



Dissemination Workshop

Torino (Italy), 1-2 February 2024

# BOOK OF ABSTRACTS



## **RETURN Dissemination Workshop**

Torino (Italy), 1-2 February 2024

DOI: [10.5281/zenodo.10598007](https://doi.org/10.5281/zenodo.10598007)

### ***Scientific Committee***

Francesco Ballio, Francesca Bozzano, Domenico Calcaterra, Fabio Castelli, Pierluigi Claps, Pierfrancesco Dellino, Mario Losasso, Salvatore Martino, Alberto Montanari, Andrea Prota, Cosimo Solidoro

### ***Organizing Committee***

Elisabetta Colucci, Elisa Costamagna, Benedetta Giudice, Monica Granetto, Farbod Khosro Anjom, Paola Mazzoglio, Maria Lia Napoli, Laura Sardone, Francesca Maria Ugliotti

### ***Abstract Book Editors***

Elisa Costamagna, Paola Mazzoglio

### *How to cite an abstract:*

Author A., Author B., Author C. (2024). Title of the abstract, *RETURN Dissemination Workshop, Torino (Italy), 1-2 February 2024*. DOI: [10.5281/zenodo.10598007](https://doi.org/10.5281/zenodo.10598007)

## Table of contents

<b>Multi-Spokes.....</b>	<b>8</b>
Multi-scale analysis of flood risk to cultural heritage.....	9
Effects of climate change on the general and on the occupational population: systematic/umbrella reviews with a focus on the urban setting.....	10
Preliminary bases on the extreme events analysis of past and future meteocean time series focused on the Calabria Tyrrhenian coast.....	12
An integrated approach for the assessment of ground instabilities-induced damage on critical structures .....	15
Future shifts in sub-daily precipitation extremes: a comprehensive analysis with a Convection-Permitting Models Ensemble .....	17
Towards the identification of climate change impact indicators on ground instabilities: the role of rainfall regime as preparatory and triggering factor for landslides.....	19
Challenges for structure assessment in a multi-risk multi-scalar framework .....	21
Social vulnerability to natural disasters in the EEA and UK: a systematic review with insights for risk reduction and emergency planning.....	22
Combined assessment of fluvial-marine sediment transport to determine the impact of coastal risks ....	24
Sediment transport in different environments: problems and challenges .....	26
The problem of model validation in natural hazard forecasting .....	27
Sea level changes over the past 30 years along the Emilia-Romagna coast and related impacts.....	29
Biogeochemical indicators for marine ecosystems .....	32
An indirect validation of national and international gridded precipitation products in Northern Italy through rainfall-runoff model application.....	35
<b>Spoke VS1: Water.....</b>	<b>37</b>
Advances in pluvial flooding modelling for the assessment of risk scenarios.....	38
Simulation of flood and debris flows in mountainous regions and of their impact on hydraulic structures .....	39
Characterization of extreme drought events over Europe .....	41
The Emilia-Romagna extreme flooding event: monitoring coastal water quality .....	43
Characterization of karst spring response to rainfall events .....	45
Stochastic temporal downscaling in Northeast Italy using convection-permitting climate models: from hourly to sub-hourly timescales .....	47
Summer drought predictability in the Mediterranean region in seasonal forecasts .....	48
Numerical model of the response of urban drainage networks in heterogeneous precipitations scenario	49
Limited impacts of salt-marsh restoration on hydrodynamic and sediment transport processes in the shallow microtidal Lagoon of Venice (Italy).....	51
Mapping the loss probability of pedestrians to improve the perception and communication of flood risk .....	53

Assessing changes on sub-daily extreme rainfall in Italy with a non-stationary frequency analysis of convection-permitting model projections .....	55
Sediment transport modelling in the design of flood-event scenarios .....	57
Evaluation of the accuracy of convection-permitting sub-daily extreme precipitation simulations over Italy .....	59
Advancing drought detection and management to improve the resilience of multisector systems under climate change.....	61
The Venice Lagoon under the flood regulation: navigating challenges in preserving the city and its lagoonal ecosystem .....	63
60-years analysis of meteorological droughts in the western Po River basin .....	65
Non-stationary simplified metastatistical extreme value approach: an application over the Rotian river catchment.....	67
Integrated modelling for water resource management during droughts .....	69
Novel machine learning approaches for remote sensing image analysis in the context of water-related risks.....	71
Vegetation indices for plant water stress detection from satellite imagery.....	73
Analysis of the banquette dynamics by four years of videomonitoring acquisitions in an urban microtidal Mediterranean beach (Poetto beach, southern Sardinia, Italy) .....	76
<b>Spoke VS2: Ground instabilities .....</b>	<b>78</b>
Advanced satellite and aerial monitoring applications for the identification of ground instabilities in subaerial and shallow water environments .....	79
Towards a national network of natural field laboratories for the study of ground instabilities.....	82
Towards the Proof of Concept: from single tools to tool chains. An example for co-seismic slope failures.....	84
The preparatory role of natural and anthropogenic wildfires on the occurrence of shallow landslides and their territorial distribution in view of effect scenarios conditioned by the temporal distance from fire events .....	87
Data-driven microseismic event classification for the early warning of landslides.....	90
Machine learning approaches for the assessment of ground instabilities. An overview of Return VS2 approach against existing literature .....	92
Statistical methodology in GIS environment for the elaboration of dynamic ground instability susceptibility maps .....	95
<b>Spoke VS3: Earthquakes and volcanoes.....</b>	<b>97</b>
Vulnerability assessment of rooftop telecommunication towers under seismic events.....	98
Optimal design of FPS devices for isolated multi-span continuous deck bridges depending on the ground motion characteristics .....	100
Scouring effects on dynamic response of caisson foundations.....	102
Dynamic response of a liquefiable sand for shaking table testing by a large laminar shear box.....	104
Analysis of active and fossil seismic structures near the city of Genova: a multidisciplinary study for the seismic risk assessment in low-seismicity regions.....	106
Analyses of the infill panels performances in case of volcanoes and/or seismic events .....	107

Probabilistic hazard maps of dilute pyroclastic density current at Vesuvius volcano (Italy) .....	109
Refining age and ash dispersal of small- to medium-size explosive eruptions at Neapolitan volcanoes from high-resolution investigation of core C106 – eastern Tyrrhenian Sea .....	111
Ocean acidification caused by shallow volcanic CO <sub>2</sub> seeps in the Pozzuoli Bay, Campi Flegrei, Campania (Italy).....	114
Linking active structures with seismogenic sources in tectonically polyphasic areas. A case study from the Martana Fault System (Central Apennines).....	116
A methodology for multi-risk analysis: Santorini application.....	118
<b>Spoke VS4: Environmental degradation.....</b>	<b>121</b>
Improving the assessment of the contamination levels of a river catchment basin accounting for the dilution effect generated by fluvial transport. The case study of Sarno River in Campania.....	122
Phytostabilization long term trial in an abandoned Sardinia Mine .....	124
Ecological Risk Assessment: principles and methodologies .....	126
Effects of combined stressors on the ecosystem functioning in the Grado-Marano lagoon .....	128
Use of passive sampling techniques for chemical, physical and ecotoxicological analysis of seawater at various marine locations throughout Italy .....	131
Classification of Mater-Bi® bioplastics in anaerobic sludge by SWIR hyperspectral imaging .....	133
On the detection of bioplastic content in marine water using analytical and spectroradiometric techniques .....	134
Proposal of new environmental monitoring protocols for emerging contaminants in the pilot site of the Port of Genoa .....	136
Combined use of potassium ferrate and surfactant for the remediation of hydrocarbons contaminated soil .....	138
Adsorption of lanthanides ions onto geopolymer and Neapolitan yellow tuff.....	140
Preliminary design of a new soil column test for physical simulation of infiltration and evaporation processes .....	142
An integrated approach to assess the combined effects of climate change and contamination on habitat-forming species under future scenarios.....	145
Distribution, contamination sources and risk assessment of priority organic pollutants in the soils of a heavily contaminated river basin: the case study of the Sarno River Basin (Southern Italy).....	147
Environmental risk due to micropollutants release: the contribution of wet-weather discharges in urban catchments .....	149
LiDAR-based modeling of wildland fire behaviour and bark beetle outbreaks interaction: new perspective for Italian catchments.....	152
Recent trends on environmental degradation: a bibliometric analysis.....	153
Effects of chronic PFAS exposure on mitochondrial antioxidant defences in a freshwater fish species ( <i>Squalius Cephalus</i> ) from the Veneto region .....	155
Multiple ingestion exposure routes for alkylphenols: an integrated human health risk assessment including drinking water and crops' food .....	158
Consequences and risk modeling of NaTech in industrial environments.....	161

Nanocellulose-based solutions for water treatment.....	162
Litter distribution in marine and coastal sediments: case studies from Apulia region .....	164
Impact of biodegradable and unbiodegradable microplastics on soil quality and ecotoxicity .....	167
Sustainability of contaminated sites remediation: benchmarking in the international contest .....	168
Plastic leachate impact in aquatic environment.....	170
Nanoremediation of contaminated aquifers .....	172
Bio-electrochemical remediation of soil polluted by 2,4-dichlorophenoxyacetic acid .....	174
Assessing spread and distribution of antimicrobial resistance and potential pathogenic bacteria in the Gulf of Trieste: a combined metagenomic approach .....	176
<b>Spoke TS1: Urban and metropolitan settlements.....</b>	<b>179</b>
Retrofitting through the loss-based earthquake engineering approach .....	180
Identification, analysis and evaluation of building risk.....	181
Spatial indicators and strategic approaches for increasing territorial resilience.....	183
Disaster risk reduction and climate mitigation and adaptation for the Italian context: towards the selection and validation of best practices across plans and urban projects .....	185
Multi-risk mitigation and energy efficiency measures at building and neighborhood scale to increase urban resilience .....	186
Enhancing climate resilience: generating future weather files for typical and extreme conditions .....	188
A flexible methodological approach to ground resilience-oriented planning policies.....	189
A building taxonomy for multi-hazard assessment .....	192
Ecosystem services and green infrastructure for resilient cities .....	196
Systemic approach and multi-scalar urban knowledge: urban hotspot and critical context identification .....	199
Geosphere risk-related factors in urban areas: a perspective from a 3D- modelled geological subsurface .....	201
Towards redevelopment of contaminated decommissioned sites through the application of circular economy principles.....	204
Recognition of the minimum urban system to improve multi-hazard recovery by exploiting participatory planning approaches .....	206
Storyline-based approach for multi-risk assessment of urban and metropolitan areas.....	207
Derivation of surface aerosol concentration from satellite AOD over the city of Bologna .....	209
Towards a circular metabolism for urban and metropolitan settlements.....	210
Development of software tools for seismic damage scenario assessment: a case study in Emilia-Romagna .....	212
Defining urban contexts towards multi-risk assessment: a clustering and hazard-based scoring approach for urban settlements based on open source data .....	214
ADAPTIVE HOUSING: solutions for adaptive and resilient low-energy housing under climate change scenarios.....	216
<b>Spoke TS2: Multi-risk resilience of critical infrastructures .....</b>	<b>218</b>

Impact of detention basins on flood frequency curves.....	219
ALARP criterion for assessing the quantitative resilience indicators of critical infrastructures (road tunnels) .....	221
On site investigations and laboratory testing on full scale elements for the characterization of an existing RC bridge.....	224
Enhanced dashboard for prioritizing interventions to mitigate risks and improve resilience.....	226
Beyond NaTECH risk: safety and resilience in Hythane transport infrastructure .....	229
Identification and localization of critical industrial assets in Italy .....	231
Transport infrastructure efficiency improvement: strategies to assess the landslide risk .....	233
Spatial vulnerability characterization between industrial infrastructure and territory using a multi-hazard, multi-scale approach .....	235
A case study of assessment of railway infrastructure vulnerability to debris flows.....	237
The Italian FIOod and Catchment Atlas (FOCA) .....	240
Merging road network functionality analysis with a probabilistic approach for flood impacts definition	242
Key elements for a homogeneous flood hazard assessment on Large Dams in Italy .....	244
A comprehensive analysis of actions taken for resilience assessment of critical infrastructures .....	245
Methodologies for soil characterization and field monitoring of river embankments .....	248
Co-creation process for requirement identification to strengthen disaster risk management.....	250
Evaluation of dam siltation in different Italian geological context through sediment transport model ...	253
Towards flood-related hazard assessment guidelines for land transport infrastructures.....	255
Planning and management of reservoirs for agricultural use: assessment of water resource availability through rainfall-runoff modelling in ungauged catchments.....	257
Advanced approaches for the assessment of coastal structures/infrastructures resilience: tsunami fragility .....	259
Application of a stochastic model for water demand assessment under water scarcity and intermittent networks.....	261
Dynamic identification of bridges: from field tests based on standard equipment to laboratory validation of advanced solutions.....	263
Definition of offshore boundary conditions for earthquakes tsunami inundation numerical simulations through probabilistic databases .....	265
Flood risk mapping through advanced machine learning techniques and geomorphic data integration.	268
AI and Deep Learning systems for intelligent unsupervised surveys: tunnel and cavities applications....	270
A new perspective for national landslide susceptibility assessment.....	272
Digital Twin, Virtual Reality and Metaverse: what technologies to support the asset management workforce?.....	273
Hydrogen leak detection: monitoring and control methodologies .....	275
Proof of concept of an exceptional transport corridor exposed to multi-risk conditions: definition and preliminary analyses.....	277
<b>Spoke TS3: Communities’ resilience to risk: social, economic, legal and cultural dimensions.....</b>	<b>279</b>

Structuring co-design approaches for built environment and widespread heritage in fragile contexts: a first analysis of existing successful practices .....	280
Assessing the exposure of cultural heritage to multiple risks, with a focus on cities of art and intangible social, aesthetic and spiritual values .....	283
Citizen participation in civil protection planning (CPP) considering different demographic and socio-cultural contexts .....	285
Stakeholders' identification and engagement in the RETURN project .....	287
Guidelines for systematic multi-risk mapping for cultural heritage, from site to urban to regional and national scales .....	288
Why aggregate ratio judgements to improve epistemic, ethical, and legal aspects of decisions about natural risk? .....	290
Analyzing effective risk communication: evidence from a literature review.....	292
The Audit for the forecasting, monitoring and communication Institutions of Civil Protection: with RETURN to improve the "risk weighting" phase.....	295
Empowering communities: the key to effective disaster risk reduction strategies.....	296
Task 7.2.1: on the use of Multi Criteria Analysis to evaluate risk reduction effectiveness in a multi-hazard environment .....	298
Deep vs shallow magmatic systems controlling pure Plinian vs caldera-forming eruptions: natural and experimental evidence .....	301
The matrix "Hazards-Impacts" as foundation for implementing MCA in natural risk management.....	302
Natural hazard education with XR technologies: a scoping review.....	305
Community resilience to flooding risks under climate change: case of cultural cities.....	307
A meta-analysis on the antecedents of risk perception of various natural hazards.....	309
<b>Spoke DS: Science underpinning climate services for risk mitigation and adaptation .....</b>	<b>312</b>
An impact oriented application of dynamically downscaled CMIP6 scenarios .....	313
Double-nested domain to downscale global CMIP6 data from a regional European domain to a fine spatial scale domain centered over Italy.....	315
A matter of scale: thermodynamic and large-scale constraints in extreme rainfall under a changing climate .....	318
Improving the ecological knowledge needed for sustainable management and climate change adaptation in marine-coastal ecosystems: fisheries in the northern Adriatic Sea and the Venice Lagoon.....	319
Exploratory investigations for the development of a novel Mediterranean Sea reanalysis.....	320
Unrevealing political, socioeconomic, and institutional barriers in climate mitigation and adaptation strategies—A comprehensive analytical framework for a systematic literature review .....	322
Drought and human mobility in Africa .....	324
A methodology for railway infrastructure vulnerability assessment with respect to rain-induced hydrogeological instability under different climate change scenarios. Case study: flood induced risk assessment along Fabriano - Jesi railway .....	327
Scanning Electron Microscope protocol for exogenous particles and pollutants detection in human tissues .....	330



A new perspective for multirisk assessment under multiuncertainty.....	332
A regionalized framework for the Metastatistical Extreme Value Distribution applied to sub-daily rainfall .....	334
Historical rainfall data in northern Italy predict larger meteorological drought hazard than climate projections.....	335
Nine centuries streamflow reconstruction for the Po River.....	336
Mountain permafrost in the Eastern Italian Alps: assessment of the current and future state of a crucial hazard indicator.....	337
Inventory and assessment of impact-oriented hazard indicators .....	338
Paleo and historical climate records: fluvial terraces and floodplains along the northern Apennines (Italy) .....	341

## A flexible methodological approach to ground resilience-oriented planning policies

*Federica Isola<sup>1</sup>, Sabrina Lai<sup>2</sup>, Federica Leone<sup>3</sup>, Corrado Zoppi<sup>4</sup>*

(1) Dept. of Civil and Environmental Engineering and Architecture, University of Cagliari, [federica.isola@unica.it](mailto:federica.isola@unica.it)

Following the European Environment Agency (2019), “land take” can be understood as the phenomenon wherein urban areas, with their impermeable surfaces, encroach upon agricultural or forested areas. The most severe manifestation of land take is soil sealing, an irreversible process driven by building activities and infrastructure construction where pervious land covers, characterized by the presence of soil and vegetation, are replaced by impervious artificial materials such as asphalt and concrete. Land cover dynamics, such as land take, modify soil characteristics, hydrogeological processes, and vegetation structure, and are therefore strongly connected with landslides, i.e., with the downward and outward movement of rocks and soils. Moreover, by causing the loss of natural and seminatural ecosystems, land take and soil sealing bring about the loss of multiple ecosystem services, i.e., the benefits that ecosystem supply to human beings. Some ecosystem services are relevant to the RETURN project because they contribute to reducing hazards and risks in urban and metropolitan areas; labeled “regulating ecosystem services”, these include local temperature regulation, urban flood risk mitigation, coastal protection.

The relation between land cover changes and landslides has been studied by various authors (among many, Pisano et al., 2017, Hao et al., 2022), yet the relation between land take and landslide hazard is still under-researched. Therefore, such relation is here assessed to understand to what extent land-taking processes increase landslides, and it is investigated by taking as a case study the catchment basin that includes the town of Sassari, and by coupling spatial analyses and inferential models. This analytical framework is also applied within Spoke TS1 of the RETURN project to analyze, in quantitative and spatially explicit terms, the relationship between hazards related to climate change in urban and metropolitan areas, such as heat waves, and the provision of multiple ecosystem services supplied by green areas (WP3, task 5.3.4), therefore paving the way for identifying place-specific policy recommendations to improve the local environmental quality (WP4, task 5.4.3), and in turns, the quality of urban life.

The relation between land take and landslide hazard is assessed through a regression model that relates the level of landslide hazard to a set of land cover variables that includes artificialized land, i.e., land taken up through urbanization processes, and a set of covariates that represent the main land cover types within the Land and Ecosystem Accounting (LEAC) taxonomy (Figure 1). Spatial units for the analysis are 300-m square cells, and the model operationalizes as follows:

$$LH = \alpha_0 + \alpha_1 L\_TAKE + \alpha_2 ARA + \alpha_3 PMF + \alpha_4 FOR + \alpha_5 GRSH + \alpha_6 DEPOQ + \alpha_7 VOLSE + \alpha_8 ELEV + \alpha_9 HGLAGGED$$

where, in each cell:

- LH = landslide hazard.
- L TAKE = land take.
- ARA = arable land.
- PMF = pastures and mosaic farmlands.
- FOR = standing forests.
- GRSH = natural grasslands, sclerophyllous vegetation, and heathlands.
- DEPOQ = quaternary deposits.
- VOLSE = volcanic sedimentary rocks.
- ELEV = average elevation.

- HGLAGGED = spatially lagged dependent variable controlling for LH's spatial autocorrelation.

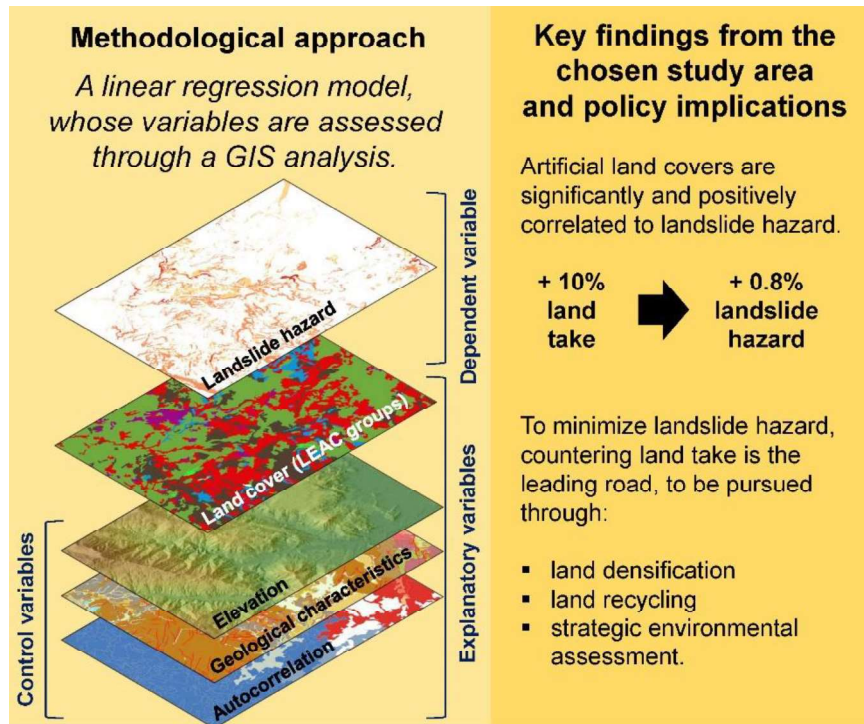


Figure 1 – Graphical representation of the methodological approach (left-hand side); main result and overview of the policy implications (right-hand side).

The estimates of the coefficients  $\alpha_i$  show the correlations between landslide hazard and the LEAC land cover types and, particularly, the interdependence of LH and the size of land take.

For a full overview of the results and of the policy implications, the reader can refer to Isola et al. (2023). The most important finding is that a significant and positive correlation is identified between the land take-related covariate (L\_TAKE) and the variable associated with landslide hazard (LH) namely, a 10% increase in L\_TAKE is associated with a 0.8% increase in LH. Therefore, as far as land covers and their effects on landslide hazard are concerned, controlling land-taking processes is the main road to mitigating the hazard.

On this premise, three main groups of policy implications, respectively concerning land densification, land recycling, and strategic environmental assessment (SEA), can be identified (Figure 1). As for land densification, it implies that land is developed within existing settlements to take advantage of existing infrastructure without using undeveloped land, hence land recycling strategies and compact urban models should be promoted in the case study area, and they could be supported through appropriate financial or regulatory tools, also including, flexible and performance-based zoning regulations. The last policy implication concerns SEA, a mandatory appraisal planning tool in EU countries, which can pave the way for the integration, within spatial plans, of measures aimed at preventing or minimizing land take.

The flexible methodological approach here proposed as a tool to support decision-making processes provides an already developed example of how the research activities within Spoke TS1 of the RETURN project can be carried out to analyze the relationship between the provision of multiple ecosystem services and climate-related hazards in urban and metropolitan areas, and to ground place-specific policy recommendations.

## References

European Environment Agency (2019). The European Environment—State and Outlook 2020. Knowledge for Transition to a Sustainable Europe. Luxembourg: Publications Office of the European Union. ISBN 978-92-9480-090-9.

Hao L., van Westen C., Rajaneesh A., Sajinkumar K.S. Martha T.R., Jaiswal P. (2022). Evaluating the relation between land use changes and the 2018 landslide disaster in Kerala, India. *Catena*, 216, 106363, 1–13.

Isola F., Lai S., Leone F., Zoppi C. (2023). Assessing the relation between land take and landslide hazard. Evidence from Sardinia, Italy. In: Gervasi, O., Murgante, B., Rocha, A.M.A.C., Garau, C., Scorza, F., Karaca, Y., Torre, C.M. (eds.) Computational Science and Its Applications – ICCSA 2023 Workshops. ICCSA 2023, Athens, July 3-7. Lecture Notes in Computer Science, 14106, 642–658. Cham: Springer.

Pisano L., Zumpano V., Malek Ž., Rosskopf C.M. (2017). Parise, M. Variations in the susceptibility to landslides, as a consequence of land cover changes: A look to the past, and another towards the future. *Science of the Total Environment*, 601–602, 1147–1159.