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# INTRODUCTION

## PREFACE CONFERENCE PROCEEDINGS

Global warming and its massive impact on natural disasters is one of the main challenges of our era. Extreme weather events and associated natural disasters are increasing both in alpine regions and generally globally. Traditional concepts of hazard prevention and disaster management need to be evaluated because climate change requires sustainable adaptation processes of the protection system.

The international conference **INTERPRAEVENT 2024** addresses this topic: "Natural hazards in a changing climate – How to manage risks under global warming?" and takes place for the first time in Vienna. The conference connects science and practice and provides a platform for the exchange of experiences and possible solutions. The outstanding conference program is divided into six thematic sessions, with new natural hazard processes such as forest fires also being intensively discussed at the conference:

1. **Climate Change: Drivers, Triggers and Consequences**
2. **Risk Governance, Policies and Resilience**
3. **From Observations and Experiments to Modelling and Simulations**
4. **Hazard and Risk Assessment**
5. **Structural and Non-Structural Mitigation Measures**
6. **Emergency Management and Recovery**

238 papers with 19 papers for the Student Award were submitted for **INTERPRAEVENT 2024**. The majority of submissions came from the host country Austria with around 44%, followed by Switzerland with around 16%, Japan with around 10% and Germany with around 7%. Further submissions came from Australia, Canada, Czech Republic, France, Italy, Korea, Norway, Slovakia, Slovenia, Sweden and Taiwan.

All submissions were double peer reviewed and over 211 papers were accepted. The Scientific and Technical Advisory Board of **INTERPRAEVENT** selected 46 inspiring and trailblazing papers for oral presentations and 151papers are presented as innovative and exciting posters. At this IP 2024 conference, lectures and posters are presented both physically in the conference rooms and are also offered to participants virtually via streaming.

In order to ensure that the extensive knowledge of the conference is long-lasting, all presented papers (oral and poster) have been compiled in this conference proceedings.

**INTERPRAEVENT** likes to thanks all authors, reviewers and the Designstudio Kopfsache for their valuable contribution, without whom this conference proceedings would not have been possible. Special mention should be made of the perfect work of the editors and co-editors, members of the the **INTERPRAEVENT** Science and Technology Advisory Board (STAB), who made a smooth and excellent review process possible. Their names are listed on the next page. Finally, we would like to express our sincere thanks to the local organizing team (LOC), whose persistent work contributed to the success of this volume and the conference. They are also mentioned by name on the next page.

We hope you enjoy reading and thank you for your contribution and your participation at **INTERPRAEVENT 2024**.

Yours sincerely,
Editor in chief,

**Josef Schneider**

# B02 CLIMATE CHANGE ADAPTATION IN THE ALPINE TERRITORIES: RISK PERCEPTION, OBSTACLES AND ADAPTATION STRATEGIES

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## ABSTRACT

Climate change-induced extreme events and natural hazards present growing risks to the Alpine region. Climate change affects risk perceptions, awareness, and behaviour, thereby influencing public responses to hazards. Effective risk management is essential to reduce damages during extreme events, but challenges in public risk perception persist. This article presents the initial findings of the AdaptNow project, which seeks to enhance adaptive capacity through climate adaptation and risk mitigation tools. Overcoming barriers to adaptation requires addressing risk perception, public awareness, and the lack of skilled personnel. To achieve this, it is recommended to have data-based discussions, participatory decision-making, and improved communication. The Alpine region urgently needs to address complex risk factors in a multidisciplinary way. Territories should intensify efforts to adapt to climate change, emphasising active stakeholder involvement and cautious public engagement.

## INTRODUCTION

Extreme events and natural hazards have always been a part of life in the Alpine region. The people and their possessions are inherently exposed to risk from geological, hydrological, and meteorological hazards. These hazards include river floods, torrents, rockfalls, avalanches, heavy rain, landslides, heatwaves, forest fires, and storms. In 2014, the IPCC (Field, 2014) confirmed that certain areas of the Alps are already experiencing altered meteorological conditions, which are affecting local communities. There is increasing evidence to suggest that temperatures are rising more rapidly at higher elevations. This leads to faster changes in mountain ecosystems and their hydrological systems (Baselt, 2021; Schneiderbauer, 2021). It also affects low-lying areas that rely on the processes occurring in the alpine catchment in various ways. The AR6 Synthesis Report on Climate Change 2023 confirms that certain ecosystems, including mountain areas, are approaching irreversibility in terms of the impacts of climate change.

Although public risk management measures aim to prevent hazards up to a certain level of design and reduce the impact of extreme events beyond that level, it is important for the population and stakeholders to participate in taking their own precautions. However, successful implementation of protective measures and effective response during extreme events requires enhanced awareness and sensitization to natural hazards in the future. Therefore, it is crucial to maintain objectivity and avoid subjective evaluations when discussing climate change. It is important to note that 'climate' refers to the average weather and its fluctuations over a 30-year period, expressed statistically in terms of the mean and variability of relevant variables. Detecting changes in climate conditions can be challenging due to the subjective nature of individual experience. However, society is already experiencing the consequences of climate change and related natural disasters and must prepare for future events.

## RISK PERCEPTION IN A CHANGING CLIMATE

Risk perception is the intuitive evaluation of risks carried out by individuals and groups when presented with uncertain and restricted data. It can manifest in various ways, including awareness, concern, and preparedness (Raaijmakers, 2008). When individuals have a specific understanding of a particular threat, their risk perception is their personal interpretation of the level of risk associated with the perceived object. Risk awareness and risk perception are two distinct concepts. Risk awareness refers to the level of acknowledgement regarding potential hazards, such as those associated with climate change. On the other hand, risk perception concerns the subjective evaluation of these risks (Lechowska, 2018). It is important to note that increased risk awareness and perception have been identified as factors that promote public support for management policies and the adoption of precautionary measures for disaster reduction.

Dominicis et al. (2015) argue that risk perception is influenced by environmental and psychological processes. The impact of extreme weather conditions caused by climate change raises questions about the public's response to modifying risk and resulting behaviour during a hazard event from a social-psychological perspective. Individuals are generally more willing to act against a hazard when they perceive a greater risk. Currently, scholars acknowledge the importance of examining the social, political, and cultural contexts in which risk is intertwined. They also recognize the connections between individuals, their risk perceptions, and the specific locations where they encounter risk (Cardwell and Elliott, 2019).

Besides the public's individual perception of risk, the risk governance approach focuses on the effective cooperation of different stakeholders in dealing with natural hazards and the consequences of climate change. The risk governance approach aims to achieve a shared risk agenda through diverse protection options and their implementation by stakeholders. In the context of risk governance, it is crucial

to incorporate preventative, active, and sustainable public relations to reduce damages during extreme events. According to Schindelegger (2019), several aspects must be acknowledged to foster risk governance. Firstly, there is no standardized and universally applicable scheme for integrating risk governance mechanisms into society's approach towards natural hazards. Secondly, it is important to note that risk cultures and institutional frameworks can vary not only nationally, but also regionally and locally. Additionally, the degree of acceptable risk may differ. Therefore, the risk governance approach can have a significant influence if it successfully connects stakeholders from planning, disaster management, and natural hazard management through the use of platforms, joint consultations, and frameworks. The implementation of hazard prevention measures requires active citizen participation within the self-protection framework. Attems et al. (2020) report that citizens in the urban area of Graz would like to be involved in the decision-making process regarding public flood protection measures. It is essential that people take their own steps to minimise the consequences, whether caused by climate change or a natural hazard. However, the implementation of such protective or adaptive measures for self-protection is often contentious due to self-financing, effectiveness concerns, or lack of knowledge about technical measures. Pagliacci et al. (2020) conducted a study in the Veneto region of Italy, which is periodically affected by heavy rainfall. The results (Fig. 1) show that more than two thirds of the population do not consider any countermeasures because they do not perceive themselves to be threatened by an extreme event, even though there is an objectively high risk of flooding due to heavy rainfall in the region. Eleven percent of respondents do not believe they have any direct responsibility for installing countermeasures. Seven percent reported a lack of knowledge about available protection measures and their benefits. According to Pagliacci et al. (2020), this perception is the main barrier to successfully mitigating flooding of private property due to heavy rainfall.

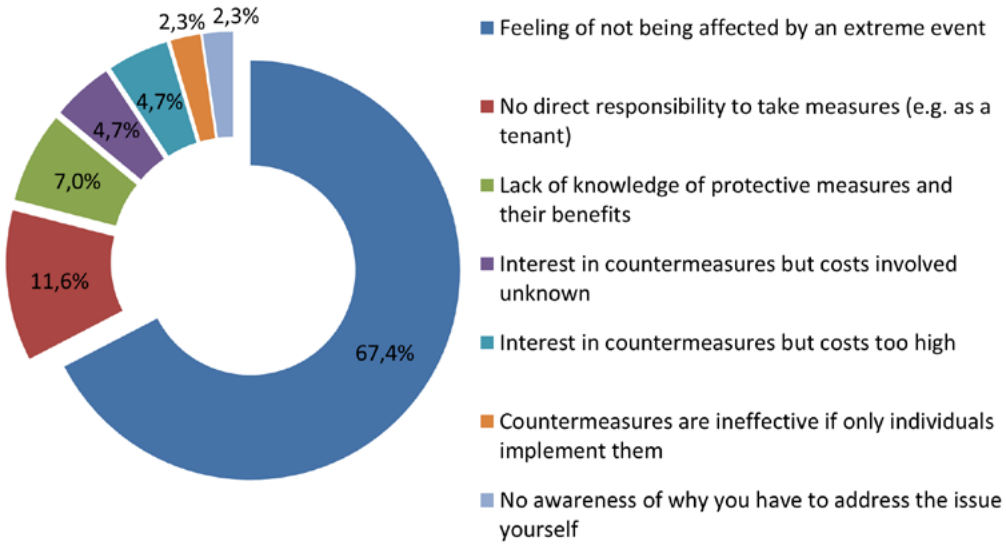


*Fig. 1:Reasons for reluctance to implement appropriate measures against flooding caused by heavy rainfall events in one's own home: The data is taken from a study conducted by Pagliacci et al. (2020) on the Italian region of Veneto, which is at risk from heavy rainfall events.*

## OVERCOMMING OBSTACLES FOR SUCCESSFUL CLIMATE CHANGE ADAPTATION

Alpine regions are facing a rise in extreme weather events, including heavy rainfall, flash floods, heatwaves, droughts, low water levels, and forest fires. These sudden events are accompanied by gradual processes, such as rising temperatures and changing rainfall patterns, which are slowly but steadily altering biodiversity, melting glaciers, lowering groundwater levels, and drying up green spaces in urban areas. These processes can be addressed through climate protection and climate change adaptation. Climate protection aims to reduce greenhouse gas emissions, which are the underlying causes of climate change. The goal is to limit the emergence and intensification of climate change, for example, by using fewer fossil resources. However, there is an increasing focus on climate change adaptation, which deals with the symptoms of climate change. Climate change adaptation refers to adjusting to changing conditions and environmental influences, as well as preventing certain phenomena such as heat waves, surface runoff, and heavy rainfall. To use a serious disease analogy, you need to treat the symptoms (adaptation) until you can cure the cause of the disease, or at least keep it at stable, manageable levels (protection).

The Interreg Alpine Space project AdaptNow (ADAPTation Capacity Strengthening for Highly Affected and Exposed Territories in the Alps NOW, www.alpine-space.eu/project/adaptnow/) aims to strengthen the adaptive capacity of highly affected and exposed territories. This is achieved by promoting, implementing, and evaluating available climate adaptation and risk mitigation management tools and practices. The project also assesses climate adaptation plans and develops climate services to support territories and their local authorities. After the first year of the project, an inventory of existing climate adaptation and risk mitigation management tools was collected and published on the Climate Adaptation Platform for the Alps (CAPA). These tools can be found by filtering with the keyword 'ADAPTNOW project'. The goal of AdaptNow is to integrate, collaborate, and include risk and adaptation planning. AdaptNow aims to achieve a more dynamic, agile, and

participatory planning process involving all local stakeholders. To support pilot actions and help set up and run climate services in the Alps, AdaptNow brings together regional sectoral agencies and research centres from five alpine countries.

In recent years, various measures have been implemented to enhance risk perception, raise awareness of natural hazard risks, and encourage personal initiative for climate protection and adaptation among the population, as well as decision-makers in politics and business in alpine regions. However, the AdaptNow project group has recognised that, despite the wide range of communication techniques and funding programmes available, the willingness to implement these measures remains rudimentary in most alpine municipalities. The reasons for the lack of implementation of adaptation and mitigation measures are varied and highly dependent on the local area. While some successful examples, such as the Italian metropole Turin or the Slovenian village Selnica, exist, in most cases, various obstacles are cited as preventing their realization or implementation.

The AdaptNow project has found that climate change and energy consultants, as well as local and regional authorities, encounter significant challenges when promoting the implementation of climate change adaptation and mitigation measures to the public. One of the main obstacles they face is the differing risk perceptions of the public, as well as the lack of public awareness and knowledge regarding the impacts of climate risks. The public's reduced willingness to act fruitfully in adapting to climate change is often due to the large number of pressing issues that require or preoccupy their attention, such as ongoing wars, inflation, energy prices, and refugees. Additionally, fundamental scientific facts are regularly misrepresented or distorted in political discourse, which further contributes to this issue. Whether used in official speeches, personal discussions, stakeholder meetings, or on social media platforms, rhetorical tricks can be difficult to detect for non-experts. To address this issue, the website 'klimafakten.de' provides information on the techniques that are purposefully deployed to spread disinformation in the climate change debate. Argumentation patterns are often used to distort scientific facts and hinder or prevent climate protection or adaptation measures. These patterns are almost always present in discussions about climate change. The website 'klimafakten.de' identifies such patterns, including redirecting responsibility to other polluters ('blame-shifting'), promoting weak countermeasures ('radical change is not necessary'), emphasising the disadvantages ('change will hurt us'), or prematurely capitulating ('there is nothing more we can do anyway').

A significant challenge is the scarcity of proficient personnel and resources to promote climate adaptation tools. Experts with practical knowledge of a particular issue are hard to come by. Finding experts for niche measures, such as adaptation measures for highly touristic areas, training of forest workers in thematic climate adaptation measures (native seedlings, climate-resilient trees, changes in daily forest and agricultural practices), or mitigation of strong wind currents in cities with narrow and dense urbanisation, can be challenging. This goes hand in hand with political obstacles within the municipalities to provide the necessary funding, in particular for staff, but also for promotional activities, feasibility studies or even the implementation of adaptation measures. Furthermore, the Alpine regions and municipalities frequently face multiple hazards concurrently, such as severe floods, heatwaves, gravity risks, forest fires, and storms. This results in various sectors being affected simultaneously, including urban planning and infrastructure, forestry, tourism, health, and biodiversity.
Although communicating risks and realising climate adaptation can be challenging, the AdaptNow project consortium has compiled recommendations from workshops, stakeholder meetings, and roundtables. These recommendations have proven helpful in discussing climate change issues and related hazards, and in motivating the implementation of adaptation and mitigation measures:

- Avoid downplaying or exaggerating the effects of climate change.
- Back up viewpoints with scientific evidence and facts to establish a trustworthy and reliable basis for discussion.
- Encourage the expression of all concerns and ideas without judgement.
- Create an open and innovative environment that encourages productive discussions.
- Foster creativity, collaboration, and team building.
- Build societal resilience and promote collaboration among regional stakeholders.
- Focus on delivering outcomes that benefit the group, rather than highlighting individual opinions or concerns.
- Ensure decision-making processes are more participatory.
- Improve communication between institutions and citizens and share the benefits of success with all stakeholders.

## CONCLUSIONS

The Alpine region is experiencing more severe, frequent, and unpredictable disasters due to climate change, which have significant impacts on both nature and society. Conventional weather patterns are being replaced by volatile climate events that are increasingly difficult to manage. It is urgent to address these uncertainties and cope with climate change-related disasters to give the most affected and exposed areas a fighting chance.
Efforts to better understand how people living in mountain areas perceive and respond to risk are imperative. The study should address the extent to which unique mountain-related factors, encompassing biophysical, economic, social, and cultural dimensions, play a central role in shaping risk perceptions. A multidisciplinary approach is essential to understand the complex interactions between different influencing

factors. Future activities at all levels should aim to analyse risk perception in mountainous areas, going beyond a mere description of the concept. Ideally, this analysis should include mountain-specific factors, such as critical aspects of religious, social, cultural, and political contexts.

In addition, the effects of climate change in the Alpine region and the resulting natural hazards will need to be addressed intensively at all levels. In addition to climate protection, the adaptation of territories to climate change is becoming increasingly important. The Adapt-Now project demonstrates that all stakeholders must be actively involved for successful implementation. To increase risk perception and awareness and ultimately implement adaptation measures, a cautious approach should be taken. The development and implementation of adaptation and mitigation measures should actively involve the public without overburdening them.

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