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IPL Project (IPL - 243) Annual Report Form 2019-2020

”Wildfire related landslides in Italy: triggering mechanism and propagation processes“.

WORKING GROUP

- Università di Torino (UNITO): Giuseppe Mandrone, Giandomenico Fubelli, Jessica Chicco, Damiano Vacha, Laurie Jane Kurilla
- University of Salerno (UNISA): Dario Peduto, Luca Iervolino, Vito Foresta, Gianfranco Nicodemo
- Università di Pavia (UNIPV): Claudia Meisina, Cesare Perotti, Massimiliano Bordoni, Valerio Vivaldi, Giacomo Panza
- Università di Firenze (UNIFI): Veronica Tofani, Guglielmo Rossi, Elena Benedetta Masi, Antonella Marinelli
- Università di Bari (UNIBA): Mario Parise
- Università della Calabria (UNICAL): Giovanna Capparelli
- CNR-IRPI: Giuseppe Esposito, Carmela Vennari

ACTIVITIES

The Project IPL-243 is a composite work carried out by many Italian researchers with background from field geologists to engineering geologist, from geotechnical to hydraulic engineers. Unfortunately, this first period was affected by all problems related to COVID-19 pandemic emergency: field surveys were very limited, laboratory activities for many months were prohibited, exchanges between researches have been very difficult. So, the entire project went on with many difficulties.

Anyway, some working groups could develop the researches that can be summarized as follow.

The working group of UNITO has carried out a multiscale research activity on the Piedmont Region detailed in:

- Regional long-term statistical correlation between burned areas and landslide/debris-flow triggering;

- Watershed scale analysis for assessing fire-related susceptibility to enhanced erosion, sediment availability and increased runoff;
- Local scale case-study analysis for detailing events triggering and process characterization;
- Field and lab experiments for quantifying fire physical effects on burned soils.

Overall, studies regarded 9 wildfires, 49 watershed and 1 detailed case study.

The Geotechnical Engineering Group of UNISA is following an innovative multiscale approach that aims to combine:

- on-site surveys and multi-sensor and multi-temporal satellite monitoring for mapping and characterizing the severity of fires;
- geotechnical laboratory tests (conventional and advanced) for the physical-hydro-geo-mechanical characterization of burnt soils;
- numerical modeling to investigate and objectify any space-time increase in landslide susceptibility. In this first year, post-fire mapping and laboratory tests on burnt soils have been carried out with reference to two fire events that hit Salerno area in 2019 and 2020.

CNR-IRPI working group focused the research on several post-fire erosion responses occurred in Southern Italy in correspondence of steep watersheds mantled by cohesionless pyroclastic soils. A series of post-fire flooding events that hit a small village, damaging buildings, roads and a railway has been documented, highlighting that all the flooding events were triggered by rainfalls evaluated as “non-extreme” and associated with the first convective storms impacting the burned watersheds. In addition, it has been observed that flooding responses occurred in watersheds where flames affected more than 70% of their surface, mostly with moderate-high severity. The role played by man-made modifications of the natural drainage network in increasing the consequences of the flooding processes was also ascertained.

MSC/PHD THESIS

The following MSc thesis dealt with these issues:

- Title: Frane e incendi: analisi sperimentale degli effetti indotti dal fuoco sulle proprietà fisiche, meccaniche e idrauliche dei terreni di copertura di pendii potenzialmente instabili (Landslides and fires: experimental analysis of the effects induced by fire on the physical, mechanical and hydraulic properties of soils covering potentially unstable slopes) in Italian, Author: Albino Di Filippo, supervisor: Prof. Dario Peduto, eng. Vito Foresta, Department of Civil Engineering, University of Salerno. Academic year: 2019-2020
- Title: Incendi su pendii: mappatura e caratterizzazione fisico-meccanica dei terreni di copertura coinvolti nell'incendio del settembre 2019 nel Comune di Siano (SA) (Fires on slopes: mapping and physical-mechanical characterization of the soil covers involved in the fire of September 2019 in the municipality

of Siano (SA) in Italian, Author: Luca Iervolino, supervisor: Prof. Dario Peduto, eng. Vito Foresta, dr. Gianfranco Nicodemo, Department of Civil Engineering, University of Salerno. Academic year: 2019-2020

- Title: L'alluvione di Bussoleno del giugno 2018: la causa è stata un debris-flow propiziato dagli incendi del 2017? (The June 2018 Bussoleno Flood: the cause was a debris-flow propitiated by the 2017 fires?). Author: Battista Taboni, supervisor: Prof. Giuseppe Mandrone, Earth Sciences Department, Università di Torino. Academic year: 2017-2018

Two Phd Project are currently running:

- PhD Thesis of Eng. Luca Iervolino: activity started on November 2020 till November 2023 (3 years). Self-funded by University of Salerno.
- PhD Thesis of Dott. Damiano Vacha: “Wildfire induced landslide in the western alps: analysis, modelling and mitigation strategies”. Conclusion 2021

PUBLICATIONS

Two international papers and two national repots have been published in this period. In detail, these are the references:

Esposito G., Parodi A., Lagasio M., Masi R., Nanni G., Russo F., Alfano S., Giannatiempo G. (2019) *Characterizing Consecutive Flooding Events after the 2017 Mt. Salto Wildfires (Southern Italy): Hazard and Emergency Management Implications*. Water, 11, 2663. <https://doi.org/10.3390/w11122663>

Vacha D., Mandrone G., Garbarino M & Morresi D. (2021) – “*Post 2017 wildfire debris flows in Susa Valley (NW Italy)*” – In “*Icd Contribution To Landslide Disaster Risk Reduction*” - Issn: 2662-1894. In Press

Esposito G., Masi R., Nanni G., Russo F., Alfano S., Giannatiempo G. (2020) *Analisi di una sequenza di eventi alluvionali post-incendio nell'area del Monte Salto, Montoro (Avellino)*. Geologia dell'Ambiente, Supplemento al n.1/2020, pp. 184-189. <https://www.sigeaweb.it/documenti/gda-supplemento-1-2020.pdf>

Mandrone G., Parise M., Vacha D., Capparelli G., Meisina C., Peduto D., Tofani V. (2020) *Le frane connesse agli incendi boschivi: stato dell'arte e sviluppi futuri della ricerca anche alla luce dei cambiamenti climatici*. Geologia dell'Ambiente, Supplemento al n. 1/2020, Atti del seminario nazionale analisi e attività di mitigazione dei processi geo-idrologici in Italia, pp. 137-143, ISSN 1591-5352, Anno XXVIII, gennaio-marzo.

Torino, March 2021

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