID470

PP117 - DO PRESCRIBED FIRES AFFECT THE DIVERSITY OF NONVOLANT SMALL VERTEBRATES IN OPEN SAVANNAS OF SOUTHEASTERN BRAZIL?

Marcio Martins[1], Luciana Furtado, Ana Paula Carmignotto, Giovana Felício, João Paulo Vieira-Alencar, Juan Díaz-Ricaurte, Filipe Serrano

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Managers of protected areas use prescribed fires in integrated fire management in Brazilian savannas. We explored the effects of prescribed fires on the diversity of small vertebrates in a Brazilian savanna. In a spatial experiment (SExp), we used two sampling sites from August 2016 to October 2019, each with an unburned area and a burned one (burned in August 2016 and August 2018). In a temporal experiment (TExp), we sampled three sites from August 2016 to March 2018, the area was then burned in August 2018, and then we sampled again from August 2018 to March 2020. In both experiments, each sampling site had two pairs of pitfall trap arrays and two sets of live traps in burned and unburned areas. To test for the effect of fire on the abundance and richness of animals, we used GLMs and GLMMs depending on the fit of data. In the SExp, we found no effect of fire on richness of frogs, lizards or mammals; regarding abundance, no effect of fire was found for frogs or mammals, and a positive effect was found for lizards. In the TExp, we found for both richness and abundance no effect for frogs, a positive effect for lizards and rodents, and a negative effect for marsupials. Our results indicate that different taxonomic groups might respond differently to fires and that, except for marsupials in TExp, prescribed fires used in fire management do not negatively affect the diversity of nonvolant small vertebrates in open savannas of southeastern Brazil.

ID475

PP121 - ROOT AND STEM BARK FEATURES OF BANARA ARGUTA BRIQ. (SALICACEAE) FROM BURNED AND UNBURNED AREAS IN THE PANTANAL, BRAZIL

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Banara arguta (Salicaceae) is a species with great ecological importance in the Pantanal, once it composes the riparian vegetation of rivers and produces fruits consumed by several animals. The big fires recently occurred have affected the floristic composition of the Pantanal, and little is known about the morphoanatomical characteristics of the bark and its role in the survival capacity of the trees in the Pantanal. Aiming to know how B. arguta responds to fires in the Pantanal, this study was carried out by analyzing the root and stem bark of three individuals collected in each affected and non-affected by fire in 2020 areas. Samples were processed and analyzed following routine light microscopy techniques. We observed numerous lenticels on the surface of the periderm of the stems. The secondary phloem, in both organs, is made up of sieve tube elements organized in tangential bands and has inclined reticulated sieve plates, and numerous sieve areas on the lateral walls, with two to three cells. The axial parenchyma contains phenolic compounds. The rays are formed by upright and square cells and contain starch grains. The sclerenchyma is in caps in the stem and continuous tangential bands on the roots. The results indicate that individuals unaffected by fire had relatively thicker secondary phloem areas in root and stem bark compared with the affected area. The results suggest that B. arguta is a non-fire-resistant species, indicating that measures must be taken to avoid fire events in its occurrence areas.

ID507

PP125 - DIRECT MORTALITY OF SMALL VERTEBRATES CAUSED BY PRESCRIBED FIRES IN GRASSLANDS OF CENTRAL BRAZIL

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The effects of fire on animals can be direct or indirect. Here, we explored the direct effects of prescribed fires on small vertebrates in the Serra Geral do Tocantins Ecological Station (SGTES), a large protected area in central Brazil where integrated fire management has been used since 2014. We followed seventeen prescribed fires from 2019 to 2022, during the usual fire management schedule at the SGTES. We searched for dead small vertebrates just after each prescribed fires to assess the mortality caused directly by fires. We used GLMs to test for the effect of time since the last fire (TSLF) on the direct mortality. We found 344 dead vertebrates just after fires: 241 lizards (six species), 101 snakes (11 species), one bird and one rodent. The animals found were whole, partially or completely burned. The number of dead reptiles significantly increased with increasing TSLF. Although direct mortality deserves attention, the prescribed burns in SGTES may not be an important threat to small vertebrates, especially those that occur in high abundance. So, we recommend that prescribed fires in areas with high TSLF should be of low severity (e. g., fires early in the dry season, late afternoon fires) to avoid increased mortality of small vertebrates.

ID512

PO128 - FIRE IN MARGINAL ECOSYSTEMS OF THE ATLANTIC FOREST WITH MARINE INFLUENCE

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The occurrence of fire has always been essential for the carbon cycle and terrestrial dynamics; however, the increasing aridity of combustible materials has doubled the amount of burned areas and provided the occurrence of increasingly severe events. These occurrences of wildfires outside of natural patterns catalyze rapid changes in plant communities, which can result in high losses of diversity. The marine-influenced plant formations called 'restingas' are considered fragile, due to soil composition, presence of salinity, and high rates of degradation. These open, ventilated, dry, and grassy areas are frequent scenarios for anthropic fires on the Brazilian coast. For this reason, we analyzed fire scars located in marginal ecosystems of the Atlantic Forest in the state of Espírito Santo, Brazil, between the years 2010 and 2020. In 2020, the highest densities of fire scars in the state were present in coastal formations and in forest-savannah ecotone areas. The burning of the phytophysiognomies present in the restinga has transformed them mainly into pasture areas, flooded fields, and mosaics of uses. Despite the fragility, the effects of fire in these environments are still misunderstood. There are few existing studies on the impacts that fires have on the plant and animal communities, and on the dynamics of the landscape. Greater efforts and incentives should be made to carry out new research to fill in the gaps that exist regarding the presence of fire in these environments.

ID518

PO126 - EVALUATION OF AREAS AFFECTED BY FOREST FIRES AND FIRES IN THE STATE OF MARANHÃO - BRAZIL BETWEEN 2001 AND 2021

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The objective of this work was to analyze the processes of temporal and spatial change in the dynamics of areas burned by the territory of the State of Maranhão during the years 2001 to 2021, using images of the MODIS Burned Area MCD64A1 sensor with a hybrid algorithm that applies dynamic limits to composite images generated from a burn-sensitive vegetation index (VI) derived from modis 5 and 7 shortwave infrared channels, and a measure of temporal texture. During the period, cumulatively, the sum of the burned area was 46,391,870.68 hectares, equivalent to 1.41 of the state territory, with emphasis on the southern and western mesoregion of the State, in the municipalities of Balsas, Alto Parnaíba and Mirador, including environmental protection areas, especially in the months of July to November. The scientific findings are important when considered as valuable information that expands the frontiers of knowledge, as well as to subsidize strategic government actions aimed at protecting areas of interest against the repeated incidence of fire.

ID488

PP13 - PHYSIOLOGICAL DEMANDS OF WILDFIRES SUPPRESSION ACCORDING TO WILDLAND FIREFIGHTERS' SEX

Jose A. Rodríguez-Marroyo[1], Fabio García-Heras[1], José Gerardo Villa-Vicente[1], Jorge Gutiérrez-Gutiérrez[1], Juan Rodríguez-Medina[1], **Belén Carballo-Leyenda**[1]

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Purpose

The aim of this study was analyze and compare the exercise demands of female and male wildland firefighters during real deployments. Methods: Eighty-one wildland firefighters (WFFs, 19 females and 62 males) took part in this study. Over three consecutive wildfires seasons, WFFs' exercise intensity and physiological load (PL) were analyzed based on HR during 42 wildfires. The HR response was categorized into 5 intensity zones according to different percentages of the maximal HR: 50-60, 60-70, 70-80, 80-90 and 90-100%. The PL was calculated from the integrated volume and intensity relative to the 5 HR intensity zones. Results: No significant ($p>0.05$) main effect of sex on any of the dependent variables analyzed was found. The time spent in the different HR-based exercise intensity zones were 57.7 ± 72.3, 55.5 ± 53.7, 53.5 ± 31.9, 31.5 ± 18.7 and 8.6 ± 7.1 min in 50-60, 60-70, 70-80, 80-90 and 90-100%, respectively. The mean PL was 423.1 ± 278.8 AU or 126.3 ± 46.9 AU·h-1. Conclusions: The present data support the idea that female and male WFFs perform the same physiological effort during wildfires suppression.

This work has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 883315.

ID495

PP12 - THE EVOLUTION OF GENDER EQUITY IN THE PREVFOGO/IBAMA INTEGRATED FIRE MANAGEMENT PROGRAM IN BRAZIL

Paula Lima[1], Elisa Silva[1]

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The inclusion of gender diversity in brigades for preventing and fighting forest fires is a way of promoting the empowerment of women in the integrated management of fire in the Brazilian context. Since 2021, the National Center for the Prevention and Combat of Forest Fires - Prevfogo sought to encourage the inclusion of women in the Federal Brigades Program, both by adjusting the physical tests that all brigade members to be hired by the Program undergo and by training brigades exclusively with female volunteers, as an incentive for women to participate in integrated fire management activities. In this sense, this study sought to analyze the participation of women in the composition of contracted and volunteer brigades from 2019 to 2022. For this, it adopted a quantitative methodology, with data collection through documentary and bibliographical research. From the information gathered, it was found that between 2016 and 2019, women represented, on average, 3.5% of brigade members hired by Prevfogo. In 2021, 36 women and 1,555 men were hired. In addition, in 2021, Prevfogo formed the 1st exclusively female indigenous brigade, with 27 members. Thus, in 2021, women accounted for 3.89% of brigade members formed by Prevfogo. In 2022, 55 women and 1,691 men were hired and four female volunteer brigades were formed, totaling 100 female volunteer brigade members, accounting for 8.39% of female members. The data indicate that there was an increase in the number of female brigade members over the years, corroborating the global movement for gender inclusion.

ID11

PO30 - DEFORESTATION AND FIRES IN THE BRAZILIAN AMAZON

UBIRAJARA OLIVEIRA[1], **WILLIAM COSTA**, Britaldo Soares-filho

[1]*UFMG*

Forest fires are on the rise in the Amazon. As a rainforest, fire is not part of its ecosystem. Fires mostly occur in the southeastern Amazon, a region known as the arc of deforestation. Most fires are thus applied to carry out deforestation. Yet it is necessary to demonstrate the causal relationship between these phenomena so as to design effective public policies to reduce forest fires in the Amazon. We performed a Granger causality test to verify the temporal relationship between deforestation and forest fire events in the Amazon and tested different temporal lags in order to identify the time interval that fires relate to deforestation. Granger's analysis was significant only at the one-year time lag, indicating a close temporal association between fire and consequent deforestation. Therefore, public policies that curb deforestation in the Amazon can also reduce fires, as there is a strong association between these phenomena.

ID55

PO16- FIRE SEVERITY INDICATOR FOR FIREFIGHTING DISPATCH: BEHAVIOR ANALYSIS OF DIFFERENT TYPES OF FIRE EVENTS IN THE BRAZILIAN AMAZON

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The behavior diversity of fires represents a big challenge for modeling active fire. Brazilian Amazon fires caused by anthropic activities are mainly linked to deforestation, pasture maintenance and farm-fallow agriculture. The knowledge of fires spatial and temporal distributions is crucial to understand their severity. Censipam is a Brazilian agency that has created a webgis application called "Fire Panel" to improve fire monitoring response. Its model clusters satellite active fire detections into fire events and provides a near real-time fire-level severity indicator, which is recalculated with each new detection generating a time series of the event severity level that can be visualized on a chart. This work studied the behavior of the severity indicator for six different types of fire events in the Brazilian Amazon since 2020: (i) deforestation, (ii) understory forest, (iii) small clearing/agricultural, (iv) grassland, (v) wildfires, and (vi) spurious. The first four were defined from the work of Global Fire Emissions Database. Wildfires are defined as uncontrolled fire of anthropic or natural origin. Spurious events stand for areas that typically generate heat sources that do not correspond to fires in rural areas. The analysis showed that each fire type generates a particular response in the severity curve: wildfires present multiple oscillations and elevated levels; agricultural fires are linear lines that usually last two or three detections with low severity; deforestation fires last longer and present medium to high levels. This work has demonstrated that the fire severity indicator can be a valuable tool to interpret forest fire type.

ID60

PP33 - MANAGING EMERGENCIES WITH A XR VIRTUAL SITUATION ROOM

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[1]The Singular Factory Group LLC

Spatial computing is the concept behind several technologies that will allow us to create virtual content (holograms), fix and mix and integrate them into our natural world.

We have been working on a Mixed Reality project which allows accessing GIS environments and 3D Revit digital resources, BIM in the cloud, combining and representing them in the form of holograms with conferences of up to 20 simultaneous users managing their relative situation in a virtual space.

We represent the real-time position of wildfires and the resources involved in the situation management (GPS position, planes, drones, hydrologic maps, weather forecast, etc.)

Any manager (from the camp base, situation room, on the field, etc.) can just put the XR glasses on and access a real-time virtual meeting where all the information need to make decisions there, along with other resources.

We built a virtual and remote command and control system, displaying the area of operations with multi-user and 3D holograms, where different layers of information can be added by integrating internal and external information resources.

ID67

PP35 - GLOBAL TO LOCAL: NASA'S FIRE INFORMATION FOR RESOURCE MANAGEMENT SYSTEM (FIRMS) SUPPORTING INTEGRATED FIRE MANAGEMENT

Diane Davies[1], Jenny Hewson[1], Veerachai Tanipat[3], Brad Quayle[2], Otmar Olsina[1], Asen Radov[1], Greg Ederer[1]

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The design and development of a robust global framework for wildfire management must be informed by the perspectives of a multitude of stakeholder groups that are informed by, and rely upon, a range of technological solutions and fire information systems. In this presentation, we share the development of NASA's Fire Information for Resource Management System (FIRMS) which has evolved to continually address the demands of a range of stakeholder groups with diverse global, regional, and local needs. Examples highlighted in this presentation capture global to local use cases and include: the global user groups ingesting FIRMS data for generating value-added products; the development of the FIRMS US/Canada version – spearheaded by the long-standing collaboration between NASA and the US Forest Service – designed to capture technological advancements and solutions, provide additional contextual information, and reflect stakeholder-driven data requirements; and the range of national to local-level activities informed by FIRMS in Thailand from national government ministries responsible for forest fire control operations, to provincial level governors and military units tasked with assessing the daily fire situation, to park rangers monitoring fires in individual national parks, as well as individual communities needing local-level fire situational information.

ID76

PO35 - LAND TENDER: A COLLABORATIVE, CLOUD-BASED DECISION SUPPORT PLATFORM FOR RESOURCE MANAGEMENT AND WILDFIRE MITIGATION

Hugh Safford[2], Scott Conway[1]

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Interactions between climate warming and human impacts to landscapes and ecological processes are leading to increasing scales and velocities of ecosystem degradation. The scale and complexity of the problem challenge rapid, concerted management responses. Key components of responding to complex, multijurisdictional management problems include (1) efficiently incorporating stakeholder input; (2) generating data and analytics that can be understood and manipulated by users; and (3) prioritizing potential investments and actions. Land TenderTM (LT) is a cloud based, visual scenario-building and decision support application built to resolve these and other resource management issues at local, statewide, or national scales. LT incorporates high-resolution data, disturbance simulations, and optimization routines to develop a comprehensive atlas of management scenarios for a given planning unit. A key step is the calculation of the "restorative return on investment", the sum of treatment-driven avoided costs and direct treatment benefits. Climate change effects are incorporated via changes to fire and drought occurrence and intensity, and by modifying ecosystem site potentials. The optimization function schedules treatments based on user-generated prioritizations of a set of "resilience" categories linked to strategic assets, resources and areas, including water, biodiversity, carbon, economic outputs, forest resilience, and fire safety. Stakeholder participation occurs throughout the workflow, and users can readily visualize scenario treatment tradeoffs, treatment prioritizations, and treatment sequencing. LT outputs include spatial and tabular comparisons of final management alternatives – including projected costs and relative benefits of each alternative across the resilience categories – that can be exported to environmental assessments that precede implementation.

ID89

PO28 - A NEW ATLAS OF MONTHLY BURNED AREA MAPPING FOR PORTUGAL (1984-2021)

Alana K. Neves[1], Manuel L Campagnolo[1], João M N Silva[1], José M. C. Pereira[1]

[1]*Forest Research Centre, School Of Agriculture, University Of Lisbon*

The Portuguese Fire Atlas was developed by the Pyrogeography Laboratory – CEF/ISA (1984-2010, 2014 and 2017) and ICNF (remaining years), and produced burned area annual maps from 1975 to the present. Our work has the objective of determining the closest date (day and month) of the burned areas and to assess the intra-annual fire variability in Portugal. A time series containing all available Landsat images with less than 40% cloud cover was created for each year (1984 to 2021) in Google Earth Engine. We used DOY, NBR and ΔNBR to select the first image observation immediately after the fire. The validation was performed using daily MODIS and VIIRS active fire products to compare their dates with the burned area date assigned by our algorithm. The sub-annual dating of the Portuguese Fire Atlas enabled the burned area analysis within each year entirely based on satellite data. Our results improve understanding of the intra-annual dynamics of burned areas in Portugal, where most of the fires are concentrated in the boreal summer season. Dating the fire patches also allowed the disaggregation of fire perimeters in the original Atlas into individual fire events. In turn, this permits to better describe the distribution of fire sizes in Portugal during the study period. Future steps of this in-progress work include the use of robust classification techniques to complete the temporal and spatial mapping of burned areas with fires that were not included in the original Fire Atlas due their season of occurrence to lack of imagery.

ID94

PP40 - AN OVERVIEW OF THE NASA ADVANCED CAPABILITIES FOR EMERGENCY RESPONSE OPERATIONS PROJECT

Marcus Johnson[1]

[1]NASA Ames Research Center

Improperly managed wildland fires can have a detrimental impact on communities through the creation of conditions that result in fires that are bigger, more severe, that move faster and are more destructive than before. To reduce the impact of wildland fires in the United States, the NASA Aeronautics Mission Directorate (ARMD) has initiated a new project, called Advanced Capabilities for Emergency Response Operations (ACERO). The ACERO Project is a multi-year research effort that aims to develop, demonstrate, and transition to operations, emerging aviation technologies (e.g. drones, automation, and digital traffic management), to identify, monitor, and suppress wildland fires. The integration of more modern aviation technologies into wildland fire and other emergency response operations will enhance safety for emergency responders, improve situation awareness and the overall effectiveness of the aerial and ground response. The ACERO project will focus on four main areas of research: leading the development of a multi-agency concept of operations for wildland fire management, improving communication and coordination for aerial firefighting operations through the integration of a digital traffic management ecosystem, extending the ability to conduct aerial operations during low visibility conditions using drones for remote sensing, communications, and suppression, and supporting the increased use of drones by incorporating aircraft safety automation systems. The NASA ACERO project is collaborating with other NASA science and technology development projects, US federal and state wildland firefighting agencies, and commercial industry to conduct field demonstrations through the preventative, active response, and post disaster recovery phases of wildland fire management operations.

ID97

PO17- FIRE EDUCATION PLATFORM: A COLLABORATIVE KNOWLEDGE TRANSFER TOOL ON WILDFIRES, DEVELOPED UNDER THE FIRE-RES PROJECT

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[1]i2ADS/FBAUP, [2]CEABN/InBIO

Extreme wildfires pose a global threat that demands considerable investment from the European Commission in researching and developing new models and approaches to cope with them. Aware of this complex matter, the project FIRE-RES (Innovative technologies and socio-ecological-economic solutions for fire resilient territories in Europe) aims to boost the socio-ecological transition towards a more fire-resilient Europe based on innovative actions. One of its main goals is to share knowledge, raise awareness, and engage society by creating an immersive online tool: the Fire Education Platform. This platform will be developed by CEABN/InBIO in collaboration with i2ADS/FBAUP and some international project partners. The platform's development methodology will comprise a deep understanding of the fire culture within Europe using a design thinking approach. Its creation will consider distinct perspectives by applying participatory design methods with the stakeholders involved (e.g., politicians, educators, students, and local communities) to 1. understand the problem, the users, and their scenarios of use, 2. collect the content to be shared through the platform, and 3. prototype and test the user experience design. This methodology's iterative and collaborative quality will help us reframe and tackle the problem from a hands-on systemic perspective based on local knowledge provided by citizens and scientists from 13 European countries. As a result, FIRE-RES will deliver a multimedia repository of data, including educational materials covering the different phases of the fire cycle. It will also explore topics like fire ecology, fire risk and its social dimensions (oral, artistic traditions, and fire use by local communities).

ID113

PO23 - ANALYSIS OF WILDFIRE MODEL FOR SYSTEM OF SYSTEMS RESEARCH

Jorge Lovaco[1]

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Objectives

In the field of System-of-Systems (SoS), the study of interactions between complex systems from a holistic point of view is important to find emergent behaviours and enable synergies. To detect as many as emergent behaviours as possible - especially when field testing is not possible – multi-domain simulations play an important part. A new wildfire simulation framework using an Agent-Based Model (ABM) is presented here. This ABM is being used for comparison of different fire-detection tactics with different types of airborne vehicles (UAVs) to assess the performance of different firefighting setups. An important prerequisite is a qualitatively correct wildfire model. To verify the implemented model, an analysis is performed and compared to data of a real wildfire case.

Methods

The fire model has been implemented following the double-ellipse fire spread rate model adding terrain slope corrections. Additionally, the spread rate is also influenced by environmental variables such as relative humidity. In the ABM, each tree is treated as an independent agent that emits smoke when on fire.

Results

The relative humidity of the model has a big impact on the evolution of the fire. When assumed constant and taken as the average between the initial and final time instants, the area is underpredicted.

Conclusion

The relative humidity seems to impact on the fire spread more than the other variables. Therefore, its proper initial value and evolution in time should be considered to enhance the model for SoS studies (comparison of fire detection tactics and aircraft conceptual design).

ID119

PO11 - NOVEL REMOTELY PILOTED AERIAL SYSTEM BASED HYPERSPECTRAL IMAGING FOR WILDFIRES CHARACTERIZATION

Juan Pablo Arroyo-Mora[1], Margaret Kalacska[2], João Caetano[3], Gonçalo Cruz[3], Luis Felix[3], **George Leblanc**[1], Oliver Lucanus[2], Gabriela Ifimov[1]

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Given the increase of wildfires in different ecosystems worldwide with very diverse characteristics (e.g. vegetation type, fuel load, proximity to urban areas), international cooperation is key to test novel technologies that allow the characterization, monitoring and mitigation of active fires. To date, remotely piloted aerial systems (RPAS, aka drones) provide a significant emerging technology with the potential to address at local scales, the detection, mapping, characterization and suppression of wildfires. With the support of the NATO Science & Technology Organization's (STO) Collaboration Support Office (CSO), and the National Research Council of Canada's Integrated Aerial Mobility (IAM) program, three controlled active wildfire experiments were carried out in Portugal and Canada, in order to test the utility of a pushbroom hyperspectral system for detecting potassium (K) and other spectral emissions (i.e. sodium) of biogenic fires. For instance, K-emission signatures for hyperspectral imagers of flaming activity can be related to fire temperature and fire radiative power (FRP). The three experiments consisted of two wood and other vegetation debris loads in Canada, and the burning of a patch of natural vegetation in Gestosa, Portugal organized by the University of Coimbra (ADAI). To measure the spectral emissions in the three experiments, we implemented NRC's hyperspectral imager (400-900nm), on a Matrice 600 Pro hexacopter. Our results indicate that for the three experimental fires, we were able to detect the K and Na emission signatures at different locations of the active fire including smoke, active fire under smoke plume, smoldering and active flame front with different intensities.

ID138

PO10 - PYO3F: A PYTHON FRAMEWORK FOR FIRE-RELATED OPTIMIZATION

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We describe a framework implemented in python for addressing fire-related optimization problems. The objective is to provide a tool for supporting decision making in fire suppression, fire-aware forest management, and location and network design of fire related structures.

The framework relies on optimization models and methods to support i) the dispatching and positioning of fire fighting resources, ii) the selection of prescriptions taking into account different criteria (e.g. net present value, biodiversity, carbon stock, erosion) and also the fire risk and iii) the effective design of a network of resources ans structures (e.g. surveillance equipment and roads) to allow the quick detection and movement of resources.

We provide an overview of the integer programming models and approximate methods, deterministic and stochastic, that are used in the optimization approaches.

We discuss the class structure of the framework, its inputs (e.g. topography, fuels, resource types, prescriptions) and its outputs (e.g. where to locate the fire fighting resources, which prescription for each stand).

Results from a proof of concept implementation will be presented.

This work is supported by FCT - Fundação para a Ciência e Tecnologia within project PCIF/GRF/0141/2019 "O3F - An Optimization Framework to reduce Forest Fire".

ID140

PP32 - A SEGMENTATION APPROACH FOR AUTOMATIC MONITORING OF BURNED AREA USING SENTINEL-2 IMAGERY

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Accurate information on burned areas (BA) is essential for forest management and land use planning. However, the high variability of fire frequency and BA extension makes it difficult to have a consistent record over time and space. In this context, we develop an automatic procedure to accurately map BA using satellite imagery and an object-based image classification approach. Sentinel-2 imagery from 2017 at 20m resolution was downloaded from Google Earth Engine (GEE) for mainland Portugal, including “pre-fire” and “post-fire” images. These data were used to calculate the Normalized Burn Ratio (NBR), an index specifically designed to discriminate BA. The segmentation step was processed through the Large-Scale Mean-Shift (LSMS) algorithm. To select the training data (segments) for the BA classification, we used information on active fires obtained from the Visible Infrared Imaging Radiometer Suite (VIIRS) product. The classification was performed with the MaxEnt classifier, a presence-only algorithm, and a mask was applied to exclude artificial and agricultural areas. Our results produced 20m resolution BA maps with an accuracy of 92.5% and F1-score of 87.5%. We identified 135,130 ha of area burned between June and August and 243,982 ha burned between September and October. The proposed methodology is computationally efficient due to its segmentation-before-classification approach and avoids the manual selection of positive training segments, allowing high temporal and spatial coverage with low effort. This approach can be easily extended to other periods and geographical regions.

ID176

PP29 - THE USE OF RPAS TECHNOLOGIES AS AN INTELLIGENCE AND HUMAN RESOURCE TOOL DURING ACTIVE WILDFIRES.

George Leblanc[1], Gabriela Ifimov[1], Margaret Kalacska[2], Juan Pablo Arroyo-Mora[1], Oliver Lucanus[2]

[1]National Research Council Canada, [2]Applied Remote Sensing Laboratory, McGill University

The use of piloted aircrew for non-firefighting related activities has an impact on the duration that wildfires can be actively fought, due to pilot duty day limitations. In this study, we address the objective of greater utilization of flight crew time, by using Remotely Piloted Aircraft Systems (RPAS) for fire intelligence gathering activities. In this work we have utilized several common RPAS platforms that have visible and long-wave thermal infrared imaging systems, to determine if current commercial-off-the-shelf (COTS) systems are able to supply useful intelligence to the fire management officer. A small controlled fire (~ 30m x 15m x 3m of piled forest slash material) in Dryden Ontario, Canada, was used as a target. A small (under 25kg) RPAS was flown at 120 m altitude to various distances from the fire until it could no longer be seen in the RPAS imagery. The results of this work show that even imaging immediately after sunset, and into the sunset direction, at a distance of 6 km (maximum available operational range for this experiment) the fire was still located by the imaging system. At 6 km the spatial size of one pixel was ~8 m so the fire was occupying less than 4 pixels and due to the slant range, closer to 2 pixels. Our approach to the use of RPAS into the airspace operations is to have RPAS activities occur around and between sunset and sunrise to de-conflict with piloted activities and provide greater time for piloted fire suppression activities.

ID177

PP34 - CO-CREATION OF KNOWLEDGE AND TOOLS TO SUPPORT BETTER DECISION-MAKING IN FIRE SUPPRESSION IN PORTUGAL

Akli Benali[1], Fábio Silva[2], Ana C.L. Sá[1]

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Decades of landscape and climate changes in Portugal have resulted in frequent large wildfires, that culminated in the dramatic year 2017, with more that 120 fatalities and over half a million hectares burned. This shocking year boosted awareness regarding the occurrence of extreme wildfires, contributing to an evolution of civil society, public entities and researchers, to better coexist and mitigate the impact of large wildfires. If well integrated in operational contexts, scientific knowledge and tools can improve fire management decisions.

This presentation will focus on how Science is currently contributing to improve decision-making in fire suppression under the framework of the FIRE-MODSATII project. In particular we present:

i) A novel wildfire-behavior atlas for Portugal that combines data from multiple sources and describes fire progression and behavior. The work results from a joint effort between researchers and fire operatives, and will be updated in the following fire seasons. We used environmental data to model fire behavior and develop exposure products for the following days.

ii) Stochastic fire behavior predictions that integrate uncertainties in input data and parameters. Their integration in operational fire suppression strategies and tactics in active wildfires is presented, along with their evaluation using examples from real case studies.

We further discuss the major limitations in the integration of science-based products in decision-making and the necessary improvements in the future to enable improved management of large wildfires.

ID180

PO14 - DEFINITION OF A HOLISTIC REGULATORY FRAMEWORK FOR ENHANCING SAFETY AND RESILIENCE OF THE BUILT ENVIRONMENT IN THE WILDLAND-URBAN INTERFACE

Hélder D. Craveiro[1], Luana Tesch[1], Aldina Santiago[1], Luís Laím[1]

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Worldwide, observed demographic dynamics have led to additional pressure from urban zones on forest areas in the last few decades. Consequently, buildings and groups of buildings have arisen in the Wildland-Urban Interface (WUI) areas with high susceptibility to forest fires. As a result, there was a significant increase in the number of WUI fires, with substantial negative impacts (direct and indirect) on urban areas. The objective of this research, undertaken in the scope of the research project WUIFireSafe, was to develop and propose a new holistic framework adopting a performance-based approach for enhancing the safety and resilience of WUI areas and communities against fire.

The WUI fires are inherently a multi/interdisciplinary problem that requires a holistic approach from a technological point of view to the management of the built environment and forest, evacuation, socioeconomic impacts, health, climate change and sustainability, education, and public policies, promoting the adoption of meaningful regulations amongst all civil protection bodies and civil society. The most relevant research included risk assessment, mapping and characterization of WUI critical areas in the central region of Portugal, real-scale fire tests in a simulated WUI environment, numerical modelling to understand wildfire impacts in the built environment, fire safety engineering and ignition potential of the built environment, and economic impacts. The main results supporting the proposed framework will be presented. Technological developments enable the adoption of a performance-based approach to develop and implement innovative tailored policies to mitigate risks and protect assets.

ID183

PP41 - A WEB-BASED OPERATIONAL WILDFIRE MONITORING AND DECISION-SUPPORT TOOL - FEB MONITORIZAÇÃO (FM)

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[1]*ANEPC*

Before 2018 the flow of operational information was supported, mostly, by verbal communications and their transcription to the National Authority for Emergency and Civil Protection (ANEPC) operations management platform (SADO). This methodology resulted in a high potential for bias in the operational analysis and, inherently, implied an inefficient management of resources. The evaluation of the system at that time revealed the need for a new platform that complied with the needs expressed by the operatives and allowed a rapid integration of data and information by all the entities involved in the relief operations. The decision support unit for the analysis of rural fires (NAD-AIR), operated by technicians and fire analysts of the Special Civil Protection Force (FEPC) developed a tool designated by FEB Monitorização (FM). It can be described as a geospatial intelligence solution, based on ArcGis technology that integrates a WebGIS portal, dashboards and mobile apps, combining real time data with previously prepared and/or analysed static information from different sources, including remote sensing data, the location of operational assets and relevant products to support decision-making. It guarantees the mapping and analysis of the operations, the creation of products for the operational chain of command and the sustained information from all stakeholders (common picture). This presentation aims to provide insight about the conception of FM, capabilities, available data and processes of data acquisition, integration, analysis and sharing. Additionally, it will demonstrate the usage of FM in the Castro Marim (2021) wildfire and how it supported fire suppression strategies.

ID185

PP30 - SEMI-AUTONOMOUS ROBOTIC PLATFORMS FOR FOREST FUEL MANAGEMENT AND FIRE FIGHTING

Carlos Viegas[1], Sérgio Cruz[2], Maria Araújo[3], João Ruas[2], Francisco Cruz[2], Tiago Gameiro[2], Tiago Pereira[2], Daniela Ferreira[3], Mihail Babcinschi[2], Jacinto Reis[3]

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Each year, wildfires cause an increasing number of victims and damage to property and environment, exacerbated by the effects of climate change. Current risk mitigation actions are highly labour intensive and struggle to deal with this ever rising threat, due to the lack of human and technological resources. Semi-autonomous robotic means are needed to provide support to fire management efforts, including preventive actions through forest fuel management, and fire suppression.

This work describes the development and implementation of novel robotic platforms engineered to navigate autonomously in forestry environments. These platforms include multiple redundant sensors for safe navigation, operation, perception, control and communication. Ad-hoc sensor architectures and algorithms had to be developed to ensure reliable functioning under highly challenging scenarios, such as a wildfire, as existing localization and perception systems fail in the presence of dense mist, smoke, debris, different lighting, lack of distinctive visual references, rough terrain, steep slopes, extreme heat and radiation.

Two use case scenarios of autonomous forest fuel removal and navigation in dense smoke environment are demonstrated using a full-scale robotic platform prototype. Experiments reveal the time and cost effectiveness of the employment of such technology over traditional means. The design of a fully electric robotic platform for forestry services is also discussed.

The findings of this work may constitute the basis for the development of novel robotic systems to support operations in challenging and unstructured environments, beyond the scope of wildfires, potentially mitigating risks and threats to human workers and saving lives.

ID215

PO27 - USE OF HIGH-ALTITUDE BALLOONS FOR WILDFIRE MANAGEMENT – A DEDICATED “SATELLITE” FOR EACH MAJOR FIRE EVENT

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The increasing complexity of wildfires requires the use of cutting-edge technology. Unmanned aerial means are one of these technologies, which has proved to be very useful in wildfires management. However, it still has some limitations, such as the interference with the airspace typically occupied by aerial firefighting vehicles, the low autonomy of operation or the area covered.

To overcome these limitations, the Eye in the Sky project proposes a system based on a high-altitude balloon (HAB) carrying a glider-like unmanned aerial vehicle with payload suitable for the operation, namely perception (e.g., visible and infrared cameras) and communication (for data transmission and signal repeater) payloads. The HAB can rise up to 35 kilometers, quickly abandoning the firefighting airspace, following a previously estimated wind-based trajectory so that it can survey the area of interest. At any moment defined by the operator, the glider is released with the payload, descending with a controlled trajectory defined by the operator over key points, while sending the acquired geotagged imagery in real-time to the operational decision center. The operation time can exceed 10 hours.

The system components have been successfully tested in field experiments and in real wildfire events, demonstrating the great potential of this on demand customizable “satellite” for fire detection, fire front and burnt area monitoring, as well as to support communications when carrying a signal repeater.

The Eye in the Sky project is funded by the Portuguese Foundation for Science and Technology (PCIF/SSI/0103/2018).

ID218

PP39 - ARBARIA: ARTIFICIAL INTELLIGENCE FOR WILDLAND FIRE PREDICTION AND ASSESSMENT.

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The project ARBARIA is an initiative of the Spanish Central Administration for the prediction and assessment of wildland fires using Artificial Intelligence techniques, such as Machine Learning and Deep Learning. It exploits three main sources of information: historical records of wildland fires since 1968 provided by the National Wildland Fire Statistics, socio-economic data and meteorological variables. For prevention and planning purposes, the tool calculates the pattern of occurrence of fires at the municipal level, based on the influence of socio-economic parameters. For suppression purposes, ARBARIA allows to forecast and assess the number of wildland fires and burnt area at the provincial and national scale. This is done on a weekly basis during the maximum risk season. The results are useful for programming the deployment of terrestrial and aerial resources. Another functionality that is under development is the prediction of the daily number of interventions of the State aerial resources. In essence, ARBARIA has a strong explanatory capacity and a great potential to support wildland fire prevention and suppression planning.

ID219

PO25 - INSTALLATION OF AUTONOMOUS FIRE MONITORING SYSTEMS ON POWER TRANSMISSION OVERHEAD LINES

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2022 has been a challenging year so far. Summer has been particularly devastating to our forests and their ecosystems. Record temperatures and droughts have caused large-scale wildfires to sweep across the Northern Hemisphere.

Fire prevention is the first pillar to protect our forests against wildfires and to reduce their occurrence: “the best operation is the one you don't do". The second pilar is the early detection. Traditionally, this subject is approached using human-operated elevated outposts built on prominent terrain with high visibility.

In this work, we present an innovative approach of using power transmission overhead lines, as the base for the placement of the automatic detection systems. But there are significant technological challenges to be solved, as electromagnetic interference, electrical atmospheric discharges and even the technical skills necessary to install the systems near 400kV overhead lines.

To assert its feasibility, REN and Bee2firedetecion, SA installed a cluster of autonomous fire detection systems, using Bee2fire detection system, based on optical technologies along a 400kV overhead line in the North of Portugal. All images, alerts and telemetry data captured by these systems are transmitted to a specialist-operated situation room via an optical fiber connection.

Preliminary results indicate that the use of overhead lines as a physical base for this kind of system is not only viable, but advantageous in several ways, resulting in a sustainable approach since it opens a new use for the existing grid, applicable worldwide.

ID235

PO34 - A STRATEGIC APPROACH TO SOURCING AND USING FIRE INFORMATION INSAVANNA FIRE MANAGEMENT

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Fire management in African savannas is a complex interdisciplinary task. Fire regimes can affect carbon storage, greenhouse gas and particle fluxes, biodiversity and habitats. We developed a fire information system for the World Heritage Site Comoé National Park in Côte d'Ivoire. Key parameters describing the fire regime were compiled: burned area, fire emissions and fire behaviour. Burned areas were mapped using change detection methods. Fire emissions were estimated through fire radiative power (FRP). Meteosat data are used to provide a near real time estimate of emissions. A daily forecast model provides information on potential fire behaviour. A planning map for management fires is based on an analysis of vulnerability and includes areas ear marked for early burning to reduce fuel loads as well as for high intensity burning to open grasslands. An ongoing series of fire experiments indicates that emission estimates are realistic but may be low. Fire intensity obtained from experiments shows that models provide realistic results but may overestimate due to overestimation of rate of spread. All data are made available through an online web platform for browsing and download. The platform evolved from a monitoring and information platform to a decision support and management information system that is used to plan, implement, and assess fire management strategy. Detailed data accumulated over several years thus helps shape the fire management strategy for the park. This strategy aims at balancing conservation objectives with achieving an overall reduction of greenhouse gas emissions and smoke pollution and maintain or increase carbon stocks.

ID245

PO159 - DEVELOPMENT OF A HUMAN BEHAVIOUR WILDFIRE IGNITION RISK INDEX

Pedro Almeida[1], **Isilda Cunha Menezes**[1], Luiz Rodrigues[2], Saulo Freitas[2], Mateus Ferreira e Freitas[3], Rodrigo Braz[2], Valter Ferreira de Oliveira[4], Karla Longo[2], Diogo Lopes[1], Joana Ferreira[1], Myriam Lopes[1], Ana Isabel Miranda[1]

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Wildfire ignitions have been mainly attributed to environmental factors, but there is ample evidence that human settlement and agricultural activity play a role in ignitions characteristics, as well as in the size of a forest fire. With the goal of developing an index that incorporates human behaviour in forest fire ignition risk estimation, the main human drivers that should be taken into account, as well as the most appropriate statistical method to relate and weight the different variables, were identified and characterised for mainland Portugal, a territory severely affected by forest fires over the last decades, most of them caused by human action. Checks for multicollinearity, multivariate correlations, and geospatial analyses, to relate the different spatial and temporal information, such as population density, roads, the number of ignition occurrences, soil and land use, and proximity to forestry space, were applied. Based on the statistical analysis results, a human behaviour fire risk index was developed, allowing predictions of locations where the risk of forest fire ignition is higher. This prediction index will be incorporated into the BRAMS model, an atmospheric model coupled to a spread fire model that runs in real time at the meso- and local-scales, developed within the scope of the FIRESMOKE project.

ID260

PO15 - NEW IMPROVEMENTS ON THE BRAMS WILDFIRE-ATMOSPHERE MODELLING SYSTEM

Isilda Cunha Menezes[1], Luiz Rodrigues[2], Saulo Freitas[2], Mateus Ferreira e Freitas[3], Rodrigo Braz[2], Valter Ferreira de Oliveira[4], Pedro Almeida[1], Karla Longo[2], Diogo Lopes[1], Joana Ferreira[1], Myriam Lopes[1], Ana Isabel Miranda[1]

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Wildfire smoke production and dispersion are fundamentally driven by wildfire behaviour and plume dynamics generated by feedback between the fire and the surrounding atmosphere. This can be reliably predicted by modelling fire-atmosphere interactions. The improvement of wildland fire and smoke models is essential for the assessment and improvement of the accuracy of air quality forecasting and for the prevention of public health consequences.

This work aims to present the improvements in the meso-local scale atmospheric modelling system, BRAMS, coupled to the surface fire spread model, SFIRE, namely the introduction of a crown fire behaviour. The modelling system was also improved by linking the fire smoke released during a fire event with the BRAMS chemical mechanisms. These developments were made under the scope of the FIRESMOKE project and are oriented towards the design and creation of a FIRESMOKE forecasting system, which incorporates anthropogenic and biogenic sources of air pollution, to provide a public access service in the scope of air quality over continental Portugal.

ID266

PO26 - THE "SENSOR MAN" IN FOREST FIREFIGHTING OPERATIONS.

Luiz Motta[1], Lawrence Nóbrega de Oliveira[1], Talita Freitas[1]

[1]Ibama

Developments in the area of information technology have evolved in recent decades, and taking advantage of this requires a new definition of the roles of the members of a forest fire fighting squad. The ability to improve the execution of combat tasks is directly related to providing spatio-temporal information for all actors involved, whether in the field or at headquarters.

The sensor man is a new profile in the forest fire fighting team, where his function is to exchange data for the fighting actions, either at the headquarters or in the field activities. The sensor man is the link between the Geoinformation sector and the field operators, where the field information is inserted in a Geoinformation platform, being available in a dashboard for decision making by stackeholder, or updating the field maps, used in mobile applications in the field. The role of the sensor man is to enable the use of big geodata in an "easy peasy" way, by the team of a combat squad.

For technological tools, such as satellite internet, computing infrastructure and licenses for a programs are solved by having financial resources. The biggest challenge is to measure the necessary information and still make it practical for the actors responsible for taking action to combat.

Changes in fire behavior occur rapidly, the information such as maps and satellite images have a "shelf life", and getting this information up to date depends on the ability to process and deliver it. The role of the sensor man becomes fundamental.

ID286

PP38 - ASSESSMENT AND ENHANCEMENT OF OPERATIONAL WILDFIRE MODELING

Adrian Cardil[1], Joaquín Ramirez[1], Santiago Monedero[1], Philip SeLegue[2], Sergio de-Miguel[3], Geoff Marshall[2], Tim Chavez[2], Scott Purdy[1], Raul Quilez[1], Carlos Alberto Silva[4]

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Objectives

We assessed the performance of fire models (either surface or crown) currently used in operational environments in California through the analysis of the rate of spread (ROS) of 2,500 wildfires. We developed new models, which are presented in this work, to enhance prediction accuracy of ROS.

Methods

For each wildfire, we retrieved the observed fire progression every 15 minutes from the FireGuard (FG) database and ran an automatic simulation with Wildfire Analyst software. Then, we assessed the accuracy of the fire simulations by comparing the observed and predicted ROS according to well-known error and bias metrics. We also analyzed the main factors influencing the accuracy of fire simulations, including fuel moisture, wind speed, and fuel types. This data was also used to build a new crown fire spread model and custom timber fuel types.

Results

The automated simulations' errors and biases were improved significantly when model enhancements, proposed herein, were implemented. Also, we identified how some environmental variables may bias ROS predictions, especially in timber areas where the original fire spread models clearly underestimated ROS.

Conclusions

The fire spread model's performance for California is in line with previous studies developed in other regions and the models are accurate enough to be used in real-time operations. This work allows users and the scientific community to better understand the performance of fire spread models in operational environments.

ID318

PO22 - ALARMES: NEAR REAL-TIME BURNED AREA INFORMATION SYSTEM TO SUPPORT FIRE SUPPRESSION AND MANAGEMENT ACTIVITIES IN BRAZIL

Renata Libonati[1], Miguel Pinto, Julia Rodrigues, Caio Sena, Filippe Lemos Maia Santos, Leonardo Peres, Liz Belém, Allan Pereira, Carlos C. da Câmara

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Near real-time burnt area products have important applications for emergency services and rapid assessments for decision-making. This work presents the ALARMES system, developed to provide near-real-time information on burned areas in order to support environmental agencies in fire prevention and firefighting actions. ALARMES combines VIIRS imageries and active fire information together with artificial intelligence to identify burned areas on a daily basis through near-real-time monitoring. All information is disseminated free of charge at https://alarmes.lasa.ufrj.br/. Maps and Statistics are provided at the biome level (Cerrado, Amazonia and Pantanal) and also for states, municipalities, indigenous territories, protected areas and some other regions of interest. The system provides information on the current fire season through the provision of near-real-time statistics of burnt areas, as compared to the average of the last 10 years (2012-2022). Daily, monthly and annual statistics of the current year can be compared to a single year or to the historical period (2012-2022). The FOGOTECA is a database inside the ALARMES portal that exhibits geo-located in-situ photos of fire events as registered by any user in the context of citizen and science initiatives. These photos are used to validate the information provided by the near-real-time burned area monitoring. ALARMES is currently being used by Brazilian environmental agencies and firefighters for supporting emergency and management activities and for assessing post-fire impacts.

ID326

PO32 - TERRAIN DIFFICULTY INDEX (TDI): EVALUATING THE OPPORTUNITIES IN THE LANDSCAPE TO SUPPORT INITIAL ATTACK ASSESSMENT.

Raul Quilez[1], Carmen Robles[1], Francisco Díez[1], Adrian Cardil[1], Joaquín Ramirez[1]

[1]*Tecnosylva*

Objectives

The density of infrastructures is essential to facilitate a rapid deployment of means. In turn, the fuel patterns present in the area or the topography condition the type of attack and can limit the use of the different extinguishing means. The objective of this work is to develop an index that allows quantifying the conditioning factors for the initial attack.

Methods

For the formulation of this index, cartographic information on roads, fuels and the California digital terrain model have been used at 30 m resolution. Evolving from SDIt index from Silva FR et al (2020), three other sub-indexes have been refined that integrate the Accessibility Index, Penetrability Index and Fireline Opening Index. In turn, each of these subindex have been weighted independently, scaling them according to the limitations they present from a firefighting point of view.

Simulations of 14,229 fires collected in IRWIN in California during 2021 have been evaluated to obtain the values of the different fire behavior metrics.

Results

The index has been evaluated during 2020 to 2022 fire seasons in California. The results obtained were compared with the official area covered by the fire and significant correlations were found in the mean TDI value in fires with an extension of more than 400 ha.

Conclusions

TDI is a good indicator to quantify the difficulty of initial extinguishing, while facilitating decision making regarding the most appropriate types of extinguishing media to carry out the initial attack depending on the fire detection zone.

ID339

PO36 - DEVELOPMENT OF AN EMISSION-BASED WILDFIRE EARLY WARNING SYSTEM

Haris Sefo[1]

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Wildfires are becoming a greater threat worldwide as a result of climate change. The rise in temperatures and droughts are leading to a steady increase in their intensity. Year after year, the areas affected are becoming larger and spreading to regions that were not previously involved.

Extinguishing large-scale wildfires is a dangerous and long-lasting feat. When fires approach populated areas, human lives are put at risk. On the economic level, the destruction of settlements, private property, and public infrastructure costs billions. Such calculations do not include ecological costs. Endangered species in the affected regions are threatened. With regard to climate change, wildfires are a double burden. On the one hand by the released CO2 and on the other hand by the reduction of the capacities to bind CO2 from the atmosphere.

Considering the current dynamics of global greenhouse gas emissions, a further intensification of wildfire events seems likely.

Accordingly, wildfire prevention must also address climate adaptation strategies.

Innovative early warning systems are needed to detect and localize wildfires in their early stages in remote areas and to prevent them from spreading.

In the present study, a sensor-based early warning system for the detection and localization of wildfires is developed. It is based on an intelligent, AI recognition algorithm that can distinguish wildfire emissions from other sources such as traffic. As part of a project with DHS, the system has been tested in laboratory and field tests since 2019. Currently, the first large-scale deployments in California and Germany are being prepared.

ID340

PP37 - CLIMATE CHANGE MITIGATION IN AFRICA: MAIN GREENHOUSE GAZ EMITTED ACCORDING TO FIRE SEASONS IN GUINEAN SAVANNA (WEST AFRICA)

Aya Brigitte N'Dri[1], Aka Jean-Noel Kpré[1], Coulibaly Losseny[1]

[1]*Laboratory of Ecology and Sustainable Development / Laboratory of Botany and Valorisation of Plant diversity, Faculty of Natural Sciences*

Biomass burning from savanna induces substantial amounts of greenhouse gases (GHG) into atmosphere each year. However, these emissions are rarely taken into account in the management strategies of protected areas in savannas, particularly in West Africa. This study aimed to quantify in a 9-year experimental field study (2013-2022), the main GHGs emitted during annual fires set in three different periods of the long dry season: early-dry season (EDS), mid-dry season (MDS) and late-dry season (LDS), in a Guinean savanna of West Africa (Lamto reserve, the Central Côte d'Ivoire). The main GHGs emitted were quantified according to the International Panel on Climate Change formula. The parameters likely to influence these emissions (fuel, climate and fire characteristics) were also measured to explain any variations in GHG emissions. The results showed that the main GHGs (CO2, CO, CH4, N2O, and NOx) were emitted in greater quantities during the EDS, while the less important emissions were generally recorded during the LDS. Fire maximal temperature, fuel load, and grass height explain the emission of all the GHGs. The amount of different GHGs emitted increased with the fire maximal temperature and fuel load and decreases with grass height. Thus, the early dry season fire already extensively practiced across Africa, yield significant emissions in Guinean savanna extending over 670,000 km2. Our study suggest that a planned regime of mid- and late-dry season fires could be used to reduce GHG emissions in Guinean savannas.

ID349

PO29 - WILDFIRE DETECTION AND MONITORING

Niko Peha[1]

[1]*Overwatch Imaging Inc*

Objective

This presentation will offer a review of agency case studies, and a technology summary. The author will demonstrate how international public safety organizations have deployed aerial remote sensing systems for public benefit. Agency users include United States Forest Service, CALFIRE, and Rural Fire Service or New South Wales.

Uses cases and data will be presented from the 2021 and 2022 seasons and include: Flood Extent Mapping, Fire Detection and Perimeter Creation for Initial Attack, Large Fire Monitoring and Post-Fire Damage Inspections.

Methods

Satellite and ground based camera networks have limitations which fail to provide sufficient detail and timeliness for evolving incidents. Existing systems do not provide academics with novel data to advance our collective understanding of the wildfire problem. Video style reconaissance equipment require highly trained and alert observers who are tasked with locating small features in vast landscapes. This manual method of airborne searching can be inefficient, labor-intensive, costly and time consuming.

Results

Overwatch Imaging has developed a flexible aerial system which includes a custom imaging modeules and cutting-edge software for computer vision, GPU processing and Artificial Intelligence. Uses cases will show examples of automated landscape analysis during time-critical challenging environments, and the author will provide concrete examples and benefits to our overall communities.

Conclusions

Remote sensing offers a unique perspective of the wildfire problem, but it is only one view. Technology can play a role in improving prevention, supression and relief, and post fire intervention. To be effective a system must be linked with many adjacent processes.

ID372

PO19- SLING DRAGON:- "THE MOST SAFE AND EFFECTIVE TOOL FOR AERIAL CONTROLLED BURNING"

Sergio Fukamati[1]

[1]*Sei Industries Ltd*

Context

Automated controlled burning provides an effective tool in forest and wildland management. Helicopter deployed aerial ignition devices have a lengthy, proven track record of initiating these burns in an efficient, and controlled manner. The available technology consist of automated machines installed inside a helicopter, operated by a crew member on the back seat controlling the dropping of incendiary spheres through the side door.

Objective

Increasing the safety and performance of such technology by removing the machine/ operation from inside the aircraft prompt us to develop a slung version named "Sling Dragon".

Operation

"Dragon Eggs" are ignition spheres consisting of a polystyrene plastic shell containing potassium permanganate. When injected with ethylene glycol, an exothermic reaction is initiated. After a delay of 20-30 seconds, the sphere ignites providing an effective flame to initiate a fire.

The "Sling Dragon" is a fully automated dispenser of dragon eggs, which is slung from the helicopter cargo hook by a set of steel suspension cables. It injects the "dragon eggs" with glycol and releases them through a rotating mechanism when triggered by the pilot. It is impossible to start a reaction in a sphere and not have it leave the machine, as even in a power outage the motor will continue to rotate and release the ignited sphere. With a capacity of 5,000 spheres, it has a GPS tracker that records the drops coordinates and allows users to view a map of their burn area on Google Earth.

ID391

PO13- SAFEFOREST: A SEMI-AUTONOMOUS ROBOTIC SYSTEM FOR FOREST CLEANING AND FIRE PREVENTION

Micael Couceiro[1], Paulo Peixoto[2], Carlos Viegas[3], George Kantor[4]

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Objectives

The main objective of the SAFEFOREST project is to develop innovative robotic technologies for fire risk reduction through landscaping management tasks. For this purpose, the project contemplates two specific objectives:

1. To develop an advanced mapping and characterization system, called Forest Management Information System (FMIS), for the terrain and its detailed vegetation cover.
2. To develop semi-autonomous robots to map and clean vegetation in different types of terrain, in order to create opportunities of controlling fire propagation and to prevent the possibility of larger forest fire events.

Methods

The team, with researchers from Ingeniarius, the Institute of Systems and Robotics from University of Coimbra, the Association for the Development of Industrial Aerodynamics, Silvapor and Carnegie Mellon University, has been designing a robotic system capable of executing a land clearing mission. The mission starts with a preliminary mapping of the area, carried out with the support of an advanced unmanned aerial vehicle (UAV). This is followed by the removal of the redundant vegetation by deploying an autonomous heavy-duty unmanned ground vehicle (UGV).

Results

- FMIS platform for advanced mapping and characterization of vegetation
- UAV sensing toolkit for forestry navigation and vegetation mapping
- Heavy-duty UGV sensing toolkit for forestry navigation and vegetation removal

Conclusions

While the overall system is still at the prototype level, with most of the technology demonstrated under controlled settings, the project advances and applies innovative AI, data and robot solutions to improve forest worker tasks and supporting them in forestry operations.

ID393

PO12 - ANALYSING DIFFERENCES IN FORESTED AREA AROUND VILLAGES OBTAINED WITH TWO NATIONAL CARTOGRAPHIC SOURCES

Bruno Barbosa[1], Ana Gonçalves[1], Sandra Oliveira[1,2], Jorge Rocha[1,2]

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The 'Condomínio de Aldeia' (Condominium of Villages) program aims to increase the resilience of villages located in vulnerable forest territories, supporting the conversion of the landscape. To be eligible, villages must have at least 60% of 'Forested Areas' within 100 meters around their boundaries, and no land use/ landcover base data is defined. Our research aims to analyse whether there are differences in the compliance with the surrounding forested area criterion, testing two official Portuguese cartographic sources i) the Land use/Landcover dataset ('Carta de Uso e Ocupação do Solo' - COS); ii) the National Forest Inventory (Inventario Florestal Nacional - IFN). After selecting the villages of the Algarve region with a built-up area between 1.8 and 12.1 hectares (n=263), the 100 m buffers created around each village were intersected with each of the two official maps separately, and the area occupied by the landcover types under analysis was calculated. Preliminary results show that there is a difference of approximately 20% of villages depending on the map used, with 66 villages being eligible when using COS and 84 when using IFN. We also found that 40 villages would meet the 60 % criterion of forest spaces, regardless of the map used. Considering the villages selected as 'Condomínio de Aldeia' in 2020 and 2021 in the region (n=8), only about half would be eligible when using official mappings, indicating the use of other data sources, possibly at the local level, to analyse the eligibility criterion for the Program.

ID402

PO20 - DRONE REMOTE SENSING FOR REAL-TIME SITUATIONAL AWARENESS AND DECISION SUPPORT IN WILDFIRE MANAGEMENT

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Wildfires are one of the major global environmental threats posed by climate change. Ongoing FireMan project aims to integrate drone swarms and artificial intelligence to provide solutions for wildfire management. Objective of this study was to investigate near real-time or real-time drone image analytics for implementing a wildfire geospatial DigitalTwin, that forms the basis for situational awareness and decision support during wildfire. Existing data from the National Spatial Data Infrastructure (NSDI), such as topography, forest structure, roads, landcover etc., forms the basis of the DigitalTwin, and it is refined and updated using drone remote sensing utilizing advanced machine learning techniques. The concept was evaluated in four prescribed burning events in Finland in summer 2022. We used drone multispectral and color cameras and LiDARs to refine and update the DigitalTwin with up-to-date information about species and understory layers, and RGB and thermal cameras to provide information about fire spread and fire parameters. National GNSS virtual reference station network provided precise direct georeferencing for drone data in real-time. LiDAR provided better object reconstruction than structure-from-motion techniques but the multispectral and RGB datasets were superior to classify tree species. For the fire parameter extraction, the thermal images were able to see through smoke and therefore outperformed the RGB images. In the next project phases, the DigitalTwin together with weather information can be feed to fire models to provide predictions of the fire spread and to provide decision support for firefighting.

ID403

PO33 - ORORATECH'S WILDFIRE SOLUTION - GLOBAL, FAST, RELIABLE, SATELLITE-BASED WILDFIRE DETECTION

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Global warming has led to a new wildfire context characterized by rapid-fire spread, intense burning, and an increased economical and environmental impact. Prevention, early detection, and real-time monitoring of wildfires are essential in successfully managing wildfires and preventing them from becoming extreme.

OroraTech's Wildfire Solution (WFS) is a software as a service platform that continuously processes, aggregates and analyzes data from over 20 satellites to detect thermal anomalies and provide a holistic solution for wildfire management. WFS enables early detection and monitoring of wildfires globally, using thermal and shortwave infrared data. The service includes risk assessment, early detection, real-time monitoring, burnt area mapping and damage assessment of wildfire events.

WFS harmonises between data sources, enabling common handling of data in future processing steps. The data harmonisation is followed by detection of high-temperature hotspots that represent potential patches of burning ground. Hotspot detection is followed by spatio-temporal clustering, where spatially and temporarily correlated hotspots are aggregated into clusters representing wildfires, thus allowing tracking of relevant information on active and historical wildfires over time and providing a much more reliable detection of a wildfire than single, isolated hotspots.

In this work, we evaluate the performance of WFS based on ground truth data from The Wildland Fire Interagency Geospatial Services (WFIGS) and compare it to other state-of-the-art solutions. We show that WFS is the most complete solution for wildfire management.

ID408

PP28 - 3D- FINE-SCALE FUEL CLASSIFICATION FROM TERRESTRIAL POINT CLOUDS USING ARTIFICIAL INTELLIGENCE

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Physical fire behaviour models can represent fuel beds that are heterogeneous and discontinuous. They greatly improve our understanding of how fuel characteristics affect fire behaviour and, therefore, our ability to predict and manage fire risk. Such modelling capabilities require detailed fuel data in 3D (i.e. precise location and dimensions of individual trees and spatial distribution of understorey fuels).

Terrestrial and photogrammetric point clouds are obtained by terrestrial/wearable laser scanning and photographic cameras respectively, and they provide a precise depiction of 3D forest structures using (x, y, z) points to represent surfaces. Their advance compared to aerial point clouds is that they can provide fine-scale information from vegetation layers below the canopy, which are key in predicting fire behaviour. For this, these 3D data first need to be classified into the different vegetation fuel classes/strata present in a forest: canopy, trunks, understory and ground fuels.

Recent research in Artificial Intelligence (AI) has output a plethora of classification tools, such as Deep Learning techniques, that are well suited to advance in this problem. However, few attempts have been made so far to characterize fuels in terrestrial point clouds using these.

Here we present pioneering work on 3D fine-scale fuel classification by applying state-of-the-art classification techniques based on convolutional neural networks (CNN, or convnets) to terrestrial point clouds from forest plots. The final goal is to separate the different vegetation structures in a useful, impactful manner to later feed physical fire dynamics models with them.

ID415

PO18-A SYSTEM TO AUTOMATICALLY ASSIST IN THE GEOLOCATION OF FOREST FIRES WITH CROWDSOURCED DATA

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Wildland fires may become devastating events when climatic and environmental favorable conditions are met, generating severe human and economic losses, as well as important impacts in the natural environment and biodiversity. Therefore, it is important to detect and geolocate wildfire ignitions as fast as possible, especially when adverse conditions exist, so that they can be immediately tackled by the authorities. To this aim, a system was developed to geolocate fire ignitions with data sent by citizens using a dedicated app – The FireLoc system. Such a system may assist authorities to geolocate the events when they are not detected by observation towers but only by citizens located in the vicinity of the event.

The main functionality of the FireLoc system is to geolocate the observed events with the data sent by the volunteers using the FireLoc app. Each contribution made with the app sends a set of data to a central server, that includes the observers' location, the magnetic bearing measured with the mobile device of the direction defined by the citizen when oriented towards the fire, a photograph, along with some additional data that enables the estimation of errors associated with the contributed data. Then, the methodology used to geolocate the observed events includes a triangulation along with a fuzzy approach to model the uncertainty of the fire geolocation due to the effects of the errors estimated to exist in the contributed data.

The system was implemented and tested in controlled conditions with good results.

ID416

PO31 - MULTISOURCE DATA INTEGRATION FOR IMPROVING FIRE BEHAVIOUR ANALYSIS AND IMPACT ON MEDITERRANEAN FORESTS: ALBENGA (LIGURIA, ITALY) CASE STUDY

Lola Palmieri[1,2], Umberto Morra di Cella[1], Paolo Fiorucci[1], Nicolò Perello[1,2]

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The main objective of this work is to improve (i) traditional burned area mapping, (ii) damage severity analysis and (iii) fire behaviour knowledge by using different multi-platform, multi-sensor and multi-temporal data. This study is focused on the forest fire occurred in Albenga (Liguria, Italy) in August 2022, where more than 400 hectares burned in four days. Most of the analysis were carried out using QGIS and Envi software, through the analysis of Sentinel-2 multispectral images (from EU Copernicus Programme) and RGB/MS images from the UAV that was operated over the study area immediately after the fire and several months later. The UAV's RGB images were used to identify the fire perimeter and for the first assessment of the plant formations impacted by the fire, which was then integrated with the analysis of land cover maps and pre-fire images. Several vegetation indices were calculated, including the NBR (Normalized Burned Ratio), and damage severity was classified. The factors that influenced fire behaviour were then analysed, considering the fire suppression activities and especially the spatial distribution of conifer and deciduous trees: the former highly influenced the fireline intensity and in general the extreme fire behaviour, while the latter were only partially damaged by the fire. Moreover, UAV's RGB and MS imagery was used to validate the analysis carried out with satellite imagery, while a method for integrating the UAV's high-resolution data with the satellite's low detail data was investigated, to obtain medium-high resolution data at a larger scale.

ID458

PP36 - FORECASTING METEOROLOGICAL FIRE DANGER WITH A STATISTICAL MODEL OF FIRE RADIATIVE POWER

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Generating daily maps with forecasts of meteorological fire danger is a major tool to assist forest managers in planning fire prevention and fire suppression. As a physical quantity that measures combustion rate, and therefore consumed biomass, fire radiative power (FRP) rates fire intensity, and therefore fire danger can be conveniently rated by the probability of exceedance of specified FRP thresholds.

Probability of exceedance is estimated by an 8-parameter statistical model of log(FRP) that combines a truncated lognormal distribution central body with a lower and an upper tail, both consisting of Generalized Pareto (GP) distributions. First, a static model is fitted to a sample of FRP values as derived from satellite observations. The static model is then improved by adding information about fire weather conditions associated to each FRP observation. This is achieved by incorporating, as a covariate of the model, the Fire Weather Index (FWI), the most widely used indicator of meteorological fire danger . Classes of meteorological fire danger are finally defined based on thresholds of estimated probability of exceedance by the improved model.

The procedure described aims at refining the Fire Radiative Mapping (FRM) product developed for Mediterranean Europe that is operationally disseminated by the EUMETSAT Satellite Application Facility on Land Surface Analysis (LSA SAF). Using FRP information available from MODIS and Copernicus products, we present and discuss the results obtained when the procedure is applied to estimate daily meteorological fire danger in Portugal, Zambezia (Mozambique) and Pantanal (Brazil).

ID517

PP31 - PATCH MOSAIC BURNING IN VENEZUELA - AN EXAMPLE OF TRADITIONAL KNOWLEDGE TRANSFERRED TO GOVERNMENT PRACTICE.

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This work describes the advances, challenges, limitations and progress in scaling up a new Integrated Fire Management (IFM) paradigm with an intercultural vision in Venezuela, initiated in Canaima National Park (CNP, 30,000 km2), to its later convergence with government actions and those of firefighters. The lessons learned with the indigenous people through joint experiments on fire behaviour and participatory workshops provided the basis for a new paradigm of integrated fire management with an intercultural vision based on the involvement of different forms of knowledge and actors from members of the Pemón indigenous people, researchers and firefighters. The new paradigm was based on the transition from a highly costly, human, technical and logistical resource-demanding fire suppression policy, historically implemented in the region but with limited impact, towards the use of the traditional indigenous method, such as patch mosaic burning, as an effectual fire prevention measure, which limits the advance of flames over areas with different burning histories in savanna-forest transition zones. The experiments also provided evidence of the increased fire risk associated with fire exclusion and the ecological basis of patch mosaic burning. However, implementing indigenous traditional knowledge into new policies was a critical issue that transcended academic and technical matters and plunged us into socio-political arenas. Creating joint learning spaces based on respect, trust, and equity in the search for solutions was one of the basic premises for scaling up and capitalising on these experiences to create a national system of integrated fire management with an intercultural vision.

ID520

PO24 - BURNED AREA VALIDATION EXPERIMENT FROM REMOTE SENSING MONITORING PRODUCTS

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Objectives

It presents first results of burned areas validation using the scientific good practices recommendations. We will discuss the steps as follow: sampling design, sample size and sample allocation to strata.

Methods

We used scars burned data from Landsat-8 satellite, during the Kadiwéu operation, occured in 2021. As recomended, the sampling design was defined taking into account the ease and practicality of implementation, best cost benefit and representative spatial distribution of region of interest. The sample size definition is dependent on accuracy and area information and is obtained by speculative process. This step aims to provide insights for the best choice of sample size and sample allocation. Three recommended sample allocation to strata was tested: optimal allocation and two forms of power allocation.

Results

It was observed that smaller the standard error of the estimated overall accuracy and smaller the user's accuracy, the larger a sample size. Considering the parameters to define sample size a sample of 300 points was selected, using standard error of the estimated overall accuracy equal to 2.5% and user's accuracy equal to 0.75. The power allocation was chosen to continue the work, for including representative points also in rarer classes.

Conclusions

The preliminary study of sample size and sample allocation determination are essential for well representation of areas involved, as well for the success in the following steps. Sample size and the cost of obtaining must always be taken into account. For future work, visual assessments are being made to verify the accuracy of method.

ID45

PP62 - HOW CAN WE DEFINE A FIRE RESILIENT LANDSCAPE?

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Wildfires are becoming increasingly problematic around the world and it is apparent current strategies are not working to counter wildfire risks. The paper undertakes a global knowledge exchange, aiming to define the term 'fire resilient landscape'. Qualitative methods were utilised to explore perceptions, within both science and practice, of fire resilient landscapes. A thematic analysis was undertaken on participant responses to extract the main themes characterising a fire resilient landscape. This analysis resulted in 5 main themes; acceptance and use of fire, management of the landscape, community engagement, loss avoidance and recovery. Following, the study exemplifies how these themes can counter wildfire risks by applying them to European case studies, in Catalonia and the Netherlands. This research contributes to an overall definition of a 'fire resilient landscape' according to the diverse (e.g., trans-disciplinary and holistic) application of the term appropriate for science and practice. By understanding the five main themes of fire resilient landscapes, we conclude that interventions surrounding these landscapes must be approached holistically, engaging with both environmental and social processes.

ID66

PO155 - INDIGENOUS PERCEPTION OF CLIMATE CHANGE AND HEALTH IMPACTS OF FOREST FIRES IN THE BRAZILIAN AMAZON

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Forest fires impact the health of indigenous peoples in several dimensions. These peoples hold ancestral wisdom for the preservation of life and climate resilience. This study aims to understand the perceptions and vulnerabilities of indigenous peoples in relation to forest fires in six territories of the Brazilian Amazon: Tenharim Marmelos, Katuquina/Kaxinawá, Krikati, Parque do Xingu, Uru-Eu-Wau-Wau, and Xerente. One indigenous from each territory was selected and trained through thematic workshops. They acted in data collection together with other researchers in the study of perception, using online and face-to-face conversation circles, in addition to semi-structured interviews with their communities and leaders. The main results were: training indigenous people to disseminate knowledge and act in the management of the health risk of forest fires in their territories; strengthening indigenous brigades; the development of new participatory approaches and educational materials for indigenous health research. In the perception of the participating indigenous people, forest fires are just part of the threats that compromise your health and quality of life and impact health as a whole, not just respiratory health, but it has immediate effects on their way of life, mainly due to the loss of biodiversity, either by burning biomass, deforestation or by climate change. The approach used guaranteed indigenous protagonism, in the inclusion of their views and specificities in the dialogic process of building intercultural knowledge, integrating indigenous knowledge with scientific knowledge, on the health impacts resulting from forest fires and climate change.

ID68

PO131 - THE EFFECT OF SPATIAL DEPENDENCE AND LAND COVER ON WILDFIRE RISK IN CASTELO-BRANCO AND GUARDA (PORTUGAL)

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Objectives

Castelo-Branco and Guarda are Portuguese districts where wildfires cause several environmental damage and social alarm. The research aims to determine if the spatial heterogeneity between parish and land cover conditions the wildfire occurrence.

Methods

General I Moran's, Getis-Ord and Geary are used to measure the local heterogeneity between wildfire patterns in the study parishes. The research also implements the Local Getis-Ord to test if there is spatial clustering in the study area. Finally, the study runs a spatial econometric model considering land cover.

Results

Parish spatial heterogeneity is relevant to explain the wildfire patterns in the study area. The immediate neighbourhoods condition the wildfire risk, and the analysis records some clusters where the spatial relations determine a hot/colder spot. The econometric model shows that the land cover is relevant to explain wildfire patterns, and the public policy could act over there to reduce the fire damages. Furthermore, the model highlights the importance of wildfires recorded in the contiguity parish and how different land uses conditions the forest fires.

Conclusions

It is essential to develop cooperative public policies between local administrations to reduce the effect of wildfire affection in the study area by controlling the land cover. The supervision should also include other human activities unrelated to the forest.

ID87

PO133 - MAPPING THE RISK OF FOREST FIRES IN PROTECTED AREAS THROUGH FUZZY LOGIC

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Fire is one of the main causes for environmental and economic damage worldwide, especially in protected areas, and the definition of techniques for coping with forest fires is essential for these environments. One of the tools used for a good fire management is the zoning of forest fire risk (ZRIF). In this context, the objective of this research was to determine, through fuzzy logic, the ZRIF of the Serra da Ferrugem Natural Monument, a protected area in the municipality of Conceição do Mato Dentro, state of Minas Gerais, Brazil. Physical (altitude, slope and relief orientation), socioeconomic (urban and road proximity), biological (land use and occupation and heat zones) and meteorological (air temperature and precipitation) variables were used. For model validation, a historical series dataset of fire scars was used. The influence of each variable on fire risk was delimited by the fuzzy membership functions that best represented the fire behavior as a function of these variables. The results showed that the area has moderate to high fire risk, with strong influence of slope, altitude, temperature and precipitation, and land use (native forest, planted forest, and cerrado). The validation attested that the model was efficient in spatializing the risk, pointing out that most of the fires that occurred in the area were in the moderate and high-risk classes (66.68%). It was concluded that the model is feasible, applicable and adaptable to other areas and regions.

ID105

PO135 - FIRE FLOCKS PROJECT: PARTICIPATING FARMERS' PERCEPTIONS AND CONSUMER PREFERENCES FOR LABELING EXTENSIVE LIVESTOCK PRODUCTS PROVIDING WILDFIRE PREVENTION SERVICES

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Extensive livestock farming faces substantial threats in the Mediterranean region, provoking a setback dynamic in the sector. In 2016, the Fire Flocks (FF) project was implemented to revert this situation in the NE of Spain. FF promotes forest management through extensive livestock to reduce wildfire risk. The initiative also works on risk awareness with the aim of promoting FF products through a label. After five years, it was considered necessary to conduct interviews with participating farmers in order to gather their opinions. The farmers were interviewed using a qualitative questionnaire. They stated that although FF is not providing significative financial benefits, it does present an opportunity to belong to a group working on wildfire prevention, thereby lending them a voice, and reaching more visibility. The qualitative analyses elucidate key elements to be promoted in FF, such as redesign of the operational structure and action lines to facilitate grazing activity. In parallel, knowing that FF products can appeal to ethical consumers, a study to assess the preferences of consumers for different lamb meat from herds providing wildfire prevention services was conducted. We explore how meat consumption patterns and socioeconomic features contribute to explain preferences for different labeling options. Results highlight three consumer profiles: traditional rural consumers relying on trust with producers, younger consumers more akin to new labeling schemes, and urban consumers that support local butchers. Different labeling mechanisms may work in a complementary way to arrive to different audiences of potential consumers.

ID120

PO146 - A FRAMEWORK FOR QUANTIFYING WILDFIRE LIABILITY RISK FOR (RE)INSURANCE PURCHASING AND MITIGATION PURPOSES

Mark Hope[1]

[1]*Guy Carpenter*

Financial losses associated with catastrophic wildfire activity around the world have significantly disrupted the (re)insurance market for liability coverage associated with wildfire. Entities that fail to quantify and properly safeguard against potential wildfire liability losses are at risk of significant business interruption impacts and possible insolvency if an unforeseen wildfire event occurs for which the entity is found liable. A lack of (re)insurance coverage jeopardizes the provision and stability of numerous essential industries including power generation and distribution, forestry, and recreational activities. By utilizing (re)insurance industry standard wildfire catastrophe models and historical experience of an entity's or asset's rate of wildfire ignition a modeling framework has been developed to determine probabilistic financial liability losses. These losses represent scenarios where an entity has been determined to be liable for a wildfire ignited by the entity's actions, lack of actions, or the entity's assets. By computing commonly used metrics of probabilistic monetary losses such as average annual loss, exceedance probability loss, and tail value at risk (TVaR) entities are able to understand their liability risk for wildfire allowing for proper risk management solutions to be enacted ensuring an entity's financial resiliency in the case of a wildfire for which they are found liable.

The modeling framework described in this session demonstrates a resilient path forward for entities with exposure to wildfire liability by providing a methodology and guidance for (re)insurance purchasing and prioritization of risk management measures such as preventative maintenance and planning.

ID129

PO156 - RISKS ASSOCIATED WITH THE OCCUPATIONAL EXPOSURE OF FIREFIGHTERS DURING WILDLAND FIRES

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Wildland fires are progressively becoming larger and more severe over the last decades, being Portugal among the most severely affected Southern European countries. During fire combat, firefighters face different hazards that will promote health burden, such as alterations in the circadian rhythm (e.g., eating/sleeping habits), falls, physical exhaustion, burnings, and exposure to a complex mixture of health-relevant pollutants released by fires (carbon monoxide, particulate matter, and several volatile organic compounds including polycyclic aromatic hydrocarbons, etc.). Several studies demonstrated increased levels of different biomarkers of exposure to the pollutants found in fire emissions and biomarkers of early health-effects in the urine and blood of firefighters after firefighting. The firefighter occupational was recently classified by the International Agency for Research on Cancer as a carcinogenic activity, with sufficient scientific evidence for the development of mesothelioma and bladder cancer. Evidence remained limited for colon, prostate, and testicular cancer, melanoma, and non-Hodgkin lymphoma. It is demonstrated that firefighting strongly contributes to the health burden reported in wildland firefighters. This work aims to present an overview of the main risks of wildland firefighting activities and the associated potential health risks.

Funding

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ID139

PO154 - WILDFIRE PREPAREDNESS AND IMPACTS NEEDS ASSESSMENT FOR CALIFORNIA, USA

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Objectives

As a result of past land management and climate change, wildfire size, severity, and the ecological and socioeconomic impacts of wildfire have rapidly increased in California, USA. In response, the University of California Cooperative Extension developed an interdisciplinary Fire Team to help address the major wildland fire issues facing communities. The Fire Team conducted a broad-scale assessment to determine community needs. We intend to identify desired resources, willingness to change, social acceptability of prescribed fire, gaps in education and outreach, and how communities perceive their own wildfire risk. Community input on fire issues at this scale has not occurred in recent history.

Methods

We expect to have 1,000+ respondents to the survey and will use all means of communication to disseminate it, thus no response rate. We will administer an online survey to both English and Spanish speaking residents of California and natural resources professionals aged 18 and over.

Results

Our hypotheses for the survey (conducted in January) include 1) California communities are underprepared for wildfire; 2) diverse populations have unique needs; 3) landowners with properties less than five hectares are underserved; and 4) natural resource professionals and/or agencies tend to develop their own wildfire-related programs.

Conclusions

Preliminary conclusions may include 1) communities will see increased wildfire preparedness with help from the Fire Team; 2) development of distinct outreach and engagement to address diversity is necessary; 3) development of smaller scale financial assistance is necessary; 4) creating a nexus between existing agencies and Fire Team will enhance collective impact.

ID146

PP65 - CREATING GRIDDED FIRE PROBABILITY MAPS USING NASA DATA

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Fire is a nationally and globally significant process that strongly affects human–dominated and wild landscapes. Even though fire can be devastating, wildland fire is a natural and integral force on our landscapes, providing value by decreasing fuels at the Wildland Urban Interface (WUI) to promote safe communities. However, uncontained wildfires can devastate communities, threaten our health, and result in substantial economic losses. There has been greater than a $50B increase in wildfire insurance claims from 2017-2021, which has been exacerbated by climate change. Our objective is to develop the world's first grid-based wildfire probability product using multiple sources of satellite data to determine whether a 'conflagration' (fire larger than 999+ acres) has 'breached' a grid cell. This will substantially decrease the time it takes for homeowners to receive payouts.

We use multiple satellites and ancillary data to weigh the likelihood of fire, based on a number of sources that verify a fire burning in a grid and the level of confidence in the data source. For example, Sentinel-2 vegetation-change indices have a higher level of confidence than VIIRS (Visible Infrared Imaging Radiometer Suite) active-fire detection data; and VIIRS active-fire detection data have a higher-level of confidence than MODIS (Moderate Resolution Imaging Spectroradiometer) active-fire detection data. The first iteration has been developed for responding to wildfires in California, with the possibility to expand nationwide and globally.

ID161

PO153 - INSURANCE SOLUTIONS FOR CALIFORNIA WILDFIRE; FINANCIAL QUANTIFICATION OF COMMUNITY AND LOCATION LEVEL MITIGATION

Kimberly Roberts[1], Sydney Chamberlin[2], Manuel Chiroze

[1]*Guy Carpenter,* [2]*The Nature Conservancy*

Homes and businesses that are located in the wildland urban interface (WUI) of the United States (U.S.), and specifically California, are facing unprecedented challenges when it comes to insuring their property against wildfire. Population growth into fire-prone WUI areas, coupled with increasing intensity and occurrence of wildfire due to climate change, are compounding damages and driving insurance capacity away.

This session will explore solutions that have the potential to attract capacity from the reinsurance markets, which in turn will enable insurance companies to do business in traditionally wildfire prone areas. The modeling framework utilizes local landscape features and fuels, in combination with structure density, to identify communities that are at risk from a large loss due to wildfire. Within these communities, idealized mitigation measures can be modeled, building on previous research conducted by The Nature Conservancy, Conservation Biology Institute, and Paradise Recreation and Park District in Paradise, California. This research applies a U.S. wildfire catastrophe model to quantify the financial benefits of a range of community and location level mitigation measures, including the implementation of wildfire buffers and building code updates. Taken together, these measures could have reduced the value-at-risk in Paradise by 42%, converting a one in 100-year loss level into a much rarer one in 350-year loss level.

Importantly, the quantification of the financial benefits of mitigation can aide in designing innovative insurance solutions that are attractive to the insurer and benefit the property owner. Potential solutions include Community-Based Catastrophe Insurance (CBCI), parametric products, and multi-community risk pooling.

ID166

PO144 - FIREFIGHTING TO FIRELIGHTING: CHALLENGES AND OPPORTUNITIES IN IMPLEMENTING INDIGENOUS BURNING IN CALIFORNIA

Nina Fontana, Beth Rose Middleton Manning

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Climate change is altering characteristics and patterns of fire and fire regimes across the world. As the climate shifts from historical baseline conditions, causing an increased likelihood of extreme events, the call for increased prescribed fire in fire-adapted systems has begun to feel like a race against time. Concurrently, Indigenous Peoples worldwide are on the frontlines of climate change, experiencing extreme impacts on coastlines, the poles, islands, and across arid regions like the Southwestern U.S. These same Indigenous communities and nations are assessing risk from a deep, place-based lens, and leading the way in addressing climate change impacts through innovative adaptation strategies, such as Indigenous burning. In California, centuries-long fire suppression and colonial management practices have resulted in dangerously high accumulated levels of risk, as seen in the cascade of detrimental impacts on both Indigenous communities and ecosystems. We explore how the reconciliation of recent state policies and reintegration of traditional fire management on land depends on trust, transparent governance, and equitable exchange with Indigenous partners at various structural levels. Additionally, we contextualize and strategize multiple pathways moving forward by identifying opportunities for centering Indigenous-led burning in policy.

ID167

PO139 - WILDFIRE RISK REDUCTION: THE ROLE OF ENVIRONMENTAL EDUCATION

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This work focuses on the role of environmental education on wildfire risk reduction, focusing on two main intervenient in the rural world: Forest engineers and the rural population.

In Portugal Forest engineers intervene in the territory and their work assignments include the area of education and awareness. They are, in most cases, the ones that work directly with communities and land owners. These factors led to a survey about their training needs, comparing these with the different professional activities and their university degree. It was concluded that the greatest discrepancies between what is important for the professional performance and the preparation of the technicians, belongs to the resources management human dimension. Particularly on the integration of the social dimension of risk management.

The risk perception and the constraints for preventive action by the population were evaluated in three Portuguese communities aiming to identify future guidelines to work with the local population on risk behaviour reduction and promotion of active and preventive forest management. The analyses showed that all communities have a high risk perception and that the motivation to carry out actions on the ground are influenced by factors, both individual (negative expectation of results) and collectives ("my neighbours do not clean it is of no use to me to clean").

In conclusion, forest engineers should acquire more skills on communication and environmental education methodologies in order to work together with the rural population finding joint solutions that could promote preventive actions reducing wildfire risk.

ID179

PP56 - WILDFIRE DECISION SUPPORT SYSTEMS FOR THE MANAGEMENT AND RESILIENCE OF REN'S POWER AND GAS INFRASTRUCTURE

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Critical power, transport and communication infrastructures found in rural areas are susceptible to wildfires. In this work, we introduce a Decision Support System (DSS) for the management and resilience of power and gas infrastructures against wildfires, supported by a distributed sensor network for fire detection and fire and weather monitoring, combined with advanced fire spread simulators and Artificial Intelligence.

The distributed sensor network is comprised of optical and thermal cameras and ultrasonic anemometers installed on a electricity pylon. Communication is ensured via optical fibre connection and power is supplied via high-capacity batteries charged through dedicated solar panels. The sensor network can detect and locate a fire ignition, as well as following the progression of the fire. This data is automatically sent, along with wind speed and direction data to the fire propagation simulation service. This fire simulator is called from a geographic information system web front-end, to display the initial location of the fire and the results from the simulation, obtained in less than 3 minutes, which reveal the foreseen future location of the fire front up to 5 hours in the future. With a geographic intersection, the software determines if, and when, the electric or gas distribution infrastructure is foreseen to be hit by the fire.

This framework is installed in 8 electricity pylons distributed in the northern part of Portugal. Preliminary results reveal the importance of this DSS for the timely triggering of wildfire response actions to guarantee good management of critical systems and their continuity of service.

ID190

PP66 - COMPOUND DROUGHT-HEATWAVE CONDITIONS: A NEW THREAT FOR THE FIRE-PRONE CERRADO?

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The role of compound drought-heatwave (CDHW) conditions on fire activity is still fairly unexplored in Brazil. A recent study has compiled existing literature on CDHW conditions over Brazil's most important ecosystems, including the Amazon rainforest, the Pantanal wetlands, and the fire-prone savannas of Cerrado. While the Amazon and Pantanal have early evidence of these CDHW conditions and their impact on fire activity, Cerrado has yet to be studied. The study provided initial hints on what this relationship may look like for Cerrado, by studying four ecoregions with high yearly fire activity: Bico do Papagaio, Araguaia Tocantins, Bananal, and Alto Parnaíba. Using soil moisture (SM) from GLEAM v3.5a and maximum temperatures (Tmax) derived from the ERA5 reanalysis, along with burned area (BA) from MODIS MCD64A1 C6, yearly drought and heatwave conditions were evaluated and compared to BAs. Results show that high burning years fall above (below) the climatological median of Tmax(SM). Moreover, the top three burning years for each ecoregion are above the 75th percentile of the climatological series of a heatwave index (derived from Tmax and considering both temporal and spatial incidence). These preliminary results entail that there may be a positive relationship between CDHW conditions and fire in Cerrado, which levers new questions and concerns in the light of future climate change.

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ID216

PP58 - USING FLAMMAP TO ASSESS WILDFIRE BEHAVIOR IN THE BOHEMIAN SWITZERLAND NATIONAL PARK

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The 2022 summer fire in the Bohemian Switzerland National Park is ranked among the largest in the Czech Republic with an affected area over 1000 ha. The FlamMap fire behavior model, developed in Missoula Fire Sciences Laboratory, was used to recreate this event to calibrate the model to Czech conditions, to investigate the fire behavior characteristics of this particular wildfire, and to evaluate scenarios of fire occurrence in different fuel types or under different fire weather conditions. The model allowed us to simulate fire conditions, propagation, and extent. We specifically focused on matching the observed fire perimeter and on fire behavior characteristics (spread rate, flame length, fireline intensity, etc.). The fire took place in a region of the National Park that was heavily affected by bark beetle infestation, hence a majority of the burned area was in dead spruce forest. The best FlamMap simulations of observed fire behavior and progression were compared with several created scenarios that differ in various input conditions. Scenarios included, for example, a fire in a healthy standing spruce forest, in clearcuts that are created after dead tree removal, or under different meteorological conditions (for example, changes in temperature and humidity). In this study we were able to calibrate and use FlamMap to recreate a historic wildfire in Central European conditions. We found that the fire would have spread to its perimeter even if standing dead trees were removed, but not if live spruce stands were present.

ID222

PP54 - CONTAMINATION OF FIREFIGHTERS' SKIN DURING FIREFIGHTING ACTIVITIES AND ASSOCIATED HEALTH RISKS

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Firefighting activities contribute to the health burden of firefighters through repeated exposure to health hazardous pollutants via inhalation and dermal contact. Polycyclic aromatic hydrocarbons (PAHs) are a large group of organic compounds released during fires, with known toxic and carcinogenic properties. So far, limited data is available regarding the contamination of firefighters´ skin during firefighting. This work compiles information regarding firefighters' dermal exposure to PAHs and the related main health risks. Available literature showed the contamination of the neck (2.23–62.50 ng/cm2), wrists (0.37–8.30 ng/cm2), face (2.50–4.82 ng/cm2), and hands (1.59–4.69 ng/cm2), even with the adequate use of firefighting personal protective equipment. Some PAHs were found on the calf, scrotum, and back of firefighters. Also, levels of possible/probable carcinogenic PAHs ranged between 0.82–33.69 ng/cm2. Evidence suggests the topic permeation of PAHs and the promotion of skin inflammatory diseases. Occupational exposure as a firefighter causes melanoma in firefighters. Additional studies are needed to better characterize firefighters' dermal exposure, evaluate the protectiveness of decontamination procedures, and contribute to diminishing firefighting risks.

Funding

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ID229

PO145 - FOREST FIRE RISK ZONING IN PICO PARANÁ STATE PARK AND SURROUNDINGS, BRAZIL

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Forest fire risk zoning (ZRIF) is a fundamental tool for planning, preventing, monitoring, decision-making in fighting fires and defining public policies related to the maintenance of ecological heritage. As a result, the work aimed to carry out a ZRIF for the Pico Paraná State Park, located in Serra do Mar, with an altitude of 400 to 1877 m. Altitude,slope, slope orientation, vegetation coverage, and human presence were the factors considered using the QGIS software. The Digital Terrain Elevation Model (MDE) was based on the ALOS PALSAR images. The maps for each variable were created from the attribution of coefficients (from 1 to 5), which reflect the degree of risk or danger of fires, which were subsequently overlapped, forming the ZRIF. The work resulted in maps with five classes of forest fire risk: low, moderate, high, very high and extreme. In the study area, extreme or very high risks were identified in 30% of the area for the altitude factor, 66% for slope, 31% for slope orientation, 55% for vegetation and 3% when analyzing the risk of ignition by human presence, making it possible to identify areas of high and very high danger that had not been noticed yet.

ID253

PP67 - COUPLING FUEL MODELS AND FOREST MANAGEMENT FOR ASSESSING FIRE HAZARD IN EUCALYPT PLANTATIONS

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In mainland Portugal, at the municipal level, the methodology to calculate fire hazard includes both probability of occurrence and susceptibility which, in turn, are calculated based on the historical burnt areas recorded, the slope, and land cover. However, when applied to eucalyptus stands, this methodology fails to account for the degree of stand management performed. The Navigator Company developed a fire hazard assessment scheme to support its annual fire management planning and its forest certification requirements. To better describe its silvicultural management practices, the land cover was related to the fuel models developed for Portugal by considering silviculture and geographical location. In the case of eucalypt stands, age and rotation length were also considered. Additionally, slope classes were redefined and a 20-year time series of burned areas were used to estimate probability. Results showed that 54% of the company's plantation had a very-low to low fire hazard score, whereas if based on the official conjunctural hazard cartography, it would overestimate the hazard, with only 20% included in those classes. Furthermore, a trend towards more hazardous classes was observed, which is explained by the increase in the eucalyptus stands ages. This is not a valid result, as the higher the average age, the higher the salvage from fires since wood utilization will be higher in the case of forest fires. Using fuel models allowed us to characterize the different management scenarios applied by the company, enabling us to capture the impact of forest prevention measures on an annual basis.

ID254

PO150 - ASSESSING WILDFIRES SMOKE POTENTIAL IMPACTS

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Wildfires affect a significant part of the European population and cause considerable negative atmospheric and ecological impacts. This study aims to assess population, infrastructure, and environmental ecosystems potentially affected by the smoke from wildfires. The Barcelona province (Spain) was used as a case study, and an innovative approach based on a dispersion model was developed. The main input data required by this approach were climate variables, vegetation characteristics, fire propagation, atmospheric emissions, and exposed elements (i.e., population, road network, buildings, and protected natural areas). The ERA-5 global product was used to extract the typical wind fields (wind speed and wind direction) and calculate the fuel moisture content (dead and live fuels). We generated a large set of modeled fire perimeters corresponding to more than 12,000 years or iterations using the minimum travel time (MTT) fire spread algorithm. The methodology to estimate the atmospheric emissions was based on fuel type, burnt area, fuel consumption, fire propagation, fire intensity, and emissions factors (by combustion phase: flaming and smouldering). The obtained results allowed to identify and map potential structural (including ecological) damage and population exposure to smoke, as well as to improve prevention and preparedness planning at the wildland–urban interface (WUI).

ID257

PO148 - FIRE RISK ASSESSMENT IN THE WILDLAND-URBAN INTERFACE (WUI) OF PORTUGAL TO PRIORITIZE PREVENTION OPERATIONS

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Wildfires in Portugal are increasingly threatening settlements and their population, especially driven by i) Agricultural abandonment and subsequent encroachment of woody vegetation around settlements; and ii) Considerable afforestation over the 20th century, decreasing landscape fragmentation and bolstering large-scale fires that strain WUI protection resources.

Here we develop a WUI fire risk assessment to support prevention planning (e.g. fuel management) – from local to regional scales.

Methods

- Delineation of the WUI and its partitioning into ~50-200m segments as the basic spatial scale of the analysis.
- Definition of the variables most relevant to each of the 3 risk components (Hazard, Vulnerability, Exposure)
- Expert-assessment of each variable contribution to its component through a participative Analytical Hierarchy Process with stakeholders
- Evaluation and development of decision-support metrics.

21% of Portugal's WUI – about 28 500km - falls in the 2 highest risk classes (out of 5).

The interior North and Centre are the most concerning, with high vulnerability due to the ageing population and WUI proximity to flammable vegetation, and high fire hazard due to unfragmented landscapes and frequent human-caused ignitions. Areas in the southwest are also particularly at risk, often due to historical urbanization dynamics with isolated houses scattered in flammable landscapes.

At local scale, our high-resolution results support the identification of priority settlements, and of their most critical WUI segments for prevention.

This WUI risk assessment supports prioritization from regional to local scales, and is now part of the operational tools leveraged to design efficient prevention strategies.

ID259

PO142 - PASTORAL FIRES AND THEIR IMPACT ON THE ALTO MINHO FIRE REGIME

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To test the hypotheses that:

- There is a relationship between pastoral fires and the evolution of livestock on the Alto Minho
- Pastoral fires condition the occurrence of wildfires.

This study does not make use of official cartographic information, and therefore it starts by mapping all burned areas from the historical series of satellite images and orthoimagery. The digitization process of these areas was carried out manually and supervised and all perimeters were classified, differentiating between wildfires, pastoral fires and areas treated by prescribed burning.

From the cartographic processing work, 12,692 fire perimeters corresponding to 235,060 burned hectares were digitized for the 2001-2020 period. Out of the total area, more than 40,000 hectares respect to fires that did not involve control and extinction actions and occurred in the autumn, winter and spring seasons. These fires, associated to "pastoral fires" are more frequent in areas with higher animal load, highlighting their use in the areas of Alto Minho with higher concentration of livestock. Regarding rural wildfires in the study period, their area tended to increase with livestock decrease, both in accumulated area and in mean burned area, contrary to the trend observed for "pasture fires".

A rigorous reconstruction of burnt areas is fundamental, as well as the reconstruction and classification of the various types of fires. It is essential to review the process of attributing ignition causes related to the use of fire in pasture renewal. Institutional fire is seldom practiced and does not meet the needs of traditional communities.

ID262

PP57 - VEGETATION FEEDBACKS MEDIATE THE VULNERABILITY OF WESTERN US CONIFER FORESTS TO FIRE-DRIVEN TRANSFORMATION

Tyler Hoecker[1]

[1]*University Of Montana*

Fire-catalyzed forest transformations are now pervasive, eroding ecosystem resilience to future disturbance and altering function. Forecasting future fire activity and associated change is critical but complicated by inextricable links among climate, vegetation, and fire, leading to divergent expectations depending on how these relationships are represented in models. Area burned in western U.S. forests will continue to increase in response to a warming climate, but vegetation feedbacks to burn severity—where persistent fire-driven changes in vegetation structure and composition alter subsequent fire behavior—are unresolved. Our objectives were to 1) map the exposure of conifer forests to fire-regime change under 2 °C warming in global mean temperature; 2) characterize concomitant changes in burn severity; and 3) contextualize exposure with information about species' fire resistance. We develop a multivariate method to measure exposure by considering changes in productivity, burn severity, and fire frequency. We pair exposure estimates with an atlas of fire-resistant traits, which are a key source of adaptive capacity in fire-prone ecosystems. Some 96% of conifer forests will be exposed to fire-regime change. Changes in burn severity were negative across 63% of conifer forests. Exposure and fire resistance are not strongly related, therefore knowledge about both properties is necessary to understand ecosystems' vulnerability to transformation. Dry, low-elevation forests and mesic subalpine forests are highly vulnerable to transformation, despite representing distinct portions of climate space. Our findings suggest climate-driven change in forests and the fire activity they support under a likely future scenario, motivating planned adaptation to protect valued characteristics of conifer forests.

ID264

PO158 - EXTREME FIRE BEHAVIOUR ANALYSIS AND MODELLING

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Forest fire spread is a dynamic process due to the interaction between the fire and its surrounding environment, that modifies the fire spread properties even if the boundary conditions, like fuel, topography and meteorology, are not modified. The dynamic behaviour of the fire requires that the variable time is considered explicitly in the process of fire behaviour modelling and prediction (Viegas 2004). Under certain boundary conditions the rate of spread of the fire may change very rapidly and produce a very intense fire that cannot be attacked directly. The eruptive behaviour of a fire in a canyon is an example of such behaviour that can be modelled considering the modification induced by the presence of the fire on the flow field around the flame front, modifying its shape and dimension and increasing its rate of spread (ROS) in a feedback process that tends to reach very high values of the ROS in a finite period of time (Viegas 2005). The increase of ROS is limited by a contrary flow that decelerates the fire producing an intermittent behaviour of the fire spread (Viegas et al. 2021). The temporal evolution of the ROS is oscillatory and has an amplitude and frequency of oscillation that depends on the type of fire and its dimensions (Viegas et al. 2022).

A preliminary model to analyse and predict the behaviour of a fire during the characteristic accelerating and decelerating phases is proposed based on physical laws and supported by evidence obtained from fires at different scales.

ID276

PO134 - MAKING SCIENCE USABLE FOR FIRE WEATHER WARNINGS

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In the U.S. an effort is underway to understand usage of fire weather warnings and provide recommendations on potentially revamping the current system utilizing physical and social science research. These warnings, known as Red Flag, are meant to communicate extreme fire weather conditions that exceed normal conditions. The project aim is to quantitatively assess criteria that enables more consistent issuance criteria across the country and to better understand how the current products are used by the fire management community.

This project demonstrates the value of integrating physical and social science research into weather product development to better understand how products are currently used and may need to be used in the future. Additionally, given the high potential impact on public and wildland fire fighter safety along with large costs of resource allocation, substantiative agency support for a revamped fire weather warning product is most likely gained by working collaboratively with agency partners throughout the project lifecycle. Without this investment of time and resources by both the research team and agency staff to create an effective and high functioning collaborative dedicated to addressing the challenges with these products, the results would likely remain in academic publications, rather than aimed for operations.

From a combination of physical and social-based quantitative approaches, recommendations can be put forth to revamp the national warning system.

This presentation discusses the concept of user-inspired research as a component of translational science and provides a case example of fire warning issuance for fire management agencies and the public.

ID296

PO138 - TOWARDS A MORE INTEGRATED APPROACH TO SOCIAL VULNERABILITY: THE CASE OF BARCELONA'S WUI

Israel Rodríguez-Giralt, **Maria Cifre-Sabater**, Míriam Arenas-Conejo, Álvaro Poo-Astudillo

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Recognizing and addressing vulnerability to fire in the Wildlan-Urban Interface (WUI) is an emerging discussion among researchers and practitioners. Through the experience at the "WUICOM-BCN Fire Resilient Interface Communities of Barcelona" project, we aim to contribute to this discussion by comparing two different approaches and methodologies to understanding the complexity and diversity of factors that contribute to vulnerability in the WUI. On the one hand, we will explore the image and narratives of social vulnerability emerging from the main indexes used by some of the administrations and practitioners involved in fire management. These are indexes primarily based on census data that emphasize socio-economic, urban development and demographic variables. On the other hand, we will focus on more qualitative aspects unveiled by the ethnographic fieldwork we are carrying out in two neighborhoods of Barcelona's WUI. For example, community and social capital aspects, trust in administrations, or management and governance issues. The presentation discusses the need to complicate and diversify the definition and representation of social vulnerability, reflecting on the role (and limitations) of the different disciplines, methods and practitioners involved in conceptualizing the different social factors, and calling for more collaboration and interdisciplinarity among the different knowledges, methods and actors involved in fire management.

ID301

PP53 - DEVELOPMENT AND USE OF AN INTEGRATED MODELLING APPROACH TO SIMULATE DYNAMIC WILDFIRE RISK PROFILES AND SUPPORT RISK REDUCTION STRATEGIES

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Wildfires pose a significant risk to societies across the world. This risk will likely increase in the future, due to climate change, urban development and changing demographics. Understanding the range of potential future conditions, and the associated key uncertainties, is essential in designing disaster risk management strategies that holistically account for these drivers.

For this purpose, we have developed a spatially explicit, dynamic, multi-hazard decision support system called UNHaRMED, which calculates dynamic risk profiles as a combination of hazard, exposure and vulnerability. The aim of UNHaRMED is to better understand current and future risk, and assess the impact of (a combination) of risk reduction options under various future conditions. In order to do so, UNHaRMED consists of coupled models integrated into a policy support system. It allows the user to understand the impact of climate change, socio-economic developments and risk reduction options on the future evolution of exposure, hazard and vulnerability and hence the resulting risk.

The use of the system will be illustrated through an application to Greater and Peri-Urban Melbourne for wildfire risk, for which we simulated a range of futures using different climate and socio-economic scenarios. We found that in such a rapidly growing area, the impact of socio-economic development exceeds the impact of climate change, and spatial planning strategies can substantially reduce future wildfire risk.

The application of UNHaRMED showcases its use potential in future-proofing risk reduction strategies by assessing their impact under a range of plausible futures.

ID305

PO143 - PERCEPTION OF RISK AND CONFLICTS IN EVENTS IN DIFFERENT LOCATIONS IN FIREFIGHTING IN THE 2020 SEASON IN BRAZIL

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Objectives

To present the perception of risk and imminent conflicts in combatants and people with leadership positions in ICMBio protected areas

Method

Dialogued post-event interviews directed at key people who were in leadership positions involved in fire events in 2020

Result

The interviews were carried out after the season of the events, giving the interviewees the opportunity to reflect on the experiences they had, bringing up memories of situations that at that time of combat did not appear to be situations of imminent risk, revealing the intensity of the fatigue suffered unnoticed by combatants. Reports brought by women who were in command posts, revealed the difficulty of acceptance of their leadership role by those involved, especially external actors, intensifying mental fatigue at the time of combat. In some cases, there were no people to carry out the local change of command, increasing the stress and fatigue of those already in action.

Conclusion

There are several factors that influence the perception of risk, but the fatigue of several days of combat without changing local command reduce the perception of risk in events as the time in combat increases.

ID316

PO147 - MODELING HISTORICAL AND FUTURE FOREST FIRES IN SOUTH KOREA: THE FLAM OPTIMIZATION APPROACH

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Forest fires, often triggered by human activities and greatly exacerbated by climate change, present a great challenge to the response system in South Korea, where more than 60% of land is forested and at risk of more frequent and larger scale fire outbreaks, as seen in recent years. In this context, our study aims at the optimization of IIASA's FLAM model – a processed-based wildland fire model integrating both biophysical and human impacts on wildfire risks – to the environment of South Korea for projecting the pattern and scale of forest fires. The following model developments were performed in the study at a resolution of 1 km using downscaled national GIS data: 1) optimization of algorithms in FLAM, including ignition probabilities conditional on population density, lightning frequency, fuel availability, and distance to cropland; 2) improvement of fuel moisture computation by adjusting Fine Fuel Moisture Code (FFMC) used by FLAM to represent feedbacks with vegetation, achieved by fitting a modeled soil moisture content to daily remote sensing data; and 3) a deeper look at fire frequency in addition to areas burned simulated by FLAM. Our results show that optimization has considerably improved the modeling of seasonal pattern of the forest fire frequency across South Korea. Pearson's correlation coefficient between monthly predictions and observations from national statistics was improved from 0.171 in non-optimized version to 0.893 in the optimized version of FLAM. We will present and discuss results on future projections of burned areas based on forest management scenarios in South Korea.

ID317

PO151 - FIRE USE AND WILDFIRES IN AGRARIAN REFORM SETTLEMENT PROJECTS IN THE SOUTHWEST OF TOCANTINS STATE, BRAZIL

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This article deals with identifying and describing the use of fire in agricultural systems in three agrarian reform settlement projects in the southwest of Tocantins State, Brazil. We collected data on agricultural production and management, fire use and occur wildfire through consultation with 30 farmers from each settlement project. As a result, 26.3% of the farmers declared they had already used fire in agricultural activities. The main economic activity is extensive cattle ranching and farmer use the fire for the following purposes: (1) to open new areas for pasture implementation, using fire to burn deforestation residues, such as branches, trunks and leaves; and (2) to renew pastures, fire is used to stimulate the re-sprouting of grasses, used mainly in native pastures.

Another use of fire (3) is to burn the straw of agricultural crops. Although the agricultural use of fire presupposes controlled use, fire can get out of control and reach native vegetation areas, thus causing wildfires. In these settlement projects, the use of fire through controlled burning reaches small areas within the lots, while wildfires reach large extensions. The wildfires that affect the settlement projects sometimes originate from neighboring properties and spread through areas of native vegetation and pastures, causing negative impacts for settled families.

ID322

PP64 - FIRE PANEL: A BRAZILIAN WEBGIS APPLICATION FOR FIREFIGHTERS DISPATCH WITH NEAR REAL TIME RESOLUTION

Henrique Bernini[1], **Daniela de Faria**[1], Elisama Oliveira[1], José de Paula Assis[1], Richard Ribeiro[1], Tadeu Sanchez[2], Leonardo Dias[3], Bruno Cambraia[4], Marcelo Carvalho[2]

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Censipam is a governmental agency that monitors extreme events in the Brazilian Amazon, receiving innumerous requests to identify most important active fires to be handled by firefighters. The goal here is to present the Fire Panel, a webgis application designed by Censipam to be used during a firefighting dispatch decision making across the Brazilian territory. As monitoring key, Fire Panel delivers a NRT fire tracking through a vector layer that is updated with every single satellite pass from 5 polar and geostationary satellites. Our methodology approaches spatial and temporal resolution separately. While polar satellites like NOAA-20, S-NPP, AQUA and TERRA are used to track the fire event vector perimeter, GOES-16 is added to increase temporal resolution. In addition, the FirePanel has a severity level used to rank fire events in terms of fire combat. The spatial scope is being continually improved by the Censipam team and includes a mask for spurious areas and small fires (less than 1km). The results show more than 110,000 fire events per year in the last 3 years around the country. In Amazonia region, 14% are updated using blended temporal resolution, especially medium to larger fire events that should be a concern in terms of combat. Even using blended temporal resolution, some problems between data acquisition and delivery time from webgis still is part of the challenge of earth observation systems applied to wildland fire.

ID331

PO136 - STATISTICAL MODELLING USING CATEGORICAL DATA FOR STUDYING RELATIONSHIP BETWEEN FIRES & PARAMETERS AND FOR CREATION OF FOREST FIRE RISK ZONATION

Sunil Chandra[1], Anoop Singh[1], Satyendra Kumar[1], Vikas Gusain[1]

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A fire risk Zonation is an effective tool for managing forest fires by prioritizing different risk areas. The present study have tried to use a loglinear modelling (LLM) approach to analyze the field variables tabulated as categorical data. While forest fire incidences have been treated as main variables, the causative factors have been identified as independent variables in the modelling. Analyzing the association among variables using a LLM approach, combinations of variables associated with fires have been identified using a good fit probability method. The identified factors having the best associations with fires include- forest species, altitude, aspect, slope, grazing incidences and biotic influence. While digital elevation model have been used for creation of altitude, slope and aspect, the layers for grazing incidences and biotic influence have been created using the ArcGIS tools. The forest species layer have been generated using a neural network(NN) approach. The six identified layers based on LLM have been used in the spatial modeler for creation of fire risk zonation index(FRZI). An overlay of fire points of the last 05 years on FRZI indicates a good agreement between FRZI and the past fire incidences which are based on SNPP-VIIRS fire detections. From the results, it could be inferred that 35.48% of the total fire detections are in the very high and the high risk areas, which is in good agreement with the model. The above method provides a statistical approach for zonation of risk areas based on the risk factors.

ID337

PP60 - POLICY COHERENCE ANALYSIS TOWARDS INTEGRATED WILDFIRE RISK MANAGEMENT IN THE EU

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Wildfire risk (WFR) has been exacerbated across the world due to climate and land use changes, favoring more severe, damaging, and extreme wildfire events that put communities and values at risk not only in traditional fire-prone areas but also in unprecedented territories, with different socioeconomic, ecological and political implications. Especially, when WFR management policies centered on ignition control and fire suppression are being exceeded. Consequently, integrated approaches tackling the root causes related to fire spread capacity (hazard) as well as the creation of exposures and vulnerabilities become determinant. Beyond approaching wildfires as an emergency, WFR reduction needs to be integrated in all sectoral policies influencing risk "(de)construction" process, such as urban planning, bioeconomy, nature conservation, green energy or within touristic sector.

This research identifies the landscape of policies and initiatives under the European Green Deal (such as 3 Billion Trees Pledge initiative, Just Transition Mechanism, related EU Strategies or Nature Restoration Law proposal) influencing WFR in terms of hazard, exposure and vulnerability trade-offs, and analyses up to what extend they are aligned in a (in)coherent way for wildfire disaster risk reduction.

Results conclude that significant dysfunctions, but also potential synergies exist to move forward to integrated WFR management under a common policy frame supported by multi-stakeholders' risk governance bodies. Key aspects that could be approached in a more coherent way along and across the initiatives and policies analyzed are suggested. Moreover, the method and results offer a general frame that may be downscaled from EU to national or regional level.

ID364

PO157 - CLIMATE CHANGE AND THE IMPACT ON THE FINE FUELS MOISTURE CONTENT AFFECTING FOREST FIRE INTENSITY

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Climate change causes droughts decreasing the forest fuels moisture content and leading often to extreme forest fires. The objective of this study is to analyze and discuss the impact of the climate change in Portugal on the fine fuels moisture content and consequently in the frequency of extreme forest fires. A long series database of collected samples of fine fuel moisture content created by ADAI during the last few decades and historical meteorological data were analyzed. The days with very low fine fuel moisture content and high Fire Weather Index were identified. The results of this analysis were compared with the number of fires and burned areas in Portugal during the time period under analysis. The evolution of the annual frequency of occurrence of dangerous days with very low fine fuels moisture content was calculated. The results show an evident increase of this frequency during the last decades. This information will be useful for planning/preparation of the firefighting strategy and assessment of human and material resources needed.

ID380

PO137 - STATISTICAL MODELLING USING CATEGORICAL DATA FOR STUDYING RELATIONSHIP BETWEEN WILDFIRES AND FIELD PARAMETERS FOR CREATION OF FOREST FIRE RISK ZONATION

Sunil Chandra[1], Anoop Singh[1], Satyendra Kumar[1], Vikas Gusain[1]

[1]*Forest Survey of India*

A Forest Fire Risk Zonation is an effective tool for managing fires by prioritizing different risk areas. The present study have tried to use a Loglinear Modelling(LLM) approach to analyze the field variables tabulated as categorical data. While forest fire incidences have been treated as main variables, the causative factors have been identified as independent variables in the modelling. Analyzing the association among variables using a LLM approach, combinations of variables associated with wildfires have been identified using a good fit probability method. The identified factors having the best associations with wildfires include- forest species, altitude, aspect, slope, grazing incidences and biotic influence. While Digital Elevation Model(DEM) have been used for creation of altitude, slope and aspect, the layers for grazing incidences and biotic influence have been created using the ArcGIS tools. The forest species layer have been generated using multisource data and a Neural Network(NN) approach. The six identified layers based on LLM have been used in the spatial modeler for creation of Fire Risk Zonation Index(FRZI). An overlay of fire detections of the last 05 years on FRZI indicates a good agreement between FRZI and the past fire detections which are based on SNPP-VIIRS fire detections. From the results, it could be inferred that 35.48% of the total fire detections are in the very high and high risk areas which constitutes only 3.74% of geographical area. This is in good agreement with the model and provides a statistical approach for zonation of areas based on the risk factors.

ID389

PO132 - CHARACTERIZATION OF EXPOSURE TO AIR POLLUTANTS DURING FIREFIGHTING ACTIVITIES BY BIOMONITORING

Bela Barros[1], Ana Margarida Paiva[1], Marta Oliveira[1], Simone Morais[1]

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The aim of this study was to identify which pollutants have been biomonitored in the context of firefighting activities while discussing the available results and biological matrices used. Scientific literature published during the last 6 years was reviewed. The available data focused mainly on the biomonitoring of volatile organic compounds, heavy metals and metalloids, and several persistent organic pollutants (e.g., flame retardants, pesticides, dioxins/furans, phthalates, perfluoroalkyl substances). Generally, higher levels of the respective biomarkers of exposure were determined in the biological fluids of firefighters than in the general population and after firefighting activities. Urine was the most explored matrix followed by blood; exhaled breath and saliva were much less frequently evaluated. The obtained results show the importance of exposome characterization. However, recommended biological values set for occupational context are lacking for several pollutants, their persistence on the human body is also dependent on the complexity of exposures and metabolic interactions that might alter the biological pathways of these chemicals. As so, futures studies should aim to address these gaps to accelerate the implementation of mitigation strategies for health impacts.

Funding

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ID400

PP61 - LIGHTNING-INDUCED WILDFIRE IN BRAZILIAN CERRADO BIOME

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The Brazilian Cerrado is a biome adapted to the occurrence of natural fires; however, there are still gaps in the knowledge about the amount, behavior, and frequency of wildfires caused by lightning ignition. The objective of this study is to search for lightning-induced wildfires in Brazilian savannah-like Cerrado between 2015 to 2020. We search for the probable lightning candidates among all cloud-ground lightning strokes that occurred up to 72 h (3 days) before a fire detection and within 1 km of the ignition point detected for each active fire in remote sensing data, considering the location accuracy of both datasets. The results show that lightning candidates in the Cerrado represent only 0.2% of total active fires detected by the Visible Infrared Imaging Radiometer Suite (VIIRS) of the Suomi National Polar-orbiting Partnership (S-NPP) satellite, from 2015 to 2020. The results also address the electrical characteristics of the lightning candidates and explore the relationship between lightning-induced wildfires and aerosols. We conclude that the large number of fires detected over this period demonstrates that they are mostly of anthropic origin. Our results confirm that there is an urgent need to mitigate and develop strategies to manage and combat the impact of fire on society and ecosystems. These findings provide a useful tool to support local fire managers in decision-making regarding fire management and in identifying ignition sources of wildfires in protected areas.

ID437

PO152 - USING MACHINE LEARNING FOR SHORT-TERM WILDFIRE HAZARD ESTIMATION

Julia Gottfriedsen[1], Dmitry Rashkovetsky[1], Dominik Laux[1], Johanna Strebl[1], Max Helleis[1], Martin Langer[1]

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Forest fires are an increasingly unpredictable problem and have become more destructive in recent years. As a result of climate change, environmental parameters associated with forest fires are becoming increasingly unstable, which might lead to changing fire regimes in Europe and globally. This makes wildfire hazard assessment difficult. Reliable hazard models are needed for forest owners to deploy resources in vulnerable areas, governments to plan mitigation strategies, and insurance companies to be able to offer fair pricing.

We built a machine-learning based wildfire hazard model that infers fire susceptibility based on environmental conditions that led to fire in the past. It therefore learns from actual fire conditions.

We evaluate the ability of the model to correctly classify an impending fire using F1 Score and compare the results against selected standard fire hazard models such as FWI (Fire Weather Index). Compared to classical fire hazard models based on standardised parameters, this approach allows us to account for regional and atypical fire conditions.

Based on our thermal infrared satellite data, we are able to predict fire hazard up to 7 days in advance.

ID438

PO140 - USE OF COUPLED SIMULATIONS TO UNDERSTAND PYRO-CONVECTIVE ACTIVITY IN PORTUGAL

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[1]University Of Évora, [2]University of Corsica Pascal Paoli – SPE

Pyro-convective activity can have a significant impact on fire behaviour through feedback processes between the atmosphere and the fire. For example, the fire spread associated with extreme pyro-convective activity is currently highly unpredictable and difficult to suppress. The study is developed under the PyroC.pt project framework and aims to investigate how a wildfire can influence the occurrence of violent pyro-convective activity. The Meso-NH model has been configured into three nested domains with horizontal resolutions of 2000 m, 400 m and 80 m. The emission of heat and vapour into the atmosphere was made using the ForeFire model. Initial and lateral boundary conditions for the outer domain are provided by ECMWF analysis, with updates every 6 h. Such a configuration was applied for two mega fire events occurred in Portugal in 2017. The findings showed the benefits of the use of cloud-resolving models in order to assess the potential for dangerous fire conditions associated with pyro-convection. In the Pedrógão Grande mega fire event, for example, the violent fire-driven convection manifested as a PyroCumulonimbus cloud (PyroCb). The extreme pyro-convective activity was also verified in the simulation by the development of microbursts originated from the PyroCb cloud. The second case study showed a PyroCumulus cloud during the Quiaios wildfire. Besides an improved understanding of these events, the use of coupled simulations may be important in the future for fighting extreme fires if used in operational context.

ID473

PO141 - MAPPING OF ACTIVE FIRE FRONTS IN SENTINEL-2 IMAGES IN THE SERRA DO CIPO NATIONAL PARK - MG - BRAZIL

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[1]National Institute For Space Research (INPE), [2]Operations and Management Center of the Amazonian Protection System (CENSIPAM)

The availability of images from the Sentinel-2 satellites allows the generation of new products for monitoring active fire in vegetation. The Copernicus mission comprises two satellites in a lower orbit, enabling each satellite to have a 10-day repeat observation period, and when flown 180° apart, they achieve 5-day repeat coverage at the Equator and more frequent acquisitions in cloudless conditions, which results in 2-3 days at medium latitudes. The Sentinel-2 instrument is the multispectral imager (MSI) which has 13 spectral channels with differing spatial resolutions, including 10 image bands and 3 bands for calibration; it is possible to detect the active fire fronts and thus calculate the extent and speed of propagation of a forest fire. This study was carried out in the Serra do Cipó National Park - MG - Brazil from 28/09/2020 to 10/05/2020. Four images were used with tiling id 23KPU, which were processed based on the spectral bands RED, NIR, RED, EDGE and SWIR using the Google Engine platform to generate spectral indices and thus generate the final products. The data were compared with coordinates of active fire spots detected by the GOES-16, AQUA, TERRA, SNPP and NOAA-20 satellites confirming that the results effectively represent areas that are burning at the time of imaging. The results obtained can be used in processes to evaluate the maturity of other products, such as the Fire Spreading Model for the Brazilian Cerrado developed by UFMG and also in the improvement of the Fire Panel tool developed by CENSIPAM.

ID476

PO149 - FOREST FUELS MOISTURE CONTENT MONITORING AND ASSESSING THEIR BEHAVIOUR IN THE LIGHT OF NEW CLIMATIC CONDITIONS

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In Portugal, some of the climate risks with higher frequency and intensity are droughts and heat waves, which have a significant influence in forest fire danger and its effects.

One of the main factors determining fire danger is the forest fuel moisture content (FMC), thus its assessment allows to improve early warning systems and characterization of fire over extreme weather conditions.

Living and dead tree foliage and living shrub FMC measurements were carried out at different locations in Portugal from 2019 to 2022 under the scope of MCFIRE research program, creating a significant database that allowed an exhaustive knowledge of the relations between FMC, meteorological conditions, fire danger and forest fires occurrence.

Dead tree foliage and living shrub FMC modelling based on meteorological conditions was also performed from 2019 to 2022 and used in fire danger determination and comparation with the indexes of the Canadian Forest Fire Weather Index System (CFFWIS).

To reduce the costs of FMC measurements carried out in several places with standard methodologies, expedite methods for “in situ” and “in real time” measurement were also tested.

The use of 10 h fuel moisture stick can be used as an expedite method to FMC assessment when compared with the standard methodology.

The results of the present research program show that FMC is a good indicator of fire danger and fires occurrence at any meteorological conditions. FMC modelling allowed fire danger continuous determination and thus, the knowledge of other extreme conditions than the ones determined by the CFFWIS.

ID490

PO130 - CLIMATE CHANGE AND THE XINGU INDIGENOUS TERRITORY

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[1]Indigenous from the Mehinako people of the Xingu Indigenous Park and collaborator of PrevFogo/Ibama in Brazil

The study states that the increase in climate change in the Xingu Indigenous Park, located in the State of Mato Grosso, Brazil, has aggravated forest fires, mainly in the Amazon Forest of Alto Xingu. This region is inhabited by 16 indigenous peoples, of different ethnic groups, who maintain their culture, traditions and ways of life in balance with nature. However, rampant deforestation around the territory has changed the climate, fire behavior and the severity of forest fires. With each passing year, fires form wave-shaped scars within the Amazon rainforest that are visible in the field and on satellite images. The methodology is based on the perception of the indigenous author and active in the brigade and on data from PrevFogo/Ibama. During the last 4 years, there have been major forest fires in the Xingu Indigenous Park, specialists from PrevFogo/Ibama have monitored the severity of forest fires with field data, overflights for monitoring and analysis of satellite images. Such data indicate that the waves formed by fires are important to understand the behavior of fire in the following year. This destruction turns the Amazon Forest into a funeral and makes combats with speed that have been recorded in the territory difficult. In view of this, it is concluded that the situation of the Amazon Forest poses a challenge for the indigenous peoples of the region and especially for Brazilian specialists, the mission of how to control forest fires for the coming years.

ID5

PP17 - A COMPREHENSIVE HEALTH & SAFETY PROGRAM FOR WILDLAND FIREFIGHTERS

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Purpose and Aims

Our overarching goal was to develop and study a easy to use, comprehensive, feasible, cost effective safety, health and well-being program for wildland firefighters.

Relevance

Fire seasons are longer, with more and larger fires, placing increased demands and risks on all those fighting wildland fires. Those fighting wildfires in the U.S. alone include 15,000 Federal full-time and seasonal employees; 400,000 career firefighters involved in wildland urban (WUI) interface fires and deployed to fire camps; and the 800,000 volunteer firefighters, who comprise the majority of those protecting smaller, rural communities. This program addressed this high priority and improved the safety, health and well-being of those fighting wildland fires.

Methods

The three year project was a mixed methodology process at baseline and post intervention starting at year 1 with baseline survey and focus group interviews of 210 wildland firefighters across all regions of the U.S. In year two, we studied the 12 week intervention (sleep, nutrition for performance and chronic disease, supplements, stress, cancer, heart disease, respiratory issues, fitness, injury prevention and treatment, mental health for acute and chronic, fatigue, substance and tobacco use) in all settings of wildland fire suppression. Year 3 included post assessment with survey and focus group for outcome analyses.

Results and Conclusion

This program was feasible, relevant, and improved the safety, health and well-being of those involved in fighting wildland fires. A strategy for dissemination of this program is awaiting funding.

ID32

PP23 - KEY GOVERNANCE PRACTICES THAT FACILITATE THE USE OF REMOTE SENSING INFORMATION FOR FIRE MANAGEMENT IN SOUTHERN EUROPE

Ana Prados[1], Camila Rodriguez[2], Dan Green[2]

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The NASA Wildland Fire Management Program seeks to advance the use of NASA assets for integrated fire management and for living sustainably with fire. The program recognizes that to increase the effectiveness of remote sensing technologies, it is necessary to understand fire management challenges in their social context, including the role of various governance practices in the adoption of information derived from geospatial technologies.

To this end, in July 2022, NASA began a collaborative project with stakeholders in Spain and Portugal. The goal is to identify key governance practices that facilitate or hinder the translation of satellite-based fire science into decision making. Technology governance are the processes and decisions through which government and civil society shape the adoption of technology, and the way that technology shapes societies. Examples include data interoperability standards, rules regarding data security or open data; and also indirect and informal expectations driven by practice or culture.

The initial focus will be the 2022 summer season in southern Europe. Information will be collected from the literature and interviews with stakeholders. It is expected that the findings will increase the effectiveness of geospatial science in wildfire management by 1) providing a more holistic understanding of fire management and how remote sensing science fits into decision making 2) helping to prioritize scientific solutions that meet the needs of stakeholders and citizens in different social contexts, 3) establishing a baseline for the evaluation of future remote sensing projects and interventions, and 4) sharing of best governance practices among collaborators.

ID34

PP27 - MAPPING THE ROLES OF MULTIPLE STAKEHOLDERS IN FIRE MANAGEMENT IN GHANA'S FOREST AND TRANSITION LANDSCAPE

Isaac Nunoo[1], Mercy Owusu Ansah, Joseph Asante, Eric Osei, **Boakye Twumasi-Ankrah**

[1]*Tropenbos Ghana*

Wildfire is one of the most frequent disturbances in Ghana's forest and transition landscape, particularly during the dry season. A large portion of the forest and farm fires were started by human activity, such as careless fires. The objective of the study is, therefore, to map multi-stakeholder roles in fire management. Fourteen actors were identified and interviewed to determine their roles and network with each other. These stakeholders were government agency officials, non-governmental organizations, and community members. Data were collected from twelve villages within the forest and transition landscape. The Social Network Analysis was used to determine the roles and relationships among the various actors. The results from the actors revealed that fires were mainly caused by community activities. The study also revealed that governments lack the logistics to monitor and enforce laws against people who cause forest fires deliberately or unintentionally. The network density was more than 50%. The strength of the relationship was all about the high confidence to reduce fire occurrence among the fourteen actors. A stakeholder like the Ghana National Fire Service should strengthen its authority to enforce public policy and involve all actors to contribute to mitigating fire within the landscape. Authorities within the forest and transition landscape responsible for fire should work closely together to implement a cooperation agreement to reduce forest and farm fires.

ID42

PP16 - ASSESEMENT OF FOREST FIRE VIDEO MONITORING AND SURVEILANCE SYSTEM OPERATORS ATTENTION FROM EEG SIGNAL

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Fire monitoring aimed at early detection is a crucial measure for forest fire management and minimizing hazardous consequences. Video monitoring and surveillance is considered a prominent technical solution for detecting fire in early stage. The focus of the person operating the video system (operator) and responding to fires is, however, vital to prevent danger. In the course of long operations, the attention and meditation of the operators interchange.

In order to incorporate efficient response it is necessary to identify the operator's state of meditation to expand their attention span. In this paper, two objectives are stated. The first is to ascertain the subject's level of concentration and mental condition over long periods of operating video system. The second is to determine the amount of time that passes between fire occurrence, fire recognition by the operator and the reaction.

In order to achieve that, real-time EEG signals were recorded using the Macrotellect BrainLink Lite V2.0. Research involves several experiments conducted with individuals watching video footage of forest fires on one or several monitors. From the experiments we collected a data set of EEG signal and experiment details.

Exploratory data analysis of the collected data shows how the attention and meditation interchange during the period of monitoring. Algorithms to identify fire recognition from raw EEG signal are developed. Average elapsed time for fire confirmation is measured longer in case the subject is in meditation phase. Future work will aim to incorporate external attention triggers in high fire risk periods.

ID65

PO05 - FIRE RISK ANALYSIS IN PORTUGUESE COMMUNITY FORESTS AND THE SEARCH FOR EFFECTIVE SOLUTIONS FOR ITS REDUCTION

Iryna Skulska Kolos[1], Cristina Montiel[2], Francisco Castro Rego[1], Maria do Loreto Monteiro[1], Renata Pacheco[1], Inês Duarte[1], Catarina Sequeira[1], Vanda Acácio[1], Conceição Colaço[1]

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Since the middle of the 20th century, forest fires have significantly increased their impact on Portuguese ecosystems, climate, and land use. Along with demographic and socio-economic changes, wildfire risk is worsening as extreme events are becoming more frequent and intense. Such was the case of the Portuguese wildfires of 2017, which occurred in areas largely occupied by community forests (known as baldios). It was the largest pyro-convective phenomenon ever recorded, underlining the urgency of studying wildfire risk and finding sustainable management systems to reduce it in baldios.

This study was developed in two parts. In the first part, we studied the possible influence of the ownership type and governance modalities in Portuguese forest areas on fire risk. In the second part, within the scope of the SAFER-LAND research project, a baldio fire risk map was developed at the national scale for its later analysis with managers of baldios clusters (a new landscape-scale baldios' governance model).

The results show that the largest area burned in the last four decades is located in the baldios, but its size is not related to the management system but rather to the property type. The developed national map indicates that the areas with the highest fire risk are in the north of Portugal.

Throughout SAFER-LAND project the results will be discussed with baldios stakeholders in the search to reduce the fire risk, making the exploitation of their resources more productive and resilient.

ID99

PP18 - WHERE ARE THE WOMEN IN BRAZIL'S FIRE MANAGEMENT SCENARIO? WORKING TOWARDS GENDER EQUITY IN FIRE RISK GOVERNANCE

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Women make up more than half of Brazil's population and account for 47 million (~50%) of the labor market. Despite these numbers, women are still underrepresented in many sectors including in Integrated Fire Management (IFM). Historically, women participate less in courses and training related to IFM. They also occupy fewer leadership and field-based positions as wildland fire brigade coordination. Although gender equity in IFM is recognized, in Brazil this debate is still informal and poorly documented. Gender equity means that women and men are treated fairly according to their respective needs. Our study aimed to present the current situation of the role, participation, and empowerment of women in Brazil's IFM scenario. We used 17 semi-structured interviews (11 women, 6 men), 17 on-line surveys (298 respondents) and documental analysis to generate data analyzed using classical content analysis. Findings suggest that there is consensus among the people interviewed that women bring different perspectives and knowledge to IFM approaches and strategies. However, social norms; gender-based discrimination; representativeness and institutional and organizational factors impede or undermine empowerment and the increase in the number of women in IFM. We recommend three areas of intervention that bring together key themes and actions for diversity, inclusion and gender equity: Increase visibility and empowerment of women; Promote training and continuing education; and Strengthen networks of dialogue and exchanges of experiences. However, these efforts can only be implemented and expanded with cooperation among institutions, in partnership with government, organized civil society, and traditional communities.

ID141

PP24 - CO-CREATING ADAPTATION PATHWAYS TO WILDLAND FIRE IN CATALONIA

Kathleen Uyttewaal[1,2], Núria Prat Guitart[1], Lisa Langer[3], Fulco Ludwig[2], Carolien Kroeze[2]

[1]Pau Costa Foundation, [2]Wageningen University & Research, [3]Scion

Wildland fire risk is increasing due to social and climate change in the Mediterranean. Transdisciplinary strategies that support adaptive and transformational action on the landscape scale are necessary to address arising uncertainties, and to bridge gaps between top down and bottom-up approaches to fire risk reduction.

Objectives: In the semi-rural area of the Montseny massif in Catalonia, Spain, we co-created adaptation pathways to reduce wildland fire risk. We collaborated with agents of change like fire managers, local administrators, sustainable farmers and foresters, researchers, education and tourism sectors, and local knowledge holders. We aimed to leverage local knowledge as a strategic tool for adaptation, and we created space for social learning and amplifying networks between sectors.

Results: Through 3 facilitated workshops, participants created a suite of pathways to address this complex issue. The process considered past changes in the landscape, present challenges and future values in a changing climate. Results demonstrated a high awareness of intersecting climate and social issues, pointed toward “soft” approaches for fire risk reduction as a product of sustainable local development, and amplified social networks between participants.

Conclusions: This method shows promise for making wildland fire prevention actions relevant and beneficial for local communities. Diverse participants could recognize shared agendas and consider feasible changes on local scales despite administrative limits. This process allowed participants to visualize practical short-term actions while considering long term transformation under the context of climate change. Sustained facilitation, participant involvement and funding could help enact elements of these pathways in the future.

ID172

PO09 - EFFORTS TO REORGANIZE LANDSCAPE FIRE MANAGEMENT IN GREECE FOLLOWING RECENT MAJOR DISASTERS

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The two disastrous fire seasons of 2018 and 2021 in Greece, quite different from each other but both very disturbing, led to governmental initiatives for revisiting the organization of wildfire management in Greece. The work presented here constitutes the narrative of the situation by members of the independent Committee on Perspectives of Landscape Fire Management in Greece, appointed by the Greek government in 2018, to investigate the underlying reasons for increasing landscape fire problems in the country and propose future-oriented solutions. The paper refers to the conclusions of the report submitted by the independent Committee to the Greek government in 2019, which came back to the public attention following the destructive fire season of 2021, when the reorganization of wildfire management was considered as a sine-qua-non, based on the experiences of the last five years. We present in some detail the list of changes touted by the government. Still, we highlight potential shortcomings and pitfalls, as evidenced by the evolution of the 2022 fire season. Fire statistics and some financial data are used to support the assessments. Finally, the paper offers an outlook for the future under various policy scenarios. It proposes how the situation can improve in the next few years and in the long term.

ID178

PO06 - TRADITIONAL BURNING FROM EXPERTS AND RURAL COMMUNITIES' PERSPECTIVE: EXPLORING BOTH MENTAL MODELS TO FOSTER AN EFFECTIVE RISK COMMUNICATION

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Despite being culturally widespread, traditional burning has been associated with rural fire ignition and severe ecological and socioeconomic impacts. Due to the risks posed by climate change, rural abandonment, and fuel accumulation, it is important to foster effective risk communication on this topic, particularly in fire-prone countries, such as Portugal. This study aims to evaluate the expert's and rural communities' risk perception of traditional burning to build effective risk communication strategies to address the challenges of this practice in the Portuguese context. A mental model approach was applied involving more than 50 actors from the academy, public entities, third sector, industry, and community. From the comparison between two different perspectives (expert vs. rural population) and with the support of thematic analyses, this study identified gaps of knowledge, mistaken beliefs, and the most relevant factors to be communicated. The findings revealed that rural communities lack knowledge about the waste of firefighting resources due to false alarms and the preference for offline communication means with associated costs, despite an online platform being available for free. Still, some prefer not to communicate their burnings. Thus, there is a need to inform the importance of prior communicating and to inform about the associated risk involved, namely as opportunities windows to perform traditional burnings are changing due to climate change. The study offers a baseline to support stakeholders and policymakers design new risk communication strategies to prevent risks and hazards associated with traditional burning and mitigate socioeconomic and environmental impacts.

ID184

PO07 - TRIBAL CONSULTING BEFORE AND DURING AN INCIDENT: CHANGE WITHIN THE US GOVERNMENT IS HAPPENING BUT MORE NEEDS TO BE DONE.

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Deep ancestral and traditional connections tie many Native Nations to the federal Government's public lands. Both physically and legally, Indian tribes have been removed from the landscapes they occupied since time Immoral1. Since their removal, the US Government has discounted Tribal knowledge of the land and implemented laws and policies that affect Tribes without input from them. Nowhere has this been more critical than in the management of wildfire incidents on Tribal lands.

Climate change continues to make wildfire more intense and the damage to natural resources are at levels never seen in our lifetime. Indigenous communities in the Pacific West of North America have long depended on fire to steward their environments; until recently they had no voice to provide input or expertise regarding mitigation of and response to wildfire on Trust and scared lands.

During my presentation I will provide the history of wildfire on Tribal lands, discuss recent accomplishments in recognizing the mutual interests that Tribes and the Government must communicate and collaborate on wildfire issues, and detail polices presented at the White House Tribal Nations summit that will enhance Tribal participation that could result in increased mitigation efforts to wildfire management in the US.

This presentation will help highlight the checkered past, discuss the new policies and respect giving to the Tribes, and share ways we can move forward to have better coordination and collaboration with Tribes allowing them to have a voice in mitigation and response decisions of wildland fire in the US.

ID242

PO04 - ENGAGING COMMUNITIES THROUGH ARTS: COMMUNAL THEATRE AS A PARTICIPATORY TOOL TO IMPROVE WILDFIRE RISK REDUCTION AND READINESS.

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European history reveals a strong human relationship and dependency with fire, but a lot of that historical relationship is lost today. Extreme wildfires represent a major social issue. In the last decades, wildfires have become more severe, threatening human lives and nature. Communities need to became fire adapted – again - meaning that they need to learn to live with fire in the traditional ways which European society used to live with it and manage fire. Innovative approaches are needed to create engagement between communities, professionals and governments. The use of art-based methods, such as communal theatre, is shown to be a promising avenue.

In 2021, a communal theatre project directed at wildfires prevention, supported by the Portuguese Government, run in eight municipalities of Central Region of Portugal. To evaluate its effects and potential for behavioral change and community engagement, 450 questionnaires and eight interviews with community stakeholders were collected.

The positive appreciation of the play, among the public and stakeholders of the communities involved, along with an increase of internal and external exchanges, suggest that communal theatre can be an effective medium for promoting positive cognitive, attitudinal and behavioral change and engagement. This set of results suggest that communal theatre can be an efficient tool to integrate programs for wildfire risk reduction and readiness.

This study is part of a larger research program where different art-based tools, such as Forum Theatre and Photovoice, have been explored for the increase of the adaptative capacity of the communities in facing the wildfires.

ID251

PO02 - STAKEHOLDER AND SOCIAL NETWORK ANALYSIS FOR UNDERSTANDING FOREST (FIRES) MANAGEMENT – A CONTRIBUTION BASED ON A SYSTEMATIC LITERATURE REVIEW

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[1]University Of Aveiro

Finding strategies and measures to prevent and mitigate rural fires is at the top of the socio-political agendas in Portugal. This is due to the recurrence and intensity of rural wildfires, but also to constraints related to the management system of rural fires, which is based upon multiple organizations, structures, and stakeholders, probably enhancing tensions, conflicts, and poor communication, which could narrow a successful operationalization of fire management policies.

Stakeholder analysis (SA) is a tool that can help to understand and cope with those limitations. Its application enables the understanding of a complex system, including the relevant actors, their goals, interests, plans, influence levels, resources, behavior, and interrelations. Considering the limits of SA methods in determining the role of communication networks and understanding the patterns of interaction, Social Network Analysis (SNA) is an essential tool for assessing the relationships amongst actors, their positions within a network, and the drivers of the different interactions.

In this vein, a systematic literature review was conducted to explore how SA and SNA have been addressed by European studies regarding forests and, particularly, wildfires. The focus was to unveil the most analyzed topics, the main research aims, and the reasons behind the use of the different approaches. Through that, key lessons from case studies were extracted to find limitations and to provide contributions to guide future research, especially regarding its relevance for the analysis of the Portuguese context.

ID283

PP14 - WILDFIRE POLICIES ACROSS COUNTRIES: IDENTIFYING GOALS, INSTRUMENTS, AND IMPLEMENTING ACTORS

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Wildfires and societies have co-evolved during millenia, with fire being a cost-effective management tool. However, in recent decades, unprecedented wildfire seasons have disrupted the coupled human and natural system due both to climate conditions and inadequate policies, mostly targeting fire exclusion and emergency suppression rather than proactive mitigation measures. Policy development can be influenced by different factors, including the salience of an issue, the policy system as well as the domestic capacities. Hence, the aim of this study is to analyze how the development status, issue importance, and policy system influence the resulting wildfire policies in selected countries of Europe and South America. In order to identify the fire policy issues a bottom-up document and media content analysis was conducted in the selected countries. Data was obtained from nationally distributed newspapers as well as professional journals, regulations, programs, and parliamentary interventions within a specified time period. Simultaneously, actors, policy goals, and instruments were tagged to obtain a baseline sample. Actors and policy instruments were identyfied and characterized according to a proposed classification system. Data was analysed using social network analysis in order to identify actors and its power. Countries were compared with issue salience, policy system and the countries´ capabilities as explanatory conditions. Our results showed that the socio-economic as well as socio-political conditions identified, influence the resulting wildfires policies.

ID284

PP22 - PARTICIPATIVE METHODOLOGIES TO DESIGN PUBLIC POLICIES TOWARDS ENERGY TRANSITION: THE CASE OF THERMAL ENERGY WITH FOREST BIOMASS

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[1]*ISEG - Lisbon School of Economics and Management*

The use of biomass for energy purposes has been increasingly introduced into the public discussion as one of the strategies for reducing fossil fuel use and for decarbonization. In Portugal, after the implementation of the National Plan for the Defense of Forests Against Fires, the debate on the use of biomass extended to the impacts of reducing the fuel load on forests and fire prevention. One of the main concerns surrounding the use of biomass in this context relates to overexploitation and other harmful forest management practices and their impacts on soils and forest biodiversity.

The study "Contextualization and Operationalization of Small Biomass Plants" implemented a methodology that sought to promote the participation of local and regional entities in the analysis of the installation of small biomass plants in municipal buildings and collecting recommendations for future public policy. The study included surveys, visits, semi-structured interviews, work meetings/workshops with experts and different stakeholders, focus groups, and discussion of results with experts focusing on how energy production with biomass should be implemented, believing that this will impact the development of future projects.

We found that contributions by local technicians and specialists tended to focus on operationality, considering their specific context and that interviews and focus groups were central to an adequate characterization of the local forestry, given that local actors know it in detail and do not always correspond to official surveys or databases, as well as learning about the difficulties felt by the reduced municipal teams while carrying out their tasks.

ID343

PO08 - STAKEHOLDER ENGAGEMENT IN THE DEFINITION OF RESILIENT STRATEGIES TO DEAL WITH CLIMATE CHANGE: FORES PROJECT APPROACH

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Facing the current challenge of forest resilience to climate change demands finding and implementing alternative and creative options for forest management. FoRES project aims to contribute to this transition, by designing and testing alternative nature-based forest management strategies to determine those that strengthen climate change adaptation by promoting forest areas' resilience, responsiveness, and adaptation to expected future climate change. But the implementation of such alternatives hugely relies on the awareness, understanding, and capacitation of local stakeholders for this change.

The FoRES project foresees the engagement of local and regional stakeholders, targeting the case study of ZIF Baixa Lombada, in the northeastern part of Portugal. The participatory approach is designed in four stages and will be implemented in 18 months. After identifying the relevant stakeholders and understanding the study area context (e.g. current socio-economic and biophysical state of the area, current, and future policies), two workshops and two field events will be organized. The first participatory workshop aims to identify the local stakeholders' main objectives and priorities for the area, considering several aspects such as economic return, fire risk, and topographical and climate conditions. This information will feed the scenario production. The second workshop will present and reflect with the stakeholders on the results of fire simulation for three forest management scenarios, generating a discussion about critical situations, best options, and barriers to adoption.

ID347

PP20 - SOCIAL VULNERABILITY AND WILDFIRE OCCURRENCE IN THE CONTERMINOUS US (1984-2018): CONSIDERATIONS FOR RISK MANAGEMENT

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[1]USDA Forest Service, Northern Research Station

Objectives

Wildfire is increasing in frequency, extent, and severity in many parts of the United States. Considering the unequal burden of natural hazards on socially vulnerable populations, we use Census data to look at how characteristics of social vulnerability are associated with wildfire occurrence, nationwide and regionally, 1984-2018. We then consider additional data to further examine facets or types of social vulnerability.

Methods

To answer the question about social vulnerability and wildfire occurrence, we first identified all non-urban census tracts in the United States that have experienced a wildfire since 1984. Using 26 different measures of vulnerability, we compared these tracts to non-urban census tracts that have not experienced a wildfire.

Results

We find notable social vulnerabilities in areas that have experienced wildfire, including higher unemployment and economic considerations, as well as higher proportion of people living in mobile homes. These associations are robust across regions, and throughout areas that experience wildfires, from rural to wildland-urban interface settings. Some traditional markers of vulnerability—i.e., not owning a car, renting a home—were less prevalent in wildfire affected areas. We therefore considered additional variables on housing and wildfire-related infrastructure, generating vulnerability typologies specific to wildfire.

Conclusions

Whereas previous studies about social vulnerability to wildfire focus on associations with wildfire hazard potential or concentrate on a single region, this study fills a knowledge gap by examining the relationship between social vulnerability and wildfire occurrence nationwide, and then further considering types of social vulnerability, which can be linked to management actions.

ID348

PP25 - BUILDING BRIDGES FOR PREVENTION AND TIMELY RESPONSE TO FOREST FIRESIN GUARAYOS REGION, BOLIVIA

Karen Mendoza[1], Laurenz Romero[1], Juan Pablo Baldiviezo[1], Nataly Ascarrunz[1]

[1]*Instituto Boliviano De Investigacion Forestal*

This report findings from implementing an inclusive approach to improving fire management in rural Bolivia, in a territory that suffers from a complex political, economic and social scenario. Disputes over access to land and natural resources have agroindustrial and forestry development models at the center of conflicts, and this is reflected in poor responses to forest fire risk reduction. It was considered that only by bringing different authorities and local stakeholders together could generating conditions for wildfire prevention and timely responses when they do occur. To this end, spaces for dialogue between local actors were established, includingthe municipal governments of Ascensión de Guarayos and Urubichá. Technical assistance was also provided for the participatory planning and management tools for use by local government, with increased competencies in risk management; generation and access to information for reflection and action. The implementation of these strategies has resulted in improved response capacity of stakeholders, and the development of Municipal Early Warning Systems. These are managed as operational bodies that include community risk managers, forest fire departments and civil society, the latter being essential in early wildfire response, and thus to the reduction of fire damage. Capacity strengthening of local actors and promotion of social cohesion favour the implementation of actions that contribute to reducing the risk of forest fires. These efforts are being sustained by municipal governments and indigenous communities, though the challenge remains to generate interest with and commitment from livestock producers, migrant farming communities and agroindustrial companies.

ID355

PO161 - TRADE-OFFS IN FOREST MANAGEMENT FOR FIRE PREVENTION

Kevin Cianfaglione[1], Silvano Landi, Bartolomeo Schirone, Alessandro Bottacci, Camilla Wellstein, Tessa Oliver, Giovanni Damiani

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Wildfires in the Mediterranean area are largely caused by humans and influenced by weather conditions. Their intensity and spread moreover depends also on the type of landcover, land-use and vegetation. Recent studies support the idea that thinning of the forest and removal of the undergrowth reduce wildfire risk. However, a simplistic theoretical idea such as "the less biomass is available and the lower the possibility of combustion" does not match the complexity of the forest ecosystems. For example, a crude removal that is not adjusted to the particular ecosystem can damage the forest system, since the action undermines dynamics and peculiar characteristics of that system, which in case of a natural forest would be strikingly distinguished from a forest agricultural system.

Because forests play a large economic role, we believe more attention, funding and policies should be paid to manage them properly with regards to wildfire management

We report the case study of a coastal pine forest located in Pescara (central Italy), recently burned, to analyze in a wide way this problem. Likewise, the weaknesses and errors of the intervention projects aimed at reducing the risk of fire in other case study pine forests, in coastal and in mountain, are examined. Discussions are corroborated on the basis of historical analysis of the main fires that have occurred in Italy in recent years and on ecological considerations. We are suggesting several improvements, and possible alternative solutions that could be adopted in the comparable environments.

ID412

PO03 - INDIGENOUS IDENTITY AND FOREST FIRE FIGHTERS IN THE MONARCH BUTTERFLY REGION, MEXICO

Erika Garduño-Mendoza[1], Diego Rafael Perez Salicrup

[1]*IIES-UNAM*

In the central west of Mexico, the protected natural area, Reserve of the Biosphere of the Monarch Butterfly is located; place that houses the migratory phenomenon of the monarch butterfly, and where the conservation of the cloud forest of Montaña, are essential to preserve this natural phenomenon. Forest fires in the region are attended to by official brigades (CONAFOR, CONANP, COFOM), these brigades are made up of some people belonging to the Mazahua and Otomí indigenous peoples. The objective of this research was to document how the indigenous identity of forest fire fighters influences decision-making and the techniques used for fire management in the region. Twenty interviews were conducted using the life history method to record the ancestral knowledge of the combatants, Mazahuas and Otomi of the ANP region. It is described how from childhood these forest fighters learned to use fire, and they use techniques such as the management of forest fuels, controlled burning, fire breaks and backfires. It is described how knowledge of the territory and decision-making from the indigenous identity is part of the collective construction for the indigenous people.

ID429

PO01 - USING STAKEHOLDER-DERIVED FOREST MANAGEMENT PREFERENCE MAPS TO MODEL THE EFFECT OF FOREST MANAGEMENT STRATEGIES ON MITIGATING FOREST FIRE.

Bushra Sanira Asif[1,2], Umberto Pernice[2], Paolo Fiorucci[2], Nicolò Perello[1,2]

[1]*University of Genoa,* [2]*CIMA Research Foundation*

Forest management is used to modify forest structure and composition to improve fire resilience and reduce damages from fires. The scientific literature recognizes the importance of incorporating stakeholders' knowledge and the active role of local communities to enhance and strengthen adaptive capacities to fire risk management. However, the research in this area seems to be still at the initial stage, and this gap needs to be addressed through actions that value the knowledge and voices of stakeholders and local communities. Participatory approaches need to be further developed to make community/stakeholders' involvement in fire risk areas a central aspect of the forest fire issue. This research aims to contribute to this gap by sharing the process with the application of participatory mapping GIS involving forest stakeholders in a forest fire risk area in Liguria, Italy. This study will investigate local community preferences for forest management through focus groups, interviews, and questionnaires. Respondents will express their views on forest management techniques for reducing fire damage through open-ended questions and public participation geographic information systems (PPGIS) mapping exercises. Emergent themes from the PPGIS exercise will be used to form alternative management scenarios to explore the usefulness of using PPGIS for generating inputs for a forest management modelling that can be customized to local preferences to reduce damages from the forest fire and to evaluate the costs and benefits of these actions. We expect that the stakeholders should be persuaded to engage more in forest management through this research to improve forest resilience.

ID472

PP19 - VOLUNTEER AND COMMUNITY BRIGADES: EXPERIENCES FROM THE 1ST MEETING OF BEST PRACTICES IN VOLUNTEERING IN PROTECTED AREAS IN BRAZIL

Helaine Saraiva Matos[1], **Angela Pellin**[2], Jayleen Vera[1], Suelene Couto[1], Marcelo Siqueira de Oliveira[1]

[1]U.S. Forest Service International Programs, [2]IPÊ - Instituto de Pesquisas Ecológicas

The First Meeting of Best Practices in Volunteering in Protected Areas, was held virtually on October 20 and 21, 2021 in Brazil, by IPÊ - Instituto de Pesquisas Ecológicas, in partnership with the United States Forest Service and GIZ, the German development agency. The event brought together an unprecedented working group dedicated to discussing the experiences of Volunteer and Community Brigades. Among the 42 experiences submitted to the event, six on this topic were selected. The objective of this work is to present the results of the discussions promoted by the working group, as well as the consequences of the event. From the presentations and reflections carried out, some needs were highlighted, such as: the incorporation of the concept of integrated fire management (IFM), guarantee of security and minimum structure for its performance, provision of training, establishment of partnership networks and expansion of the recognition and appreciation of these groups. In 2022, as a result of the reflections of the meeting, was published the book: Conservation Dialogues: Good Practices in Volunteering in Conservation Units. In addition, a workshop was held with key actors who have an interface with the theme, to establish priorities for action, which resulted in the construction of a Project aimed at the elaboration of a federal strategy for volunteering in the IFM in Brazil, in partnership with public institutions that manage forest fires in protected areas, and supporting partners.

ID493

PP26 - INDIGENOUS WOMEN IN THE CONSERVATION OF ANCESTRAL KNOWLEDGE OF FOREST FIRE IN MICHOACÁN, MEXICO.

Erika Garduño-Mendoza[1], Diego Rafael Perez Salicrup

[1]**lies-unam**

Indigenous women belonging to the Mazahuas and Otomí peoples preserve the ancestral knowledge of the use of fire in agroforestry activities in the region of the Monarch Butterfly Biosphere Reserve in Mexico. The objective of this study was to document the knowledge of forest fire by indigenous women, how, when and why they use fire in field activities, beyond the knowledge and spiritual meaning that fire has in the worldview of indigenous culture. . Twenty-eight interviews were conducted using the life history method to record the ancestral knowledge of the women. The interviewees have an age range of 15 to 105 years. The results obtained were life histories, with the description and temporality of the use of fire within agroforestry activities, such as the preparation of the land for harvesting, management of forest fuels, arrangement of woody material, to mention some of the activities. They also participate in reforestation and fighting forest fires in their communities.

ID510

PP15 - INSTITUTIONAL ARRANGEMENTS LED BY CIVIL SOCIETY ORGANIZATIONS THAT CONTRIBUTE TO FIRE PROTECTION AND FIRE MANAGEMENT IN MEXICO.

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[1]*Fondo Mexicano Para La Conservación De La Naturaleza*

For more than 15 years, Fondo Mexicano para la Conservación de la Naturaleza (FMCN), through its Fire Management and Restoration Fund, has financed and supported projects aimed at strengthening the capacities civil society organizations (CSO) and rural and indigenous communities in the prevention and protection against forest fires, fire management and restoration of areas affected by fire in priority federal Natural Protected Areas (NPA) and zones of influence.

Through open calls for proposals directed to CSOs, FMCN selects the best projects with participation of independent experts. Many of these projects have enabled the establishment of medium and long-term processes that are fulfilling a crucial role by acting as a bridge between scientific, technical and traditional knowledge, as well as a facilitator in the communication, coordination, and organization processes among local groups, government agencies, academic institutions, civil society, NPA management teams, and community volunteers to improve local preparedness to prevent and manage wildfires.

This article will discuss the strategic advances in governance models that have resulted from the implementation of some projects financed by FMCN, the main lessons learned and the key success factors for the construction of improvement processes regarding the participation and commitment of local groups, CSOs, academic institutions and government agencies to achieve the professionalized community brigades; the management of incidents at the local level; the establishment of infrastructure; the development and implementation of fire management planning; and the generation, recovery and transfer of traditional and new knowledge on the behavior and effects of fire in Mexico.

ID523

PP21 - (RN21) – PROMOTING NATURAL RESIN TO IMPROVE FOREST RESILIENCE

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Rural abandonment is one of the greatest challenges for Europe in the upcoming years, with several European areas already facing demographic decline. Rural areas provide multiple services to the community, from food supplies to ecosystem services, that could be at risk with abandonment. Since the twentieth century, rural areas have experienced progressive abandonment mostly due to socioeconomic changes, with direct and indirect effects on forest disturbance regimes. Land abandonment triggers ecological processes at the landscape scale, altering land cover patterns and vegetation communities, which in turn affect disturbance regimes. The main result of land abandonment is commonly an uncontrolled colonization by woody vegetation in the abandoned areas that leads to the establishment of shrublands, woodlands or forests. This uncontrolled colonization leads to a substantial increase in fuel that associated with a dry environment creates the perfect conditions for wildfire.

The regions more affected by population abandonment in Portugal are the interior north and center, regions dominated by maritime pine (Pinus pinaster Aiton), a forest species traditionally used for resin extraction. In the 1970s Portugal was the third world producer of natural resin, but since then production has significantly decreased. Although production decreased, natural resin transformation is an expanding industry, with a net worth of 179,2 million €, 86% of which are exports. The Integrated Project RN21, Innovation in the Natural Resin Sector to Improve Portuguese Bioeconomy, aggregates all the Portuguese natural resin transformation industry in a never-before-seen joint effort to promote the sector. Funded by the Portuguese Recovery and Resilience Plan, RN21 aims to revitalize the Portuguese natural resin sector. The Project is focused on three pillars: Pilar I – Promotion of national natural resin production; Pilar II - Strengthening the sustainability of the transformation industry; and Pilar III - Positive differentiation of natural resin and derived products. By involving all the of the sector key stakeholders in a multidisciplinary approach to natural resin, we aim to boost the sector, to create jobs in rural areas and to increase the human presence in the forest, potentially decreasing fire frequency and intensity, while promoting the resin transformation industry.

Acknowledgments: RN21 is co-financed by Component 12 - Promoting Sustainable Bioeconomy, integrated in the Climate Transition Dimension of the Portuguese Recovery and Resilience Plan under the European Union (EU) Recovery and Resilience Mechanism, framed within the Next Generation EU, for the period 2021 - 2026.

ID64

PO121 - ASSESSMENT OF THE IMPACT OF BIOMASS MANAGEMENT ON FIRE PREVENTION AT PROENÇA-A-NOVA, PORTUGAL

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Wildfires' occurrence, frequency, and behaviour have varied greatly over time and space. In the 21st century, climate change is expected to trigger more intense wildfires with severe environmental and economic consequences, this is particularly important for Portugal, where in recent decades, due to several socio-economic changes, the accumulation of fuel in rural areas has significantly increased. Forest fuel management by removing biomass is known to reduce the risk of wildfires. Increasing the cost-effectiveness of fuel management should be a strategic issue to be achieved. However, only in rare cases do the benefits outweigh the costs of biomass harvesting, especially when it comes to compulsory roadside clearing. One of the goals of the Value2Prevent project is to explore new solutions that might add value to biomass management by reducing the costs for owners of the land on which these roadsides are located.

We quantified shrub biomass and assessed wildfire hazard along six roadside study sites in Proença-a-Nova. Cistus ladanifer, Rosmarinus officinalis, and Lavandula stoechas, are abundant species in the study area, and rich in essential oils which can be used in the perfume industry or as protectors of wood-based products, thus adding value to biomass removal.

This new income will allow a more frequent biomass reduction by private owners reducing their expenses.

ID100

PP105 - FIRSTINDIGE NOUS WOMEN VOLUNTEER WILDLAND FIRE BRIGADE IN BRAZIL: FROM SPECTATORS TO EFFECTIVE AGENTS OF INTEGRATED FIRE MANAGEMENT

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Greater efforts to include both indigenous communities and women in integrated fire management can bring insights to integrated fire management. However, women are commonly discriminated against in the hypermasculine culture documented within wildfire management. We sought to present the case of the Xerente indigenous women working as volunteer firefighters in a savanna ecosystem transitioning to the Amazon rainforest. 2021, twenty-nine women created the first women-only indigenous volunteer wildland fire brigade prompting a landmark for all indigenous women in Brazil. Based on a singular case study design, we collected data from in-depth interviews, document analysis, and participant observation. We found that fire management training and new technical skills acquired led the Xerente women to go beyond fire suppression within the Xerente Indigenous Land in Brazil. The Xerente women became effective agents in climate action strategies, particularly those related to environmental education connecting efforts of Prevfogo/Ibama with the understanding of the villages about integrated fire management. Also, these women were crucial to implement restoration activities and strengthen food security as they collected seeds and produced local plant seedling species. Implications of this case include pioneer initiative in the Brazilian context in shifting gender roles in a male-dominant strategy to mitigate and suppress wildfire; working closely with male allies, the Xerente women also secured fire management tools and equipment to perform their tasks; and the Xerente women can serve as role models for other indigenous women claiming space for their voices and recognized actions on climate change mitigation and adaptation.

ID157

PO117 - FROM MANAGING THE FIRE TOWARDS GOVERNING THE SYSTEM: FACILITATING COEXISTENCE WITH WILDFIRES IN CYPRUS

Judith Kirschner[1]

[1]*European University Cyprus – Pyrolife*

There is a broad consensus about the need for a paradigm change in wildfire management. While some recommendations exist, practical steps of fitting management changes within overarching governance systems and different local cultural-ecological contexts remain unclear. Here, we examine the case of Cyprus, a fire-prone Mediterranean country facing challenges to living with wildfires in the light of ongoing climatic and socio-economic changes. Our aim is to explore how recommended changes in wildfire risk management can be implemented through systemic governance interventions. We use secondary literature and interviews to examine the potential for governance interventions on multiple scales, and targeting a range of stakeholders within and beyond responsible government agencies. Preliminary results suggest a high potential to achieve transformational change in wildfire risk management. Governance interventions aiming for adaptive, collaborative, and polycentric wildfire governance settings could facilitate the paradigm shift from responding to wildfires as a civil protection emergency, towards anticipating and coexisting with wildfires.

ID159

PP104 - EDUCATION FOR COMMUNITIES AND LOCAL ADMINISTRATIONS. INTRODUCING AND UNDERSTANDING A CIRCULAR MODEL ABOUT HOW TO LIVE WITH FIRE.

Felipe Alarcon[1], Herbert Haltenhoff[1]

[1]*WildfireFT*

Objective

To introduce a proposal under a circular model involving a permanent and constant process focusing in education and considering then intervention, prevention and emergency response, engaging three big groups: communities, local administrations and responder groups, everything under a common climate denominator.

Method

Open methodology with a generic composition ready to homologate and implement anywhere with the local and current situation, offering a clear pathway for stakeholders.

Results

Created in pandemic, the model has been proved with communities, local administrations and response groups by areas, the proper standardization and the respective transversality with its local issues are the principal indicators.

Conclusions

The current lack of methodologies expressed in real solutions for most of persons in the world are calling for an alternative easy to understand and implement to contribute to adaptation and mitigation, determined by climate change. Fire is an important tool when it is under control, in opposition, when this is out of control, the landscape is modified in minutes. So inverting the situation, what about if communities efforts are focusing on things before they happen? From a fire tribune, we can find answers and solutions for current problematics today (depending on the regions) like: disasters, green urbanism, wildland, landscaping, contamination (emissions and neutralization), droughts, food solutions, agriculture, farming, etc.

This circular model has been recognized by the Global Fire Monitoring Center, it counts with support from different professionals in the world, in Chile Mr. Herbert Haltenhoff and the model is currently working in Chile, Costa Rica and Guatemala.

ID170

PP108 - TRUST AND COMPASSION IN WILLINGNESS TO SHARE MOBILITY AND SHELTERING RESOURCES IN WILDFIRE EVACUATIONS

Stephen Wong, Joan Walker, Susan Shaheen

[1]*University Of Alberta*

Advances in the sharing economy – such as transportation network companies (e.g., Lyft, Uber) and home sharing (e.g., Airbnb) – have coincided with the increasing need for evacuation resources. While peer-to-peer sharing under normal circumstances often suffers from trust barriers, disaster literature indicates that trust and compassion often increase following disasters, improving recovery efforts. We hypothesize that trust and compassion could trigger willingness to share transportation and sheltering resources during an evacuation.

To test this hypothesis, we distributed a survey to individuals impacted by the 2017 Southern California Wildfires (n=226) and the 2018 Carr Wildfire (n=284). We estimate binary logit choice models, finding that high trust in neighbors and strangers and high compassion levels significantly increase willingness to share across four sharing scenarios. Assuming a high trust/compassion population versus a low trust/compassion population results in a change of likelihood to share between 30% to 55%, depending on scenario. Variables related to departure timing and routing – which capture evacuation urgency – increase transportation sharing willingness. Volunteers in past disasters and members of community organizations are usually more likely to share, while families and previous evacuees are typically less likely. Significance of other demographic variables is highly dependent on the scenario. Spare seatbelts and bed capacity, while increasing willingness, were largely insignificant. These results suggest that future sharing economy strategies should cultivate trust and compassion before disasters via preparedness within neighborhoods, community-based organizations, and volunteer networks, during disasters through communication from officials, and after disasters using resilience-oriented and community-building information campaigns.

ID214

PO113 - A PRELIMINARY STUDY ON FOREST MANAGEMENT IN URBAN-FOREST INTERFACE AREAS IN THE MUNICIPALITY OF SERTÃ

Cátia Antunes[1], **Sofia Knapic**[1], Alfredo Dias[1]

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The occurrence, frequency and behaviour of wildfires have varied over time and space. Climate change is expected to create extreme weather that will expand the dry season, heat waves and droughts triggering more intense wildfires with severe environmental and economic consequences. This is particularly serious in Portugal where changes in land use, abandonment of the territory, and lack of forest management have contributed to an increase in fuel load, affecting the usual fire regimes. These extreme events endanger not only the forest but also the Wildland-Urban Interface Areas.

The objective of this work consists in proposing measures, according to the DL 156/2004 in its current wording, increasing the local awareness of the importance to carry out the fuel management (reduction of forest biomass). Two pilot areas, affected by rural fires in 2017, were defined in the municipality of Sertã.

The land use and occupation of the urban-forestry interface areas inserted in the combustible management strips, of the settlements and isolated rural buildings were assessed, and a preliminary forest management plan was drawn up for each of the areas. It was suggested to clear cut some areas eucalyptus and maritime pine within these areas to create mixed hardwood and coniferous and agro-forestry mosaics in accordance with DL 156/2004 in its current wording. For other hardwoods and existing chestnut trees pruning and sanitary cuts were considered.

The creation of mosaics in these areas will allow a diversification of the natural landscape, hence promoting the decrease of forest fire intensity and severity.

ID230

PP100 - “MITIGATION, ADAPTATION OR SUFFERING” IN RELATION TO WILDLAND FIRE

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Wildland fire events are becoming more widespread and impactful across the globe. In this study, we explore how three components; mitigation, adaptation and suffering, are related to wildfire events. Originating from climate science, the idea that we must mitigate and adapt to wildfires to avoid suffering is a pertinent one. Within this research we focus predominantly on adaptation; understanding that to lean on the idea of mitigation may feed into maladaptive suppressive techniques To understand what types of suffering can be associated with wildfires, we establish seven themes of suffering, acknowledging both anthropogenic and environmental aspects. The themes are global in scope; not designed for one region or particular fire. Looking to establish ways of reducing suffering and moving towards living with fire, we propose seven adaptation principles that can help society move forward; three global and four local. Using two case studies, the Las Maquinas fire in Chile (2017) and the Fort McMurray fire in Canada (2016), we explore what suffering can be associated with these events, and how the adaptation principles we have established could help reduce such suffering.

ID233

PP110 - INTEGRATION OF FIRE INCIDENT MONITORING INTO ENHANCED LAW ENFORCEMENT IN MOZAMBIQUE'S CONSERVATION AREAS

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[1]*Administracao Nacional Das Areas De Conservacao*

The digital revolution is progressing in all spheres of societies, including in conservation area management. Mozambique's network of conservation areas cover 233,249km2 of land corresponding to approximately 26 % of the country's terrestrial surface. The size and remoteness of these areas set limitations to the effectiveness of conventional methods of field-based monitoring and response to any biodiversity-harming incidents. Wildfire are an annually recurring event that conservation area managers seek to mitigate with controlled early season burns. Resources are too scarce for fire suppression at scale. Therefore a different approach is followed to dealing with fire events.

Satellite sensor-based fire incident detection systems capable of pooling and categorizing records are increasingly utilized in support of law enforcement operations and biodiversity protection. The technology used in Mozambique is being developed by OroraTech GmbH, and the National Administration of Conservation Areas of Mozambique is experimenting with the platform as it evolves. Fire occurrence serve as proxy of human presence, while the intensity, duration and extent of fires are indicators of the purpose for which fires are deployed. The temporal and spatial precision of the wildfire detection algorithm in combination with the ability of distinguishing fires based on their nature enables managers to identify hotspots, plan field interventions well in advance, and allocate resources timely and location-based. The interception of unwanted human activities in conservation areas acts as a deterrent and while not stopping large wildfires, it contributes to the reduction of biodiversity loss. The authors will present examples that may inspire further innovations.

ID234

PP101 - HOW DEMOGRAPHIC CHANGES IMPACT ON WILDFIRE REGIME

Juan José Fernández[1], Rubén Chamorro González[2], Juan Antonio Muñoz Navarro[2]

[1]*INFOCAM / Forest Fires Unit,* [2]*INFOCAM / Analysis and Plannig Unit*

Objectives

The main goal is to analyze and assess how both demographic and forest structure changes modify wildfire regime in terms of number of fires and forest area affected in Castilla-La Mancha region (Spain).

Methods

Advanced geographic information systems analysis (geostatistical analysis) allows to identify which factors have stronger relationship with number of fires and burnt forest area trends. Research use data from National Forest Inventory to assess fuel spatial connectivity and demographic data from Spanish National Statistical Institute.

Results

Whereas there is no significative relationship between demographic change and wildfire regimes in terms of number of fires and burnt forest area, there is a strong relationship between burn forest area and forest connectivity. Loss population does not mean burnt forest area increase directly. Nevertheless, a forest connectivity increasing due to changes in land use could affect wildfire regime by increasing forest size average.

Conclusions

Areas where a loss of population results on loss of agroforestry activity may increase burnt forest area. Thus, forestry policies should consider forest connectivity in order to prevent large fires, as well as to limit fire potential delineations.

ID239

PO122 - RESULTS OF MONITORING OF LANDSCAPE FIRES IN UKRAINE IN RELATION TO MILITARY INVASION OF RUSSIAN FEDERATION TO UKRAINE IN 2022

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[1]*Regional Eastern Europe Fire Monitoring Center*

Objectives

Military invasion of Russian Federation into Ukraine started 24.02.2022 with front of more than 1500 kilometers. Shelling, movement of tanks and positioning of troops resulted in numerous wildfires affecting landscapes. Unavailability of fire brigades for fast response due to active battling, unexploded ordnance (UXO) and land mines, the ban for using fire aviation and UAV, ground patrolling and radio resulted in large uncontrollable fires.

Methods

Monitoring was performed using the OroraTech service. Type of landscape burned were determined by Copernicus "Vegetation and Energy". Emerald Network used for the analysis of areas of nature conservation value affected by fires.

Results

For the period 24.02-31.10.2022 a total of 4 589 landscape fires occurred all over Ukraine affecting a total area 2 599 611 ha. By land use type: croplands - 1 405 989 ha, other natural landscapes - 699 036 ha, forests 351 509 ha, including coniferous - 184 856 ha, Urban-industrial areas - 143 077 ha. Due to direct impact of war 68,9% of coniferous forests burned (127 344 ha), 63,7% of croplands (895 615 ha) and 59,6% of other natural landscapes (416 602 ha). Area of protected lands directly impacted by fires reached 297 906 ha.

Conclusions

Massive dieback of forests on areas directly affected by shelling and other type of war activities will result in additional fuel load, while contamination of lands by UXO (1,6 million ha) created high risks for health and lives of fire personal and require special approach for fire management in postwar Ukraine.

ID345

PP111 - FLAMMABLE FUTURES – A STORYLINE OF CLIMATIC AND ADAPTATION IMPACTS ON WILDFIRE EVENTS IN INDONESIA

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Wildfire events are driven by complex interactions of climate and anthropogenic intervention. Predictions of future wildfire events and their impact on the environment and economy must consider interactions between these drivers. To better understand how climate-driven drought events and adaptation efforts affect burned area and agricultural production losses, we developed a storyline approach centered on Indonesia's 2015 fire events, which saw production losses of palm oil – a product imported by the EU chiefly as a biofuel – surpassing 7%. We explored analogous events under three warming and two palm oil sector adaptation scenarios using two storylines: ensemble mean climate and high aridity conditions. We employed a model chain composed of IIASA's FLAM fire model and the partial equilibrium model GLOBIOM to predict burned area and assess resultant production losses in the oil palm sector in Indonesia. To quantify changes in burned area, we applied a delta approach based on the different degrees of expected global warming. To define fire-induced oil palm losses, we combined the burned areas from FLAM with land cover and productivity estimates from GLOBIOM. We found that total burned area and production loss increase across projections and climate warming by up to 25%, with minor differences between storylines. These results captured regional variation in climate characteristics and were robust across the ensembles. Results highlight the importance of considering future warming and drought conditions in oil palm losses and leave room to explore how climatic impacts can be mitigated through economic policies affecting Indonesia and the EU.

ID353

PO119 - SMOKE FROM WILDFIRES IN CONTAMINATED SITES BY RADIONUCLIDES: A MODELLING CASE STUDY

Tobias Osswald[1], Carla Gama[1], Vera Rodrigues[1], Diogo Lopes[1], Dmytrii Holiaka[2], Sergiy Zibtsev[2], Victor Myroniuk[2], Valery Kashparov[2], Ana Isabel Miranda[1]

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[2]*National University of Life and Environmental Sciences of Ukraine*

It is not common to simulate the smoke impact from wildfires near nuclear power plants, but it is very important to be ready to obtain maps of radionuclides concentration levels in the air. The objective of this research is to develop and apply a smoke dispersion modelling system able to assess this type of smoke events.

In this scope, the DISPERFIRE smoke system, which is based on a lagrangean dispersion model, was adapted and applied to the wildfire that took place in 2016 in the Red Forest close to the Chernobyl Nuclear Power Plant. This wildfire started on the 15 of July of 2016 and lasted for 2.5 days. The region is contaminated with radionuclides, due to the nuclear accident of 1986, that were scattered and dispersed in the air alongside with the wildfire smoke.

The spatial and temporal distribution of smoke emissions of five different isotopes were estimated for the whole region, based on empirical data of the level of contamination in the forest and on wildfire progression simulations carried out with the FlamMap model. The total emissions amount to 58 GBq distributed among the isotopes Cs-137, Sr-90, Pu-238, Pu-240 and Am-241.

The concentrations of each radionuclide over the course of the event were estimated with the DISPERFIRE smoke modelling system at a resolution of (at least) 100 m, with high levels of contamination in the air near the ground.

The developed methodology will allow for a better preparedness and response to wildfires in forests contaminated with radionuclides.

ID367

PO116 - WILDFIRE INSURANCE: WHAT ROLE IN EUROPE?

Teresa Deubelli-Hwang[1], JoAnne Linnerooth-Bayer[1]

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With the significant increase in wildfire losses globally, insurers, re-insurers, insurance regulators and the insured public are paying more attention to wildfire loss financing, including public and private insurance arrangements. In Europe, insuring wildfire losses, including property, timber, crop and business interruption, presents numerous challenges such as providing insurance at an affordable premium and incentivizing risk reduction. Indeed, in some areas insurance for the wildfire peril is even unobtainable (Dixon et al. 2018), which raises the issue of public involvement in providing protection. At the same time, the Sendai Framework and other international initiatives increasingly view insurance as an instrument to provide incentives and prescriptions to reduce risk. In this presentation we provide an overview of public/private wildfire property insurance and products across selected 'hot spot' countries in Europe and discuss how they address challenges facing wildfire insurance cover. Based on recent meetings of an Insurance Working Group across two H2020 projects (FIRELOGUE and NATURANCE) we suggest new directions (e.g., community insurance) and products (e.g., parametric) that can address the manifold challenges of providing equitable wildfire insurance in Europe.

ID376

PP102 - WHAT'S THE POINT? REFLECTING ON GOALS & EVALUATION IN WILDFIRE MANAGEMENT

Eric Kennedy[1]

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Objectives

On the surface, wildfire management seems to have very clear goals: to protect life and property while preventing fire. However, there is increasing realization that fire management is much more complex: some fire is desirable, some suppression can be more problematic than useful, and some quantitative metrics can be overly simplistic. Yet, for many agencies, institutional structures - such as identified performance indicators, key metrics, and evaluation regimes - can make it challenging to adopt more holistic management goals and practices. In this presentation, we examine the current state of metrics and evaluation in fire management organizations, and consider alternatives for better capturing the holistic and complex objectives of modern fire managers.

Methods

First, we review the historical context of the shift from simple and heavily quantified objectives to more holistic ambitions of fire management. Second, we conduct a review looking at the published metrics and objectives shared by agencies in Canada, identifying the commonalities and range of metrics articulated. In doing so, we can identify ways in which evaluation regimes can help - or hinder - the transformation towards a more holistic approach to fire management.

Results & Conclusions

We identify broad patterns of continuing over-emphasis on quantified metrics (e.g., area burned, resources used, structures lost, etc) alongside opportunities to grow with respect to more subtle measures (e.g., quality of fire, alignment with management objectives, ecosystem or cultural impact, etc). We also identify opportunities for improved agility in updating evaluation regimes based on emerging science (e.g., smoke exposure).

ID430

PO115 - CONTRIBUTION OF A VOLUNTARY FIRE BRIGADE (VFB) TO THE DECREASE OF AREAS AFFECTED BY WILDFIRE IN AN ATLANTIC FOREST PATCH

Hallan Chimura[2], **Vinícius De Zorzi**[1,2], Mateus Queiroz[2], Daniela Fujiwara[2], Christian Berlinck[2], Guilherme Souza[1]

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One of the largest Brazilian Atlantic Forest remnants is in the State of São Paulo, which includes Serra do Itapetinga, a densely populated area, under strong human pressure, and increasingly affected by large and severe wildfires. In order to prevent them and protect biodiversity and ecosystem services, the NGO SIMBiOSE VFB has strengthened its capacity to reduce reaction time and size of wildfires and inhibit ignitions by seeking greater training, building partnership with public and private institutions, and purchasing proper equipment. Between 2017 and 2022, 364 wildfires were fought within an area of 25,000ha. Even though the number of ignitions increased, the reaction time was reduced by 74% and the size of the burned area was shortened by 74%. Nonlinear regression and Principal Component Analysis were used to assess correlation and influence of the independent variables – Number of Firefighters Employed (NFE), Average Reaction Time (ART), Number of Volunteers and Other Professionals (NVOP) involved in the wildfire fights, and weather conditions –, explaining 78% of the variance. It was observed a strong direct correlation between ART and burned area particularly evidenced in 2017 and a strong and poor inverse correlation between NFE, NVOP, and burned area mostly relevant in 2021-2022. Among meteorological variables, precipitation showed strong inverse correlation with the number of wildfires fought, mainly in 2018-2020. Despite weather conditions, results showed that professional qualification of VFB reduced burned area, suggesting the need to enhance cooperation with land owners and public sector to plan and operate fire use practices.

ID451

PO118 - "DESIGNING" FOREST RESILIENCE UNDER CLIMATE CHANGE – BEYOND TREES AND FUEL LOAD

Paula Maia[1], Jacob Keizer[2], Paulo Fernandes[4], David Carvalho[3]

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Climate changes, which will bring increases in the frequency and intensity of extreme fire weather events and droughts and, consequently, fire danger, and land cover changes (in terms of vegetation characteristics), can have major effects on potential forest fire behaviour and severity in Portugal.

FoRES aims to develop an integrated methodology to address forest resilience, in face of future climate change and expected fire scenarios in the ZIF of Lombada, Bragança, recently part of the AIGP network.

In a concerted strategy developed with the local stakeholders, represented by the APATA Forest Association, the FoRES project will develop (based on GIS software) and test a series of alternative forest planning scenarios, concerning:

1. the baseline scenario that considers the forest management plan approved for AIGP for the period 2030-2070, but also alternative forest management scenarios considering:
2. the improvement of the status of specific Natura 2000 Habitats,
3. the optimized plant composition according to future climate projections
4. carbon neutrality (CO2 sequestration) and soil conservation

These forest scenarios will be derived and validated, in terms of fuel model, in order to be fed into the WRF-SFIRE model, that will be ran on the resulting fuel-complex structure matrix, under a series of high fire risk episodes.

The expected outcomes are expected to allow supporting decision making, for the forest planning of the AIGP Baixa da Lombada for the decades to come, in terms of Forest Resilience to Climate Change, particularly concerning the reduction of vulnerability to Forest Fires.

ID484

PP103 - FIRE FORESTRY ACCIDENTS IN GALICIA

Fernando Iglesias Rey[1], Jorge Raposo[2,3], **Gilberto Vaz**[2,3], Daniela Alves[2], Alberto Rojo[1]

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During the last twenty years both Spain and Portugal had a lot of forest fire accidents. In this study, non-airborne occupational accidents of workers involved in the extinction of forest fires were analyze aiming to propose recommendations to try to reduce the number of accidents and their severity.

A database of accidents that occurred from 2008 to 2020 in Galicia, provided by the ISSGA (Galician Health and Safety Institute) was analyzed and statistical results were determined, namely the dependence between the involved variables.

A contextualization of fatal accidents was made, as well as a survey of the ages of all the workers in a district and the level of aging of the crews and forestry agents were determined.

As main conclusions, it was observed that the districts with high accident rate are located in the south of Galicia and that there is no greater severity in the accidents in which the crews travel outside their district.

As recommendations, it is recommended that any type of worker should not work alone during firefighting. Also, the medical tests of the workers should be more specific to identify cardiovascular diseases or any other disease incompatible with firefighting work. Finally, the workers who manifest cardiovascular diseases or elderly should not carry out firefighting work and their economic conditions should be kept.

ID485

PP107 - WILDFIRE ADAPTIVE MANAGEMENT TO REDUCE WILDFIRE RISK IN PORTUGAL: BENEFITS, OPPORTUNITIES, CHALLENGES, AND BARRIERS

Fantina Maria Tedim[1,2], Fernando Correia[1,2], Lucínia Aires[3], Elisabete Pacheco[3], Fernando Encarnação[3], Catarina Coimbra[4], Miguel Fontes[4], Margarida Jerónimo[5], Nuno Touret[6], Nuno Rocha[7], Joaquim Tavares[7], Sara Tapa[8], André Samora-Arvela[1,2], Cláudia Magalhães[2], Diogo Miguel Pinto[1,2]

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In a rapidly changing and challenging wildfire environment the capacity of any society and system to learn and change is paramount to coexist with fire and enhance resilience. Adaptive management by engaging in a continual learning and adjusting process supported by GIS tools, seems more adequate than the normative and top-down model that has been used in Portugal. The purpose of this research is to: i) identify the social, cultural, institutional, and political factors affecting the adoption of a model of adaptive management in Portugal; and ii) to understand how to facilitate and plan the shift.

The data collection was obtained by the implementation of the Delphi method in two rounds. For that, a panel of thirty people with several years of experience in managing wildfires from local governments, and regional and national institutions. The initial Delphi questionnaire contained an explanation of the scientific concept of adaptive management before the open-ended questions.

The adoption of adaptive management is recognized as important as its focus is on the integration of wildfire risk reduction in the sustainable development process, contributing to enhancing knowledge and having more effective practices. However, difficulties at several scales and sectors were identified as well as different ways to potentially overcome them. It is stated that the support of GIS tools facilitates the implementation and monitoring of adaptive management practices and outcomes.

The adoption of wildfire adaptive management requires a shift in the current governance model and closer interaction between science and local knowledge.

ID501

PO114 - MAPPING THE ECONOMIC LOSS OF ECOSYSTEM SERVICES CAUSED BY THE FOREST FIRES IN LIGURIA, ITALY

Bushra Sanira Asif[1,2], Umberto Pernice[2], Paolo Fiorucci[2], Nicolò Perello[1,2]

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Wildfires are a worldwide threat to biodiversity, especially in Mediterranean countries. Through their impact on the structure and functioning of forests, they also affect ecosystem services. Therefore, forest fires can have profound socio-economic effects. In the Liguria region (Italy), the forest ecosystem services are not exploited due to the lack of a proper framework for ecosystem services valuation. While environmental damage is evident in the region, effective management strategies are still lacking due to this reason. This study links the ecological and economic effects of forest fires to the economy of Liguria by estimating the ecosystem service losses due to fire damages in monetary value. We assessed the economic value of main ecosystem services, such as tourism, non-use value, local cultural and recreational value etc., to a study area in Liguria and estimated the loss of these values under different scenarios related to different severity of wildfire. The baseline scenario, corresponding to the present situation, will then be compared with other scenarios to estimate the loss of ecosystem services values and identify the areas with the largest losses. As the next step, these areas should be prioritized for management, and the known potential gain per area enables the choice of strategy based on cost-benefit considerations. This will highlight the need for an immediate management strategy to reduce further economic loss by forest fires.

ID2

PP47 - BURN SEVERITY CHARACTERIZATION IN WILDLAND-URBAN INTERFACE (WUI) ALONG A CLIMATIC GRADIENT IN THE SPANISH IBERIAN PENINSULA

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Altered by the warmer and drier climate of recent decades, large and severe wildfires are increasing the dangerous in vulnerable areas such as the wildland-urban interface. Our study aims to characterize and identify WUI situations prone to high severity fires under different climatic conditions. We selected fourteen large wildfires (> 500 ha) occurred between 2016-2021 in the Spanish Iberian Peninsula along a Mediterranean--Transition-Atlantic climatic gradient, where we spatially defined the building density, pre-fire vegetation variables and burn severity in WUI areas. Pre-processed Sentinel-2 images at 20 m spatial resolution were used to (i) calculate the delta Normalized Burn Ratio (dNBR) spectral index, and (ii) to determine land cover class (LCC), vegetation cover fraction (FCOV) and homogeneity of the vegetation cover fraction (FCOV homogeneity), indicatives of fuel type, amount and structure. In each climatic condition, pre-fire vegetation variables in conjunction with building density were employed to identify WUI situations prone to high burn severity through linear models validated by 10-fold cross-validation and Tukey's multiple comparisons. Results showed that WUI area affected by high burn severity increased towards the Atlantic climatic conditions, where high fuel loads, especially in terms of arboreal vegetation, are present. In Transition sites, high FCOV values in dense clustered WUI indicated a dangerous scenario with very severe wildfires. However, isolated or scattered WUI situations associated with high shrub cover were significantly most prone to high dNBR values across the climatic gradient. These results provide operational pre-fire management keys for the identification of WUI areas susceptibility to severe fires.

ID30

PP45 - THE INFLUENCE OF WEATHER AND CLIMATE ON THE OCCURRENCES OF FIRE OUTBREAKS IN BRAZIL

Marcelo Romao[1], Luciana Bassi Marinho Pires[1]

[1]World Environmental Conservancy

This study aims to assess how weather and climate conditions directly affect the occurrences and statistics of fire outbreaks in Brazil. Every year, in the winter and spring months (August to October), Brazil literally catches fire, especially in the center-west of the country and in the south of the Amazon. The detection made by the National Institute for Space Research, shows that there are an average of 50,000 outbreaks during these months. The period of fires coincides with the dry season which maintains low relative humidity, high temperatures, and low rainfall. The fires are almost entirely deliberately provoked by farmers, land grabbers and squatters with the intention of renovating pastures. Fires in Brazil occur predominantly in good weather conditions, such as clear skies, high temperatures and light/moderate winds. Conditions considered favorable to good weather were analyzed, that is, conditions that encourage people to set fires. The selected variables were: rainfall anomaly, geopotential height anomaly at 700 hPa, Mean Sea Level Pressure (MSLP) and Sea Surface Temperature (SST). It was found that in rainy years (1999, 2000, 2009, 2013 and 2018), high SST, reduced MSLP and a negative anomaly at 700 hPa led to few burning records, as this is a weather pattern which is associated with rain and cloudiness, which in turn inhibits fire application. The conditions opposite to those described above (years 2002, 2003, 2004, 2005 and 2007) significantly favored the increase in fire statistics in Brazil, showing the importance of weather and climate influence in fire outbreaks.

ID57

PP52 - ANALYSIS OF FIRES IN THE STATE OF ALASKA AND THEIR RELATIONSHIP TO CLIMATE CHANGE

Kimberly Gabriely Silva Teixeira[1], **Marcelo Romao**[1], Luciana Bassi Marinho Pires[1]

[1]*World Environmental Conservancy*

The research focuses on the increasing incidence of fires in the state of Alaska (United States) and its relationship to the worsening of climate change. In Alaska, most fires are caused by lightning with most others caused by intentional or accidental human activities. Using the NPP-375 satellite, a historical series of fires from 2012 to 2021 was analyzed, provided by the database of the Queimadas Program of the National Institute for Space Research (INPE). A significant increase in the annual total of fires was observed, as well as earlier onset of the fire outbreak season. Previously, the outbreaks started to increase in the beginning of the summer, however, in the spring of 2014, it was already possible to see this number increasing earlier in the year. The year 2015 was one of the milestones in the record of outbreaks, with 89,492 being recorded, followed by the year 2019, where 81,179 fire outbreaks were recorded. In the first nine months of the 2022 year, 67,869 fires already have been recorded. Another aspect analyzed in relation to changes in incidence of fires was the variation in the temperature of the state over the years. Through information taken from the National Centers for Environmental Information (NCEI) of the National Oceanic and Atmospheric Administration (NOAA), it was possible to observe that in the city of Fairbanks in Alaska, from 2012 to 2021, there was a trend towards an increase in temperatures of ~1.1C per decade.

ID151

PP135 - SMOKE RESPECTS NO BOUNDARIES

Peter Lahm[1]

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Many nations are at a turning point in environmental management history. The last 100 years indicates fire is a critical disturbance factor throughout much of the United States and re-establishment is urgent. The country is experiencing longer wildfire seasons and unparalleled levels of smoke for long durations leading to adverse effects on public health and safety. Realization of the severity of the Wildfire Crisis, there is heavy investment into hazardous fuels management with a vision of vastly more prescribed fire. The challenge is adding more air pollution into an atmosphere that is already choked with wildfire smoke for longer periods and with recognition that smoke has both public and firefighter health and safety risks.

Environmental regulations are frequently set by media and everyone is desirous of clear vistas and clean air. Trends in fine particulates are encouraging from all sectors but fire. The question is how to add emissions to an atmosphere which is being protected. Many barriers exist to more prescribed fire. There are no boundaries when smoke is in the air. It does not respect land ownership, political boundaries, international boundaries nor potential global effect. Government will need to prepare its citizens for more smoke, whatever the source, in close proximity and far down-wind. The communication challenge and education needed to be Smoke Ready is critical for those at most risk of smoke exposure and mitigation measure investments are critical if there is the smallest chance of public support and acceptance of a more smoke-filled world.

ID201

PP50 - FIRST EDUCATION AND AWARENESS IDEOLOGY ON WILDFIRES IN SPAIN

Víctor M. García[1]

[1]*TRAGSA*

Summary

Communication of clear, objective, reliable and agreed messages on wildfires, is essential to ensure society involvement in their prevention.

The main objective of this work is the development of a framework document for general use and reference to support education, awareness and communication actions on wildfire prevention.

The methodology used is based in the direct participation of all possible stakeholders, through questionnaires, interviews and discussions. Wildfire and emergency managers, academia, researchers, environmental education experts, media, public and private companies representatives, public employees, rangers, students, and rural population, are among the different groups that have participated.

As expected result, a part from a rich database of stakeholders and information, there will be an agreed document to serve as a common basis at national level on wildfire awareness and education, considering the necessary adaptation to each territory reality.

Main conclusions are, on one hand, the need of society collaboration and implication in good practices and both individual and collective responsibility to reduce the occurrence and consequences of wildfires. Moreover, on the other hand, the need to develop and disseminate resources, models, materials and messages that contribute to the vision, mission, values and principles of the ideology and the achievement of its objectives.

ID295

PP49 - IDENTIFICATION OF LIGHTING IGNITED WILDFIRES IN BRAZIL AND PORTUGAL, BASED ON SATELLITE DATA AND CATALOG INFORMATION.

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Forest fires constitute an important part of the global terrestrial system and the full extent of their impacts within the ecosystems still needs to be quantified. Wildfires' analysis, which can be performed based on different information sources, deeply contributes to the improvement of prevention policies grounded on an improved perception of the fire regime. Naturally induced fires have been mostly studied at high latitudes, as there, lightning strikes significantly contribute to ignition. However, in the tropics and subtropics, studies focusing on natural ignitions are still lacking. This work aims to study the relationship between fires and lightning in the Brazilian Pantanal (2012-2017) and Portugal mainland territory (2003-2020) based on the spatial and temporal simultaneity of these two phenomena, using data derived from remote sensing techniques and data available in fire catalogs. Our results indicate that lightning is not the main cause of ignition in both regions. Namely, in the Pantanal only 5% of wildfires are caused by lightning. However, it has a strong contribution to the fire regime in the austral summer months. In Portugal, natural wildfires accounted for up to 3% of the total burned area per year in regular fire seasons, occurring between June and September months and reaching their peak in August. Still, the assessment of the contribution from small fires remains a challenge when using remote sensing datasets due to inherent limitations, resulting in low detection rates. Nevertheless, the use of active fires was still able to replicate the intra-annual variability of lighting-ignited wildfires in Portugal.

ID332

PP48 - IS SOCIETY INTERESTED IN WILDFIRES? A GOOGLE TRENDS ANALYSIS

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Over the last years, catastrophic wildfires area increasingly occurring across the word, attracting substantial media and social attention. Public interest in wildfires is a key although poorly understood topic, as it not only drives policy decisions, but it can also influence fire impacts on society (e.g. via fire awareness and preparedness). We use here Google Trends, a tool that measures internet searches on Google, to evaluate the long-term (15 years) trends on public interest on wildfires both at global and country level. We analyse how that interest relates to specific fire seasons or catastrophic events and compare the public interest in wildfire with that for other natural hazards (droughts, hurricanes, earthquakes and storms). Lastly, we discuss how Google searches relates to public demand for news on the topic and what are the main issues the public look for when they search for fire-related information on the Web.

ID354

PP43 - THE PANTANAL 2020 FIRE CRISIS: THE IMPACTS OF TRANSPORTED SMOKE ON AIR QUALITY IN THE LARGEST SOUTH AMERICAN MEGACITY.

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In 2020, more than 3.9 million hectares were burned by vegetation fires in the Pantanal wetlands, in central-west Brazil, an area four times larger than the average over the 2001-2019 period. During the peak of the fire crisis (September 2020), transported smoke was observed in the southeast and south Brazil, including the São Paulo megacity, leading to dark sky and black rain episodes. In this context, we analyze the transport of the smoke plumes released by the mega-fires in the Pantanal in 2020 and the impacts on particulate matter concentrations in the state of São Paulo. Using multiple datasets from satellites, reanalyses, and in-situ air quality stations, besides simulations carried out using the EURAD-IM Chemistry Transport Model and the HYSPLIT trajectory model, two main periods of transport were identified. According to the simulations, the smoke plumes originated from the northern part of the Pantanal, traveled a distance of 1000 km from the biome to São Paulo state within three days, and persisted over the region for five days. The transport occurred through the low-level jet in central Brazil associated with a frontal system in the southern region of the country. High particulate matter concentrations that occurred in São Paulo were over 100% above WHO Air Quality Guidelines, resulting in low visibility below 5000 m. This work reinforces the importance of the Pantanal fires in disturbing air quality around the country, as already observed in the case of fires in the Amazon and Cerrado.

ID388

PP44 - THE CREATION OF THE FIRE MUSEUM AS AN ENVIRONMENTAL MANAGEMENT INSTRUMENT INTEGRATED WITH THE CAVALCANTE ENVIRONMENTAL VOLUNTEER BRIGADE - BRIVAC

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The creation of the Fire Museum, inspired by the Cerrado Biome, is the first in the country. From the perspective of Integrated Fire Management - MIF, it aims to strengthen socio-environmental processes for conservation purposes, addressing issues related to forest fires, prevention, combat and management, cultural and socioeconomic aspects of indigenous and traditional peoples, as well as such as the ecological impacts on the Cerrado after the fire has passed.

The Museum, as a non-profit institution, at the service of society and its development, open to the public, exposes material and immaterial testimonies of human beings and their interaction with the environment, through education, research, and communication, heritage conservation historical and cultural, tourist and economic, being able to generate resources not only for the municipality of Cavalcante but also to support the maintenance and sustainability of the BRIVAC Voluntary Environmental Brigade of Cavalcante, in the face of fire management actions in the territory. We believe that community engagement is done through social inclusion, which is why informing the population is the main tool to strengthen the community. Thus, the museum shares a rich theoretical and textual collection on the Cerrado, its relationship with fire, traditional peoples, forest fires and integrated fire management, indigenous equipment and artifacts, and an immersive room recreating the impacts experienced by the brigade members during the fighting forest fires.

ID422

PP51 - FIRE SCIENCE IN THE PANTANAL WETLAND: BEFORE AND AFTER 2020 MEGA-FIRE

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Climate change affects ecosystems around the world in different ways. In Brazil, the mega-fire in the most extensive and significant world tropical continental floodplain, the Pantanal, alerted us to the need to understand the importance of fire in naturally dynamic wetlands impacted by severe droughts. In this scenario, we performed a literature review to assess how fire studies in the Pantanal relate to events before and after the 2020 mega-fire. From the Web of Science database, a search was performed from 1945 to 2022 with the following expressions: “fire” OR “wildfire” OR “bushfire”; “Pantanal” OR “wetlands”; “Brazil.” Articles were categorized according to bibliographic and environmental indicators. A total of 92 articles were identified, the first dating from 1960. Only from 2000 onwards began an annual publication frequency (1.6 articles per year), which increased to 19 articles a year after the mega-fire. The networks among researchers and universities have significantly increased connections. Studies that aimed to understand the effect of fire in the long term (“fire history”) have increased in importance and frequency since 2012. However, rare articles were found experimentally approaching fire and correlating it with other ecological processes. Regarding the number of articles on remote sensing, the increase in studies on the evaluation of abiotic data was evident. We believe the increase in institutional connections and multidisciplinary research promotes long-term experimental studies that can bring accurate and practical answers concerning integrated fire management in wetlands.

ID474

PP42 - DROUGHT, FIRE AND LENTIBULARIACEAE: A CASE STUDY IN THE PANTANAL OF MATO GROSSO DO SUL - BRAZIL

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The Pantanal has a well-defined cycle of floods and dry periods marked by the occurrence of forest fires. Our objective was to evaluate how the presence of Lentibulariaceae in the Pantanal of Mato Grosso do Sul (MS), Brazil, was affected by the large forest fires that affected the Pantanal between 2020 and 2021. We compared data collected from this family with data from monitoring burned areas using the Moderate-Resolution Imaging Spectroradiometer (MODIS) and the Land Use and Land Cover classes from Collection 7 of MapBiomas using the QGis software. We gathered information from collections carried out from 1892 to date, totaling 200 records, of which 26.5% occurred in Grassland; 19% in Savanna Formation; 18.5% in River, Lake and Ocean; and 16.5% in Wetland. We observed that, compared to the year of the last collection record, 2016, the classes Wetland; Savanna Formation and River, Lake and Ocean showed a reduction in their areas, 31%, 62% and 33%, respectively, in 2021, while there was an increase of 38% in the area of Grassland. The reduction in these areas may be associated with the forest fires of 2020 and 2021, which consumed around 29,913 km2 of the Pantanal in MS, with these areas comprising 23.5% of Grassland; 9.8% from Savanna Formation; 1.8% River, Lake and Ocean; and 25.8%. from Wetland. Despite the resilience mentioned for Pantanal, fires, associated with the long periods of drought in 2020 and 2021, significantly reduced this taxon, given the changes that occurred in environments with a recognized presence.

ID482

PP21 - THE DESIGN OF A WEBSIG PLATFORM TO SUPPORT RURAL FIRE RISK MANAGEMENT AT LOCAL LEVEL

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Objectives

This work aims to create a Websig platform that can be used by local administration (Municipalities and Parishes) and operational entities (Firefighters, etc.) with the aim of making rural fire risk management more efficient at the local level and improve risk communication.

Methods

First, the websig was structured, based on the communication needs identified through the previous questionnaire and close contact with the municipalities. After designing the structure of the websig, a focus group was set up with experts from four municipalities who pre-tested the websig and gave their opinion on its improvement and on greater adequacy to the needs of the local administration.

Results

It was found, in the first instance, that there were gaps in the communities' access to relevant information in a context of fire risk, as well as problems and difficulties in communication between the populations and the local authorities. Therefore, it was necessary to eliminate this difficulty, using a websig, which, with the testing and evaluation of the experts, became even more robust, allowing to overcome the identified flaws.

Conclusions

The creation of this type of platform allows streamlining processes in the management of rural fire risk, enabling easier communication between institutions, and between institutions and communities. Thus, while allowing the participation of the population in risk management (citizen science), it makes communities more resilient in a context of increasing complexity and severity of fires.

ID74

PP09 - DEVELOPMENT OF THE INTERNATIONAL POSITION PAPERS BY THE INTERNATIONAL ASSOCIATION OF WILDLAND FIRE

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The International Association of Wildland Fire (IAWF) is an independent, non-profit organization. For more than 30 years the IAWF has facilitated global communication on wildland fire and provided objective leadership through a neutral forum of diverse experts who consider and address important, and at times controversial, wildland fire issues. The IAWF membership spans nearly all continents. The membership comprises a global voice and includes wildland fire managers, land managers, scientists, agency personnel and others who support IAWF's goal to achieve a more sustainable wildland fire paradigm.

To support agencies and organisations from different parts of the globe, the Association decided to craft position papers related to the most pressing issues the global wildland community is facing. We envisaged that these position papers would characterize the state of the issues and suggest actions needed to be undertaken by various agencies. They also serve as resource for the global wildland fire community.

In May 2022, IAWF hosted a conference on climate and wildfire in the United States and Australia. In anticipation of this important event, IAWF created a position paper on climate change.

Following overwhelmingly positive feedback from the global fire community on this position paper, the IAWF started to work on developing a position paper on use of prescribed fire.

This paper and the subsequent presentation will show the critical role that position papers play in supporting agencies and organisations in developing their policies and strategies.

ID127

PP07 - HOW TO BREAK THE BARRIER TO SHARE DECISION MAKING SUPPORT AND STRATEGIC EXPERTS ON WILDFIRE SUPPRESSION

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[1]Ministry For The Ecological Transition And Demographic Challenge

The reality of wildfires varies across the globe. On a large and small scale, regionally or nationally, the experience of wildfire professionals also varies according to the reality to which they have been exposed.

When professionals face complex situations, they may be new. Both in countries used to deal with wildfires and in countries where wildfires are just starting to occur. In these situations, the response and collaboration mechanisms are well developed, fully known and accepted. Receiving help in the form of airplanes, helicopters and firefighters is "normal". Even though we are talking about resources from countries with very different realities.

But, when it comes to share expert personnel in decision making support or other strategic positions, the reality is that there is a barrier to doing so. It seems that this type of support could be seen as a sign of lack of capability, while sharing air and ground resources is completely understood without this connotation.

Taking into account the current and future situation of greater affection and impact of wildfires at a global level, we must be humble and able to keep an open mind in all aspects. Working to find a way to share and integrate experts in strategic support during wildfire suppression will be a qualitative advance that is worth making the necessary efforts for its correct understanding and articulation.

This type of support is particularly important in countries that are just starting to deal with wildfires and do not have the experience and knowledge acquired.

ID158

PP08 - FIRE MANAGEMENT IN ETHIOPIA: PAST, PRESENT, AND FUTURE

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[1]*Consultant*

This reviews the history of wildfires in Ethiopia and discusses plans aimed at improving fire management, using an integrated approach at national, sub-national and community levels. It presents findings from a joint PENHA-TBI and CIFOR-ICRAF programme (2022-23) that identifies opportunities and challenges from an assessment of national forest management policies and fire management practices, and maps and prioritizes fire-prone areas where efforts and resources should be focused. It also identifies capacity gaps in predicting, detecting, reporting and controlling wildfires, leading to the preparation of a draft national fire management strategy for consideration by national authorities for foreseeing and acting on fire risk, and making fire management part of forest and rangeland management decisions. Federal and State forestry agencies will collaborate in developing the strategy. Outside of the programme's sphere of influence, however, is the urgent need for concerted efforts to promote participation, build awareness, and change mindsets at community and policy levels, encouraging cooperation between multiple actors, including development partners to support capacity strengthening. Alongside this, much more investment in firefighting equipment is required, to reduce reliance on external assistance, with more efficient coordination with international partners for swifter and more effective responses. It is also important to establish and equip task forces at local level, with the involvement of local administrations, communities and trained and equipped brigades and volunteer groups. Significant additional resources and coordination mechanisms must also be approved at federal level in order to facilitate this. The institutional and social aspects of effective strategy implementation are emphasized.

ID195

PP01 - WILDFIRE DISASTER RISK REDUCTION AND LANDSCAPE FIRE MANAGEMENT IN SOUTH ASIA REGION: EXPERIENCES FROM NEPAL

Sundar Sharma[1]

[1]*Coordinator-UNDRR-South Asia Wildland Fire Network*

South Asia region has diverse ecosystems, socio-economic and cultural settings and forest types; thus, having diverse fire regimes and vulnerabilities due to its geographical and climatic variations. Wildfires, among natural disasters, have been emerging as the most common disaster since last decade, destroying or degrading valuable forests and furthermore adversely affecting other natural vegetation types in the region. An increasing vulnerability of society is evident by the loss of human lives and serious threats to human health and security by vegetation fire smoke emissions.

Observations indicate that the occurrence and severities of wildfires are increasing as a consequence of climate change, aggravated by human intervention in the fragile mountain ecosystems. Over the last years, some local and regional initiatives are addressing wildfire disaster risk reduction in the region.

Nepal has demonstrated the development of policies, legal and institutional arrangements related to wildland fire management emphasizing community involvement, which has been proven a successful approach for sustainable resource management. The application of concepts community-based fire management (CBFiM) in effective adaptation and mitigation to wildfire risk reduction and management is continuously ongoing since the early 2000s. Examples of transboundary cooperation in fire management reveal the need and success of sharing expertise across the region and at international level.

Furthermore, this paper identifies the gaps and issues and suggests future directions and way forward including for wildland fire management in Nepal.

ID250

PP04 - INCLUSIVE FIRE-SMART LANDSCAPES AS A PROMISING APPROACH FOR EFFECTIVE WILDFIRE PREVENTION AND MANAGEMENT

Rosalien Jezeer[1], Atiek Widayati[2], Laurenz Romero[4], Mercy Owusu Ansah[3], Richard Ssemmanda[5], John Livingstone[6], Nick Pasiecznik[1]

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This reports initial results from the Fire-smart landscape governance programme (2021-2023), implemented by Tropenbos International (TBI) and partners in Bolivia, Indonesia, Ethiopia, Ghana and Uganda.

Effective fire management requires long-term planning and that must involve all landscape stakeholders including smallholders, indigenous and local communities, local government, private enterprises, etc.) and that incorporates the needs and interests of women, men, youth and marginalized groups. At the landscape level, the programme applied integrated, context specific fire management practices, alongside evidence-based multistakeholder dialogue and awareness-raising, to reach agreements on developing participatory fire management plans. Practices, business models, financial mechanisms and locally owned solutions were co-created and demonstrated. In Bolivia for example, two municipal governments included fire risk prevention in their development plans, and the government adopted forest fire reduction targets in its revised Nationally Determined Contributions. In Indonesia, local 'smart patrols' were established, trained champion farmers showcased fire-smart peatland agricultural practices, and formal collaboration was established between the national peatland restoration agency and the district government. However, challenges remain where improved policies and regulations related to land-use planning, agriculture and forestry are not always in place, now being developed in Ethiopia, Ghana and Uganda, to improve effective implementation of fire-smart management practices on the ground. However, this approach could be more firmly anchored in NDCs, and fire management policies and plans should be coherent with broader national frameworks on climate change adaptation and mitigation.

ID431

PP03 - INTERNATIONAL COOPERATION IN FIRE MANAGEMENT – ADVANCEMENTS SINCE THE 7TH INTERNATIONAL WILDLAND FIRE CONFERENCE 2019

Johann Georg Goldammer[1]

[1]Global Fire Monitoring Center (GFMC)

The resolution of the 7th International Wildland Fire Conference 2019 stated that in many regions of the world, wildfires are a growing threat to communities and to natural, cultural, rural, urban and industrial landscapes. The problem is increasing due to the consequences of social, economic and ecological change (land-use change, demographic change, ecosystem degradation), as well as climate change. It was stated that current risk governance and institutional arrangements are inadequate to cope with this growing trend and that cross-sectoral approaches are required by unified and integral planning in order to strengthen societal, environmental and economic resilience to landscape fires by addressing. Recommended action addressed, among other, risk governance and ownership and strengthening of local action. While the main responsibility to capacitate state authorities and civil society in applying principles of integrated landscape fire management is at national level, cross-boundary cooperation in fire management allows the exchange of knowledge and expertise in fire management. During the last four years, advancements have been made to address the principles of integrated fire management through border-crossing agreements and joint community involvement along borders between jurisdictions and nations. Bilateral and multilateral projects and programmes will be presented in the Session „International Cooperation". The GFMC will highlight and summarize those examples of international cooperation, which cannot be presented by responsible implementation partners in this Session.

ID434

PP02 - INTERREGIONAL MUTUAL ASSISTANCE IN EMERGENCIES AND CROSS-BORDER RISKS (ARIEM+ AND INTERLUMES INTERREG POPTEC PROJECTS CONTRIBUTION TO IMPROVE COORDINATION)

Angel Manuel Sanchez Martin[1], **Belinda Guerra Burton**[1], Teresa Mompín Alvarez

[1]*Castilla y León Regional Govermment*

The ARIEM+ first and INTERLUMES projects more recently have enabled the developmet of a mechanism to support collaboration between services in the Spanish regions of Galicia, Extremadura and Castile and Leon and those in northern Portugal responsible for mobilising and managing resources during events such as forest fires, floods and erosion. It has enabled the development of a single operational command structure to improve response coordination and elaborated harmonised protocols and tactics for tackling emergencies.

ARIEM+ and Interlumes are both INTERREG POPTEC projects that have enabled the member institutions to improve coordination at different levels on prevention and detection of, and intervention against, emergencies including forest fires, which are quite common in the border area. The project has also allowed Castile and Leon to acquire specialised firefighting vehicles and personal protection items to improve firefighters' efficiency. In INTERLUMES there has also been an investment in different construction of infraestructures for aerial or terrestrial means and investment in improving comuniccation and other technological developments.

One important piece of the projects was training and population awareness campaigns. Cross-border drills included simulations of different emergencies in ARIEM+ and two final exercises focusing on collaboration in preventing and extinguishing forest fires were organised in Spain in October 2019. After the drills, a set of conclusions was drawn up indicating how they could be applied to real-life situations.

In INTERLUMES there were also different training and awareness activities run from CDF (specialized training centre) from 2021 to 2022.

ID440

PP06 - AN INNOVATIVE ASSESSMENT FRAMEWORK TO CONDUCT PEER REVIEWS ON WILDFIRE RISK MANAGEMENT UNDER THE UNION CIVIL PROTECTION MECHANISM (UCPM).

Veronica Maria Casartelli[1,2], Jaroslav Mysiak[1,2]

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Objectives

Wildfires are among the key risks with cross-border dimension identified in National Risk Assessments by European Countries. The EU capacities to cope with wildfires have been recently increased, however better coordination is needed. The UCPM legislation stands that countries shall participate in peer reviews to promote effective disaster risk governance and exchanges of good practices. The 2022 EU Wildfire Prevention Action Plan foresees peer reviews on wildfires among the key actions in strengthening capacity building. In this context, a development of a specific analytical framework focused on wildfire risk become strategic to support this process.

Methods

The analytical framework guides the fact-finding desk and in-field visits within peer reviews. It ensures that all key aspects are addressed during an inclusive stakeholder consultation process. The wildfire peer review assessment framework (WF-PRAF) was developed based on sound desk research and an extensive expert consultation process and follows the structure of the wider framework drafted to support the current EU peer review cycle, successfully tested within the Romanian peer review conducted in 2022.

Results

The WF-PRAF is flexible and characterised by a modular structure that ensure an adequate level of adaptability to the specific needs and recognises 7 essential topics on which the analysis should be constructed: risk governance, risk assessment, risk management planning, risk prevention, risk preparedness, emergency response, and recovery and lessons learned.

Conclusion

The WF-PRAF will support the implementation of targeted peer reviews on wildfires, promoting a coherent risk management approach to strengthen resilience across the EU.

ID491

PP05 - AN EMERGING FRAMEWORK FOR ADAPTING TO CHANGING FIRE REGIMES: REIMAGINING SCIENCE, MANAGEMENT, AND CULTURE

Carolyn Enquist[1], Molly Hunter[2]

[1]Southwest Climate Adaptation Science Center, [2]Joint Fire Science Program

The impacts of climate change on fire regimes are resulting in lengthening wildfire seasons, more extreme fires, and restricting opportunities to conduct prescribed burning. Coupled with decades of fire exclusion, interacting disturbances, and expanding urban interface, changing fire regimes have profound implications for ecosystems and society. As the climate continues to change, land managers will be increasingly challenged in developing and adopting strategies that facilitate societal and ecosystem adaptation to changing fire regimes. This can include increasing the pace and scale of actions proven to increase ecosystem and societal resilience. These strategies must include diverse perspectives and empower Indigenous cultures to develop management strategies based on their traditional knowledge. Yet, climate change may significantly reduce the relevance of historical conditions so that novel management approaches may be needed. However, adopting entirely new strategies is challenged by uncertainty in outcomes, management of societal expectations, and longstanding organizational cultural norms. Recognizing that these challenges can't be overcome with simple science solutions, several science funding and boundary spanning organizations have partnered to explore the science, outreach, and policy needs to advance adaptation to changing fire regimes. This talk will present key themes from a recent workshop on the nexus of fire and climate change that form a preliminary framework for advancing adaptation to changing fire regimes. As an outcome of this talk, we hope to gain international perspectives to further inform the development of this emerging framework.

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