
Toward Integrated Fire Management

This case study highlights the pro-active connection of Soil Science cluster research to major societal and environmental challenges – in this case wildfire – exhibiting not only the generation of scientifically novel and societally applicable knowledge, but also commitment to engagement of, and ongoing communication with, multiple affected stakeholders in order to effect significant and sustainable impact.

Abstract / summary

Wildland fire greatly influences the natural environment, the people living in it and their livelihoods. For both fire prone regions as well as countries that are considered to be less fire prone, the occurrence of wildland fire in combination with climate change and, often, high population densities poses major challenges. These challenges can only be tackled via an integrated management approach that mitigates the impact of fires on the landscape and the people living in it. Here, we present the formation of a knowledge network that grew out of the Soil Science cluster chairgroups, and has resulted in the EU-funded Innovative Training Network PyroLife. The network links the expertise on pyrogeography within the Soil Science cluster groups to other groups. This has the long term objective being to aid society in moving away from the suppression-based approach to dealing with fire to a more integrative approach of living with fire. The central approach of PyroLife is to foster knowledge exchange between disciplines, sectors (academia and practice) and countries. Through the strong connections with multiple stakeholders, a direct influence on policy and awareness is also achieved.

Case Description

Background

Of the four basic elements earth, water, air and fire, three have been traditionally represented in a range of chair groups at Wageningen University, while fire - the element that connects them all - has long remained missing in our research, education and outreach. Yet wildland fire has the capacity to greatly influence the natural environment, the people living in it and their livelihoods. For both fire prone regions, such as Mediterranean countries, and countries that are considered to be less fire prone, such as northwest Europe and northeast US (Kerr et al., 2018), the occurrence of wildland fire in combination with climate change and, often, high population densities poses major challenges that can only be tackled via an integrated management approach (EC, 2018).

To stimulate such an approach, a knowledge network on fire was created and has resulted in the EU-funded Innovative Training Network PyroLife. PyroLife is built upon four axes of diversity: interdisciplinarity, intersectorality, geography and gender (<https://pyrolife.lessonsonfire.eu/>). Here, we focus on development of PyroLife, its current embedding within WUR and how it is being used to strengthen both the research on wildland fire within WUR and its impact on society.

Why wildfires are breaking out in the 'wrong' countries



Greek firefighters join public outcry at 'woeful' response to lethal wildfires | **Portugal Forest Fires Worsen, Fed by Poor Choices and Inaction**

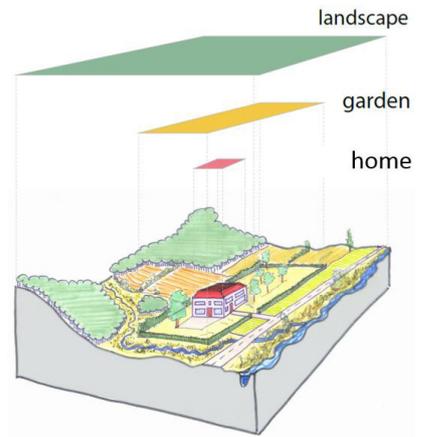
Victims of California Mudslides Were Swept Away Weeks After Surviving Fires | **Pollutionwatch: summer's deadly wildfires cause pollution worldwide**

Fire, Fire Everywhere: The 2018 Global Wildfire Season Is Already Disastrous | **Heat Wave Scorches Sweden as Wildfires Rage in the Arctic Circle**

Tsipras takes political responsibility for Greece's wildfire disaster

Development of fire research in the Soil Science cluster

Research on fire impact on soils at WUR is rooted in expertise on fundamental processes related to soil water repellency (Stoof et al., 2011), potential ash effects (Stoof et al., 2016) and how this affects soil erosion and hydrology (Prats et al., 2019; Pastor et al., 2019; Stoof et al., 2012); built upon the expertise of the SLM group. Prediction of the vulnerability of landscapes to fire requires incorporation of landscape spatial variability (the core focus of SGL), the way fire behaves spatially as affected by this variability, and the impact of this variability on the natural environment and subsequent fires (Stoof et al., 2013). At the same time, there is a major human (socio-ecological) component to fire risk and fire impact (Davies et al., 2016). Therefore, what is needed to mitigate the impact of fires on the landscape and the people living in it is an integrated fire management approach (EC, 2018). That in turn requires the linking of the expertise of the Soil Science cluster groups to other groups.



Research objectives

The overall long-term objective of the fire research at Wageningen UR is to help society move away from the suppression-based way of dealing with fire and toward a more integrative approach of living with fire. This so that i) negative impacts of wildland fires on the human and natural environment can be mitigated; and ii) humans can adapt to the present and future uncontrollable fire types (extreme fires); also in response to climate change.

Specific aims:

- Develop integrative fire management that combines the Northern European expertise in water management and planning with the long experience and knowledge of fire in Southern European countries
- Prepare traditionally non-fire prone countries (like the Netherlands and most of Western Europe) for the fires that are already happening and those that are coming.
- Connect scientific research and stakeholder needs for knowledge on integrated fire management, and to translate this into both applied and fundamental science projects.



Research approach

The central approach of PyroLife is to foster knowledge exchange between disciplines, sectors (academia and practice) and countries. In PyroLife, 22 universities, research institutes, companies, public partners and non-profit organizations work together in research. The network trains 15 early-stage researchers, PhD candidates, in biophysical and social drivers and impacts of fire, science-policy interactions, risk communication and writing policy briefs, culminating in an inter-and transdisciplinary PhD course on integrated fire management within a fire prone community in the Netherlands.

Within WUR, the PyroLife project takes direct advantage of the SGL knowledge on landscape variability and pyrogeography, WSG expertise on integrated water management, and knowledge on landscape design. PyroLife has additionally been a catalyst within WUR: MAQ and SGL now supervise the PhD project of the Catalan fire chief on predicting extreme fires, and other initiatives (with De Vries, Social Sciences, and FAO) include EU proposals on trust, policy briefs on the effects of COVID-19 on fire management (Stoof et al., 2020a), and the granting of INREF seed money to link fire communities in developed and developing countries. Finally, through ongoing MSc projects, the SGL group is working with the GRS group on small fires, and with the Hydrology and Water Management group on fundamental research on fire effects on water flow.

Through strong involvement of stakeholders such as local communities in addition to governmental bodies such as the EU, direct influence on policy and awareness is achieved (see impact below).

Stakeholder involvement

Stakeholders directly involved in WUR's PyroLife research are Águas de Portugal, Technosylva (developing a Dutch fire spread model with a visiting scholar grant from PE&RC), the Pau Costa Foundation, Arup (multinational company), the European Forestry Institute, Landworks (South Africa), the Catalan Fire service, and through its advice and research on extreme fires to the EU and beyond (e.g. California, South America). Stoof was additionally commissioned by the Province of Noord-Brabant to investigate one of the largest wildland fires in the Netherlands (the Peelbrand; Stoof et al., 2020b), establishing a new network of local residents, fire fighters, land managers and several (semi-) governmental organisations (see below).

Research Highlights

Since 2014, the research has resulted in several highly cited papers in important soil science journals like *Water Resource Research*, *Geoderma*, the *International Journal of Wildland Fire* (Stoof et al., 2014; Stoof et al., 2015; Stoof et al., 2016).

Additional highlights:

- SGL expertise shown in book chapters (Stoof, 2019; Stoof, 2020).
- Need for diversity in fire science and integrated fire management highlighted in a Letter to the Editor in *Nature* (Bowman and Stoof, 2019).
- Together with the Institute for Safety (Edwin Kok), Stoof initiated data collection on the occurrence of wildland fire in the Netherlands in 2017, after the Netherlands stopped collecting these statistics in 1996. The datasets gathered are used by the EU via the Expert Groups of Forest Fires (of which Kok and Stoof are official delegates for the Netherlands) and, with their reports, publicly available at <https://effis.jrc.ec.europa.eu/reports-and-publications>.
- Marie Curie Innovative Training Network PyroLife, EU-funded, 4 million euros, 2019-2023, 3 WUR groups directly involved.
- Marie Curie Individual Fellowship, 180.000 euro, EU funded, dr. Stoof, 2016-2018.
- Stoof is a board member of the International Association of Wildland Fire and has been invited to give talks on integrated fire management at the Fire across boundaries conference in 2020, at the FAO United Nations in 2020 and the European Geosciences Union, 2019.

Impact

The efforts of the last three years have focused on linking research to the most important actors, to be able to have impact with current and future research. Current research has direct impact on several levels:

- Europe: contributing to the European wildland fire database and the reports of the EU Expert Group of Forest Fires, Stoof has co-written a EU leaflet, and was an invited speaker at the Green Deal conference of EU policy makers. Her co-authored papers on fire management in the UK have been discussed in British parliament (Davies et al., 2016); with Technosylva, SGL is developing a fire spread model for the Northern Ireland government, as well as a Dutch model supported through a PE&RC graduate school visiting scholar grant.
- The Netherlands: SGL research into the Peelbrand (Stoof et al., 2020b) has regenerated much attention, and research findings are cited in the upcoming report of the Netherlands Court of Audit (Algemene Rekenkamer) for the Dutch government. Ongoing discussions with policy makers (provinces, safety regions, ministry of agriculture, nature and fisheries) and locals focus on what is needed to make the Netherlands more prepared for large wildland fires.
- Science communication; Dr. Stoof actively engages with the general public through public media, resulting in a reach of 17.8 million people (57% of those Dutch) in the year 2020 alone (WUR brand monitor, newspapers, radio and tv interviews, and twitter).
- Education: apart from developing new PhD courses for PyroLife, a new interdisciplinary course "Pyrogeography" will train MSc students on Integrated Fire Management.

Future outlook

The Soil Science cluster, in combination with the chair groups both within and outside the graduate schools of PE&RC and WIMEK, is in an excellent position to become the knowledge center on the Integrated Fire Management of North Western Europe by combining its strengths on soils, geography and its expertise in integrated land and water management. Fire, the fourth element that was lacking in research, outreach and education is now in the spotlight nationally and internationally. There are major opportunities for the Soil Science cluster and the broader Wageningen community to build upon the pyrogeography research lines originating from SLM and SGL, using the Wageningen approach linking science and practice. Further development into this internationally leading role requires strategic support for research, policy, outreach and education.

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