Interreg Co-funded by the European Union

Alpine Space

ADAPTNOW

TOPIC BRIEFS FOR ADVANCED PLANNING

Delivreable D1.3.1

May, 2023

European Regional Development Fund Support from the European Union: € 1.525.987,54

BLANK PAGE

This project is co-financed by the European Regional Development Fund
through the Interreg Alpine Space programme

DOCUMENT CONTROL SHEET

Project reference	
Full title of the project	ADAPTation Capacity Strengthening for Highly Affected and Exposed Territories in the Alps NOW
Acronym	ADAPTNOW
Contract agreement n.	
Duration	01.11.2022 – 31.10.2025
Project website	https://www.alpine-space.eu/project/adaptnow/
Project coordinator	AURA-EE

Short Description
ADAPTNOW will work on strengthening the adaptive capacity of HAET by implementing and evaluating the available climate adaptation and risk mitigation management tools and practices, assessing the Climate Adaptation Plans and developing Climate Services to support the territories and their local public authorities. Ultimately, ADAPTNOW aims at making risk and adaptation planning more integrated, collaborative and inclusive. This will be reached through a more dynamic, agile and participatory planning process in which all local stakeholders need to be involved.

Document Details	
Title of document	Topic briefs for advanced planning
Action	
Deliverable	D1.3.1
Delivery date	Octobre 2024
File name	ADAPTNOW_D1.3.1_Topic Briefs for advanced planning.docx
Reviewers	Consortium
Dissemination	Public

Version	**Date**	**Author**	**Organization**	**Description**
V1	04.05.2023	Rogelio Bonilla	AURA-EE	Preliminary draft
V2	31.10.2024	Fabio Carnelli	Eurac	First draft
V3	31.01.2025	Fabio Carnelli	Eurac	Second draft
V4	18.02.2025	Rogelio Bonilla	AURA-EE	Final version

RESPONSIBLE PARTNER FOR THE COMPILATION OF THIS DOCUMENT

Contribution by PP4, PP6, PP5 and PP3 respectively for each thematic workshop (nature-based solutions, CA&RM measures, integrated planning and financing tools, community engagement and communication and extreme/compound/cascading events).

Compiled by LP

PROJECT LEAD PARTNER

Auvergne-Rhône-Alpes Energy Environment Agency

Auvergne Rhône-Alpes Énergie Environnement

Rue Gabriel Péri 18, 69100 Villeurbanne, France
Phone: +33 (0)6 98 08 66 97, +33 (0)6 99 83 97 57
Email: rogelio.bonilla@auvergnerhonealpes-ee.fr, noemie.bichon@auvergnerhonealpes-ee.fr

BLANK PAGE

This project is co-financed by the European Regional Development Fund
through the Interreg Alpine Space programme

CONTENT

This project is co-financed by the European Regional Development Fund
through the Interreg Alpine Space programme

INTRODUCTION

Topic briefs suited to regional and local actors for integrated planning: examples, support tools and capacity building programmes.

Promoted to regional and local actors through regional conferences.

This project is co-financed by the European Regional Development Fund
through the Interreg Alpine Space programme

1. THEMATIC WORKSHOP 1 - NATURE BASED SOLUTIONS

1.1 DESCRIPTION OF THE CONCEPT

A transnational peer to peer thematic internal workshop on Nature Based Solutions (NbS) has been organized. The 3 mains objective of this workshop were:

1. To have an introduction to the topic with the definition of the key terms and concepts associated.
2. Presentation of NbS initiatives known by or in which project partners are/have been involved.
3. Critical analysis on NbS used and summarizing the feedbacks from the project partners.

The workshop has been conducted in 3 steps:

- Step 1: Presentations by each concerned project partners with a focus on the replicability on the NbS presented on other sites.
- Step 2: Exchanges on the effectiveness applicability, to the initiatives presented in step 1, of the IUCN concepts and criteria about NbS.
- Step 3: Use of all the material collected during the workshop for drafting the following brief topic about NbS.

A total of 13 showcases of NbS were presented during the first step of the workshop process, providing perspectives (Step 2 and 3) for the project partners. These examples covered a very broad spectrum of the possibilities offered by NbS. These are the following 13 examples:

1. Draining pavements to increase soil permeability and mitigate the risk of flooding due to heavy rain, Savona. Within the framework of INTERREG Maritime project ADAPT, a draining pavement in the courtyard of a school and one in the paths of a city park were installed.
2. Promotion of adaptation measures against the effects of heat waves in urban areas, Genova. Pilot action of the “CLIMACTIONS” project: redesign of an urban area using trees and plant able to contrast extreme heat and air pollution.
3. Promotion of adaptation measures against the effects of heat waves in urban areas, Parco del Ponte and Cerchio Rosso, Genova. Creation of botanical gardens with resilient hydraulic system to absorb and collect rain and waste water. Within the framework of the National Operative Programme (ongoing)
4. Demonstration of key climate and water-related challenges in a central and densely populated district characterized by disorganized post-war urbanization, Genova’s Lagaccio district. Within the framework of the H2020 Unalab Project.
5. Study of drainage systems, pavements and rainwater collection and outflow net on buildings and soil in public spaces, Genova. Within the framework of project “CLOUDBURST” (ongoing).
6. The Territorial Sylvicultural Plan initiative (TSP) is a strategic document intended for forest managers, which sets out the management methods approved as sustainable and meeting the challenges of the forest's multifunctional role, in environmental, heritage and economic terms.

Any forest owner can therefore take a virtuous approach and be helped to do so across France. The example used was the TSP of the Grenoble Alpes Métropole.

7. Large scale mapping of French protective forest against rockfalls danger. Based on a modelling approach, this regional map provides information about 1) the place where forest stands potentially have a protective effect against rockfalls risk and 2) a first input about the efficiency of this protection according to distance travelled by boulders in forested areas. This map serves for defining where to conduct high resolution expertise and to use the French protective forest management guidelines.
8. The 3 French protective forest management handbooks for developing protective forest sustainable management according to the Pyrenees, and the Northern and Southern French Alps conditions.
9. The Climessence application for evaluating the consequences of different IPCC scenarios on tree species future distribution for improving Nature based Strategies based on forestry.
10. The possibilities offered by the current French Risk Prevention Policy for integrating protective forest in natural risk Prevention Plan via the creation of “Green zones”.
11. Climate resilient tree species project, 10 regions in Alpine Space, IT, AT, DE, CH. The objectives are 1) to plant 500 climate-resilient trees in each of the ARGE-Alp region, which are above 1000m and “climate resilient and 2) to adapt alpine forests to climate change (Approximately 40,000 ha of Tyrolean Forest are classified as „climate-sensitive forest areas “, which are those forests located in dry areas below 1000 m above sea level). These are the priority for rejuvenation and conversion into mixed forests. The long-term goal of the “Climate-Smart Tyrolean Mountain Forests” action group is to adapt Tyrolean forests for climate change. Furthermore, they aim to raise social awareness particularly to the consequences of climate change on protective forests and the environment).
12. The RIE Index in Bolzano. Numerical index of environmental quality indicating the effect of building intervention with respect to the permeability of soil and greenery. The objectives are to decrease impermeability of soil, mitigate impact of heavy rains, contribute to CA to heatwaves and reduce high temperature. The R.I.E. procedure applies to all building and urban transformation interventions within production areas subject to building permits. In the case of building measures involving the sealing of large areas, an ecological balance must be created through green roofs, engineering-biological technologies and through greening and planting. It’s a certificate.
13. NbS for adapting of smaller streams to high water and heavy rains in Slovenia. Implementation by the Municipality of Selnica ob Dravi.

2.1 WHAT ARE THE CONCLUSIONS OF THE WORKSHOP?

Coming out from the exchanges within the workshop and with the support of a bibliographic review a synthetic drafting about Nature-based Solutions (NbS) has been set up and can be used for knowledge awareness.

NbS are defined as actions that leverage natural or modified ecosystems to address societal challenges in a way that is effective and adaptable, while providing benefits for both human well-being and biodiversity (IUCN French Committee, 2019; Sowińska Świerkosz & García, 2022). The idea of working with nature is central to NbS, to create resilient systems that support sustainable development. Protecting biodiversity is a critical societal challenge, as it underpins human development and economic activities. By utilizing natural

features—such as forests, wetlands, and coastal ecosystems—NbS seek to integrate this "biodiversity" priority with other societal challenges, such as climate change adaptation and mitigation, disaster risk reduction, biodiversity conservation, securing water supplies, fostering socio-economic development and improving human well-being (Rey et al., 2019; Young et al., 2019; Accastello et al., 2019; Alva, 2022). These solutions focus on preserving, restoring, and sustainably managing ecosystems, making them versatile approaches for achieving both environmental and socio-economic benefits.

The NbS concept was first raised during the 2009 United Nations Framework Convention on Climate Change Conference of the Parties, and in 2013 it was incorporated into the Global Program of the International Union for Conservation of Nature (IUCN) (Eggermont et al., 2015). NbS gained further international recognition following COP21 in 2015 and the 2016 World Conservation Congress, especially for their contribution to sustainable development goals, including good health and well-being, clean water and sanitation, life on land and below water, and climate action.

NbS can be applied in three primary ways, individually or in combination across regional actions (IUCN French Committee, 2019): (i) preserving functional and ecologically intact ecosystems; (ii) managing ecosystems sustainably for human use; and (iii) restoring degraded ecosystems or creating new ones. NbS is closely connected to ecological restoration, ecological engineering, and blue/green infrastructure, with a strong emphasis on the preservation and conservation of natural processes (Poratelli et al., 2020; Ommer et al., 2022).

However, effective implementation of NbS requires comprehensive planning that considers local conditions, scales, and stakeholder involvement. Potential trade-offs, such as between conservation goals and economic demands, must be managed through integrated risk management approaches that account for the socio-economic contexts of affected communities. Engaging local stakeholders, enhancing public awareness, and fostering governance frameworks that promote collaboration are all essential to the success of NbS.

As the need for sustainable solutions grows, NbS offer a promising path forward, aligning human development with ecological health, and supporting a more resilient future for both nature and society.

The International Union for Conservation of Nature (IUCN) developed a framework of eight key principles to guide the implementation and effectiveness of NbS. These are the following eight criteria (IUCN, 2020):

1. Address societal challenges: NbS should target and provide solutions to specific societal challenges, such as climate change, disaster risk reduction, food security, water security, and human health.
2. Design at scale: NbS should be implemented at an appropriate scale to achieve the desired outcomes. This includes considering the ecological, spatial, and temporal scale, as well as local and regional needs.
3. Biodiversity net gain: NbS should not only protect biodiversity but should also lead to measurable biodiversity gains over time, enhancing ecosystem health and resilience.
4. Economic viability: NbS must be economically feasible and capable of sustaining themselves over time. This includes considering cost-effectiveness, funding sources, and potential for long-term economic benefits.
5. Inclusive governance: Effective NbS require inclusive, transparent, and participatory governance that involves all relevant stakeholders, including local communities, governments, and the private sector.

This project is co-financed by the European Regional Development Fund
through the Interreg Alpine Space programme

6. Equitable and fair: NbS should promote social equity, rights, and fairness, ensuring benefits are shared and accessible to all, particularly marginalized and vulnerable communities.
7. Balance trade-offs: NbS should carefully assess and manage trade-offs to avoid compromising ecosystem integrity, biodiversity, and socio-economic benefits.
8. Adaptive management: NbS must be designed with adaptability and resilience in mind, allowing for adjustments based on monitoring, learning, and changing conditions, especially in response to climate change and evolving socio-economic dynamics.

These eight principles ensure that NbS are applied in a way that provides long-term solutions, fosters resilience, and supports sustainable development in harmony with nature.

Depending on the nature of the ecosystems involved and the engineering approaches used, NbS are classified into three main categories:

1. Blue Nature-based Solutions refer to the use of marine and freshwater ecosystems to address societal challenges. These solutions focus on managing, conserving, and restoring water-based ecosystems such as oceans, coasts, rivers, lakes, and wetlands.
2. Green Nature-based Solutions (refer to the use of terrestrial and land-based ecosystems to address societal challenges these solutions focus on restoring, and sustainably managing “green spaces” such as forests, grasslands, agricultural lands, and urban green spaces. For forest, the term Forest-based Solution is also used. In the Alpine space FbS serve in particular as protective buffers against natural hazards like landslides, floods, and wildfires, especially in vulnerable areas such as mountains and coastal zones.
3. Grey Nature-based Solutions typically refer to the integration of traditional engineering approaches (often referred to as "grey infrastructure") with blue and/or green NbS. While "grey" generally denotes built infrastructure—such as concrete flood barriers, drainage systems, and levees—Grey NbS involves blending these conventional approaches with natural processes to create more effective and sustainable solutions.

During the workshop, the case of Forest-based Solutions (FbS) proved particularly insightful, highlighting both the importance of NbS and the challenges associated with them in the Alpine Space (including both the adaptation of forest to Climate Change and the use of forest as part of the strategy to develop CC adaptation plans). FbS are of primary importance. Forests can play a critical role in preventing or mitigating natural hazards by reducing their likelihood, frequency, magnitude, or intensity—especially in mountainous (Moos et al., 2018) and coastal areas (Ahmed et al., 2022). These “protective forests” (also known as “protection forests”) help make such regions safer for habitation and serve as effective Ecosystem-based Disaster Risk Reduction (Eco-DRR) solutions (Teich et al., 2022; Nehren et al., 2023). Eco-DRR involves the sustainable management, conservation, and restoration of ecosystems to reduce disaster risks, supporting resilient and sustainable development (Sudmeier-Rieux et al., 2021). Properly managed ecosystems can act as Eco-DRR measures by influencing components of natural hazards and providing essential ecosystem services. These services are crucial for strengthening socio-economic resilience and supporting the livelihoods of communities. The Eco-DRR concept emerged in 2009 and was formally defined in 2013, aligning with forest management practices aimed at safeguarding people and assets from natural hazards, similar to the long-standing approach of multifunctional mountain forest management (Dorren et al., 2004).

As noted, NbS encompass various existing approaches, and Eco-DRR qualifies as NbS when it addresses major societal challenges while benefiting biodiversity (IUCN French Committee, 2019). By integrating protective forests as Eco-DRR measures, it is possible to prevent or mitigate natural hazards, creating resilient

landscapes as a primary goal (Nehren et al., 2014). Protective forests, therefore, can be considered a specific form of NbS, focused on hazard prevention and reduction. They can be so classified as "Forest-based Solutions" (FbS), defined as actions that use or aim to establish forests to preserve healthy ecosystems, restore degraded areas (or create new ones), and improve ecosystem management to address societal challenges, while enhancing both human well-being and biodiversity.

Effective FbS initiatives must be grounded in forest ecosystem functions, implemented at scales appropriate to the societal challenges they address, and strive to balance local and global needs without causing harm to either. They require the involvement of all forestry stakeholders to enable integrated governance and emphasize awareness and education. Additionally, managing protective forests to enhance resilience and protective capacities brings further benefits, such as carbon sequestration, aesthetic value, and support for local communities' livelihoods (Renaud et al., 2016).

The interreg Alpine Space project RocktheAlps has proposed a first SWOT analysis about the main items of protective forest policy within the different countries of the Alpine Space. The following matrix summarizes the current situation. This matrix template can and should be adapted to other NbS in order to establish a current overview of their uses.

		Austria		Germany		France		Italy		Slovenia	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Existence of a regulation for risks prevention	National	X			X	X			X	X	
	Regional	X		X			X	X		X	
Existence of a protection forest classification	National	X		X		X			X	X	
	Regional		X	X			X	X		X	
Comprehensive mapping of natural hazards	National	X			X	x		X			X
	Regional	X		X		x		X			X
	Local	X		X		x		X			X
Comprehensive mapping of natural risks	National		X		X		X	X			X
	Regional		X		X	X		X			X
	Local		X		X	X		X			X
Comprehensive mapping of protection forest ecosystem service	National	X		X		X			X	X	
	Regional	X		X		x			X	X	
	Local	X		X		x			X	X	
Financing of this ecosystem service	EU	X			X	x		X		X	
	National	X			X	x			x	X	
	Regional	X			X	x			x		x
	Local	X		X			x		x		x
Natural risk prevention document integrating this ecosystem service	National	X			X		x		x	X	
	Regional	X			X		X		X	X	
	Local	X			X		X		X	X	
Existence of a standardized methodology for risks zoning	National	X		X		X			x	X	
	Regional	X		X			X	X		X	
	Local	X		X		X		X		X	
Existence of protection forest management guidelines	National	X		X		X			x	X	
	Regional	X		X		X		X		X	
	Local	X		X		X			X	X	
Societal demand for valuing forest-based solutions		X		X		X		X		X	

Fig. 1 SWOT Analysis of protective forst policy in the Alpine Space

This matrix has to be improved for integrating the Climate Change dimension. Climate and societal changes are projected to have lasting, adverse effects on forest ecosystems in the coming decades. These impacts will manifest as increased natural disturbances (such as forest fires, droughts, and storms) and as changes in the structure and composition of forest stands. Understanding and anticipating these impacts is essential to prevent negative outcomes that may affect the protection of people and human assets from natural hazards, making this a significant challenge for the foreseeable future.

There may also be potential conflicts between the development of FbS and ecosystem preservation. For example, effective FbS might sometimes lead to reduced biodiversity or increase susceptibility to

disturbances like wildfires. To address these complexities, the Integrated Risk Management (IRM) approach should be reinforced to account for multiple risks and ensure protection strategies, all socio-economic factors in vulnerable areas should be considered (Teich et al., 2022). This includes safeguarding transportation infrastructure, economic activities, and all elements essential to regional development. IRM should emphasize the involvement of local authorities and citizens, recognizing that communities—especially in urban areas—often lack sufficient risk information. Alternative development strategies that enhance territorial resilience against natural hazards should also be explored, considering interdependence across regions and scales.

Effective integration of FbS into protection strategies requires a comprehensive understanding of their services and impacts within IRM frameworks and governance (Nesshover et al., 2017). This involves weighing the benefits and limitations of FbS based on scenarios that reflect each region's unique characteristics, including hazard types, socio-economic factors, development trajectories, and climate (e.g., altitude, drought). A key question is how to position FbS within an overarching protection strategy that must also consider technical protections and all phases of the risk management cycle, from preparedness to recovery. To support this analysis, we could develop multi-criteria decision-making tools and ensure access to robust data and models on how various FbS types impact specific benefits and risks in different landscapes. Mountain areas, in particular, are often exposed to multiple risks in the same territory, making it crucial to optimize FbS under potentially conflicting protection goals. Building on extensive experience from Alpine regions, we could develop indicators to evaluate the capacities and limitations of FbS in reducing natural risks while also preserving, restoring, or managing ecosystems and biodiversity (Shah et al., 2020).

For years, many research teams have been active in advancing FbS initiatives, and further studies are needed to deepen knowledge and expertise in this area. Future investigations, which will draw on both disciplinary and interdisciplinary research, will merge insights from forest science, ecology, geoscience, and social science. Cross-disciplinary and multi-stakeholder approaches are essential to realizing the multi-faceted benefits of FbS, which can be applied across aquatic, terrestrial, and transitional environments. This research contributes and will contribute to developing guidelines and recommendations for assessing existing FbS, identifying suitable FbS for various contexts, understanding the benefits and limitations of FbS, and effectively incorporating FbS into global protection strategies tailored to specific regional characteristics and potential environmental changes, including climate. One of the challenges is the raising awareness strategy to be implemented for educational and training purposes of all the concerned stakeholders.

The main inputs from the workshop are summarized in the following “NbS in a nutshell”.

The 2 basic principles of NbS are:

1. To rely on biological, geological, or hydrological processes to provide ecosystem services beneficial to humans.
2. To work with nature rather than control it, promoting the restoration, protection, and sustainable management of ecosystems.

The 4 Main Benefits of NbS are:

1. Sustainability: NbS provide long-term sustainable solutions by preserving ecosystems and avoiding costly and unsustainable artificial infrastructure.

This project is co-financed by the European Regional Development Fund
through the Interreg Alpine Space programme

2. Resilience: By enhancing ecosystems' ability to adapt to environmental and climate changes, NbS help strengthen community resilience.
3. Co-benefits: Nature-based interventions often deliver multiple co-benefits, such as biodiversity protection, improved human health, and the economic well-being of local communities.
4. Cost-effectiveness: In many cases, NbS can be more cost-effective than conventional solutions by avoiding the construction and maintenance costs associated with artificial infrastructure.

NbS face challenges and limitations. Here are the 4 main ones identified during the workshop:

1. Knowledge and Awareness: Currently there is a lack of a real “risk and NbS culture”. For example, the great public generally considers that the forest grows by itself and so there is no need for forest rangers. There is also a strong need for more participative management/decision making. How to harmonize and share knowledge/data/models/success and non-success stories? In this framework a greater awareness of the benefits of NbS is needed, along with a better understanding of natural processes and expressing of the uncertainty of the efficiency of some NbS according to the consequences of Climate Change. A communication strategy tailored to the relevant stakeholders, including policymakers, decision makers, managers, and the general public, must be implemented. This strategy should be based on synthesized data and illustrated with both success and failure stories. The creation of a network of experts (scientific, technical, and political) with recognized experience in NbS is necessary at regional, national, and Alpine scales. At the Alpine level, this network should build on existing structures (Alpine Convention, EUSALP) by either establishing a cross-cutting task force across existing working/action groups or creating a dedicated working/action group. The creation of an online, multilingual resource database for the Alpine region, which will gather documentation on NbS (including examples of concrete projects with a critical analysis of whether or not their objectives were achieved), is necessary. The operation of this resource center and the promotion of NbS will also require the implementation of a "NbS flying circus" in the Alpine regions by the regional correspondents of this resource center.
2. Policy Integration: To maximize their effectiveness, NbS must be integrated into policies and planning practices at all levels, from local governments to international bodies. One of the weaknesses of current policies is the financing plan (scheduling, amounts) for NbS implementation and maintenance. Policies should be developed with the goal of supporting the development of real Integrated Risk Management approach and Science-Decision-Action strategies. A solution could be provided by the EU via an European ecosystems services based policy for risk prevention.
3. Impact Measurement: Developing tools and methods to accurately assess the effectiveness and impact of nature-based interventions is essential. Short/medium/long term monitoring of implemented NbS have to be set up in order to improve adaptive management of ecosystems services.
4. An adapted time scale: While the 8 criteria defined by the IUCN are currently the most developed reference for defining NbS, the associated timescale is too restrictive. It is very rarely possible, if not impossible, to meet all 8 criteria simultaneously. Therefore, it is necessary to define an analysis timescale that takes into account both the dynamics of ecosystems and the work agenda of policymakers and decision-makers.

3.1 HOW CAN MUNICIPALITIES USE THIS INFORMATION TO INCREASE/IMPROVE/DEPLOY THE SHOWCASE ACTIONS/TOOLS/METHODOLOGIES IDENTIFIED WITHIN THE WORKSHOP?

The main stumbling block to the deployment of NbS lies in the implementation of a truly integrated management of natural risks on the scale of the entire territory concerned (notion of risk basin). Such management requires an interdisciplinary, multi-sectoral and participative approach. It is only from the moment a municipality commits to this Integrated Natural Risk Management that it will be able to make use of the examples and contributions from this workshop on NbS. To do so, it is necessary to enlist the services of an organization capable of acting as a scientific, technical, and political mediator, leading the discussions to achieve the project's implementation and the mobilization of adequate funding sources. For achieving this, the following main steps have to be address:

1. Capacity Building and Knowledge Sharing
2. Permanent state of the art on NbS with identification of success and non-success stories
3. Organize site visits to compile a catalog of examples.
4. Develop a policy for training, information, and education on NbS for all stakeholders.
5. Integration of NbS in risk prevention/protection mapping, planning and policies
6. Be aware of the scale effects
7. Be aware of the potential consequences of CC on NbS efficiency in short, medium and long term
8. Be trained on the use of online tools (modeling platforms, webgis/webatlas, database) dedicated to natural risks, CC, ecosystems for improving the territorial knowledge
9. Developing of online tools for information sharing and communication with friendly graphical user interfaces and adapted to the target groups concerned

Last but not least: developing a realistic funding and payment scheme for NbS with a proactive policy for using current and proposing new financial incentives.

4.1 WHAT FORMAT SHOULD BE USED TO PRESENT CONCLUSIONS TO MUNICIPALITIES (AT REGIONAL EVENTS)?

The most suitable format is to create a booklet presenting the key concepts of NbS along with a showcase catalog. As mentioned earlier, it is also necessary to consider the creation of an online, multilingual resource database for the Alpine region, which will gather documentation on NbS (including examples of concrete projects with a critical analysis of whether or not their objectives were achieved), is necessary. The operation of this resource center and the promotion of NbS will also require the implementation of a "NbS flying circus" in the Alpine regions by the regional correspondents of this resource center. This resource center can and should be linked to similar centers, such as the CAPA platform of Action Group 8 of the EUSALP.

References

Dorren L.K.A., Berger F., Imeson A.C., Maier B., Rey F. 2004. Integrity, stability and management of protection forests in the European Alps. Forest ecology and management, vol. 195, pp. 165-176.

IUCN French Committee. 2019. Nature-Based Solutions for Climate Change Adaptation and Disaster Risk Reduction; IUCN French Committee: Paris, France.

IUCN-UICN (2020). Standard mondial de l'UICN pour les solutions fondées sur la nature. Cadre accessible pour la vérification, la conception et la mise à l'échelle des SfN. Première édition. Gland, Suisse : UICN. ISBN: 978-2-8317-2059-3. DOI: https://doi.org/10.2305/IUCN.CH.2020.08.fr

Nehren U., Arce-Mojica T. et al. 2023. Towards a typology of nature-based solutions for disaster risk reduction. Nature-Based Solutions 3, 100057.

Nehren U., Sudmeier-Rieux K., Sandholz S., Estrella M., Lomarda M., Guillén T. 2014. The Ecosystem-Based Disaster Risk Reduction Case Study and Exercise Source Book. Geneva and Cologne: Partnership for Environment and Disaster Risk Reduction and Center for Natural Resources and Development, p. 99.

Nesshöver, C.; Assmuth, T.; Irvine, K.; Rusch, G.; Waylen, K.; Delbare, B.; Haase, D.; Jones-Walters, L.; Keune, H.; Kovacs, E.; et al. 2017. The science, policy and practice of Nature-Based Solutions: An interdisciplinary perspective. Sci. Total Environ., 579, 1215–1227.

Renaud, F.G., Sudmeier-Rieux, K., Estrella, M., Nehren, U. (Eds.) 2016. Ecosystem-Based Disaster Risk Reduction and Adaptation in Practice. Advances in Natural and Technological Hazards Research. Springer.

Sudmeier-Rieux K, Arce-Mojica T, Boehmer HJ, Doswald N, Emerton L, Friess DA, et al. 2021. Scientific evidence for ecosystem-based disaster risk reduction. Nature Sustainability 4(9), 803-810. DOI: 10.1038/s41893-021-00732-4

Shah M.A.R., Renaud F.G. et al. 2020. A review of hydro-meteorological hazard, vulnerability, and risk assessment frameworks and indicators in the context of nature-based solutions. International Journal of Disaster Risk Reduction 50, 101728.

2. THEMATIC WORKSHOP 2 - INTEGRATED PLANNING AND FINANCING TOOLS

5.1 DESCRIPTION OF THE CONCEPT

Workshop description

The aim of the workshop was to highlight all the possible **methodologies and strategies able to promote and facilitate the development of the climate adaptation measures** within the territories, **verifying their implementation feasibility** and **identifying appropriate financial and funding mechanisms** to finance the implementation of climate adaptation measures. To guarantee a circular integrated approach to the overall methodological process, **the monitoring of the implementation process** of climate adaptation measure has been discussed during the workshop.

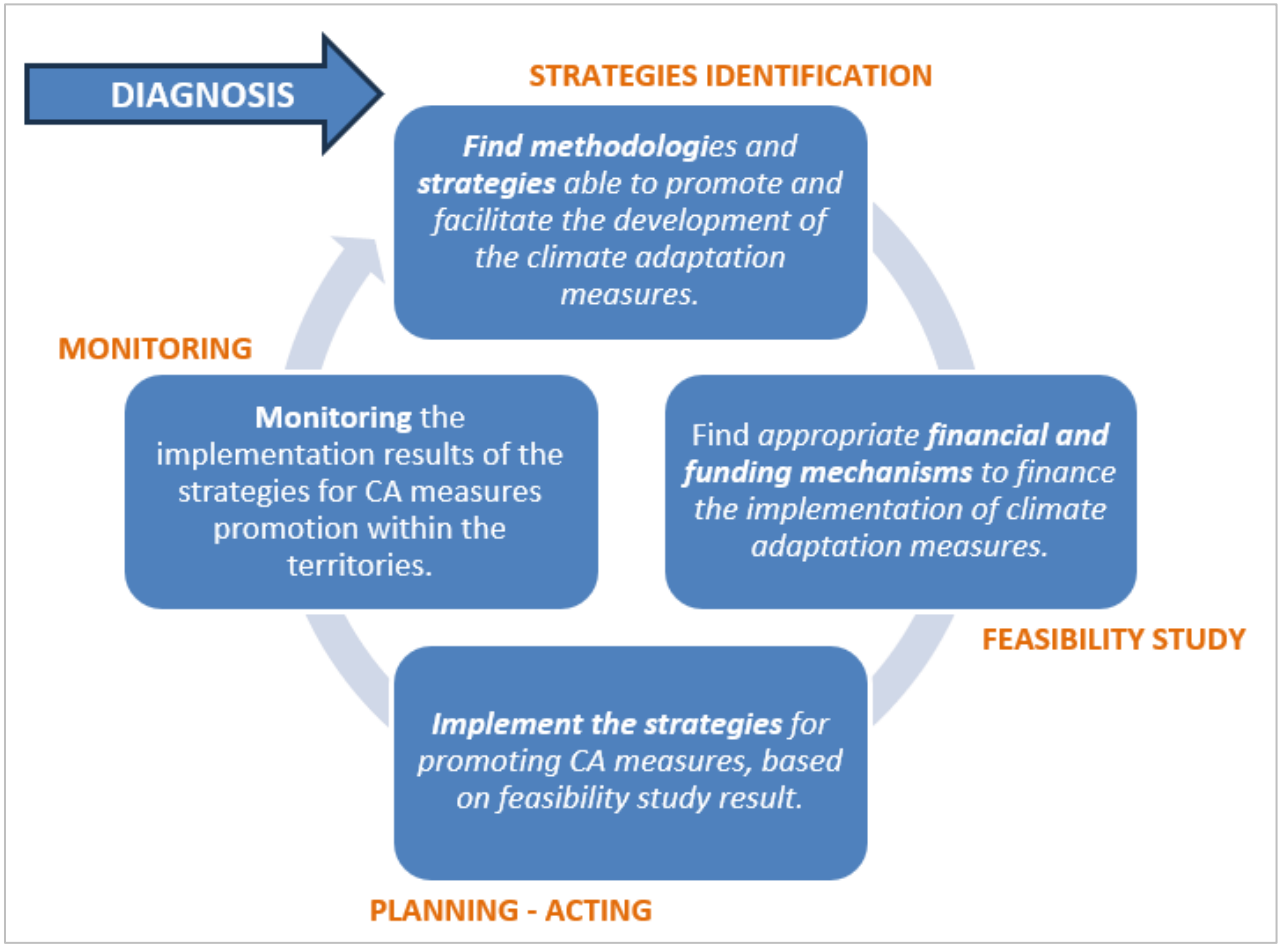

Fig. 2 Circular integrated approach to climate change adaptation.

The workshop has been organised using the *"Sprint workshop approach"*, a dynamic and interactive way to collect feedback and share/discuss them among the participants. The participants were divided into groups

of 5-6 persons; each group discussed and exchanged opinions guided by key questions aimed at finding out the best approaches and methods able to foster the development of the climate adaptation measures. The Sprint session ended with a short plenary session summarizing the outcomes from each group.

Fig. 3 One group working together

METHODS AND TOOLS FOR AN INTEGRATED APPROACH TO CLIMATE CHANGE ADAPTATION

Session 1a

- *What kind of methods and tools do you consider more affective to raise the capacity of local authorities to act in favor of climate adaptation?*
- *Is it necessary to develop new tools or methods? Which ones?*
- *What are the main barriers to overcome for a real uptake and use of climate adaptation tools and methods by local authorities?*

"Awareness" is the key word to overcome the existing barriers to the real uptake and use of climate adaptation tools by local authorities. The improvement of the awareness about the importance of the climate change adaptation must be applied transversally, starting from the citizens, up to SMEs, local and regional authorities, public administrations, private agencies, certification bodies; stakeholders aware are better motivated and confident in applying an integrated approach to climate change adaptation. Indeed, it is not easy to estimate what it means not to be adapted to climate change from a social, economic and environmental point of view, and too frequently local adaptation actions occurred after disasters happened. The implementation of a "certification on local adaptation level" can be a good balance for local authorities to act, being aware of the risks affecting the local context and, for private certification companies, to stimulate the adaptation certification market. This new generation of adaptation certification systems can

start from the inclusion, within the already existing sustainability certification systems, of indicators and qualitative aspects related to the adaptation level of the buildings.

The "qualification of the stakeholders" working in the field of climate change adaptation is fundamental for the reliability of the integrated approach process and for its local uptake through the governmental authorities.

" Visible and quantifiable results" are always the best way to capture the attention of the public and private sectors, to be credible in outcomes achieved and, consequently, to be replicated throughout the overall process by other local authorities. To ensure more visibility to such adaptation tools, they must be displayed online, taking advantage of official local channels, in order to be better disseminate and known among public and private sectors.

A natural limit of the adaptation strategies is their long-term results visibility, in contrast with the, often, large economic resources needed. Indeed, the "economic feasibility" is a practical barrier which can be faced by local authorities in implementing climate adaptation methods locally. The involvement of private company can be an answer to the problem but it's essential to create attractiveness and interest toward the certification on local adaptation level.

Since uncertainty often characterises adaptation measures, a better understanding of the topic is needed but, also, a better "transversal governance" can overcome the uncertainty, ensuring trust in adaptation measures to be funded. An effective governance avoids silos approaches by improving communication among local actors, sharing a short- and long-term action perspective, establishes common goals taking into account the citizens perspectives and needs.

Fig. 4 One group working together

Session 1b

- *In your opinion, what is an "integrated approach to climate change adaptation"?*

- *What are its key elements?*
- *What factors need to be better integrated?*

The key elements on which the integrated approach to climate change adaptation are based on:

- The participatory approach: bring together the stakeholders that usually not work together on climate adaptation measures, from different background and with various expectations. However, they are all directly concerned by the results of the climate adaptation measures put in place.
- The multi-level governance: ensuring the dialogue among all the actors involved in the adaptation process in order to give trust in the measures foreseen. Multi-level governance can overcome the uncertainty related to the adaptation measures, ensuring that they are subsidized.
- The multi thematic approach: taking into consideration the different aspects which centre around adaptation theme, balancing natural, environmental, technical, social and economic effects.
- Data Integration: improving the communication among the different sectors at local and regional level which have the information and the relevant data is the first step. It is not necessary to create something new but to integrate what already exists, ensuring greater interdisciplinarity.
- Effectiveness: the integrated approach allows to easily identify the "optimal scenario" for adapting to climate change a specific local contest, taking into account local specificities highlighted through the application of the certification of the adaptation level.
- Monitoring: monitoring the implementation of the measures foreseen in the local context in order to meet the expected results, in the estimated timeframes, with the planned resources is fundamental.
- Double vision: allows to get the short-term and the long-term viewpoint in identifying adaptation measures and actions in a clear way, with the right temporal perspective for the execution.

FINANCIAL AND FUNDING MECHANISMS FOR ADAPTATION TO CLIMATE CHANGE

Session 2a

- *In your opinion, what are the optimal funding mechanisms for the implementation of climate adaptation measures at local level?*
- *In what ways can local public authorities leverage international and national funds and grants to enhance their ability to finance and implement climate adaptation strategies in their communities?*

Long term funding mechanisms for the implementation of climate adaptation measures at local level are the most suitable because adaptation measures need time to be implemented and benefits resulting from their realisations are not always apparent immediately.

Private companies can be good financiers but it's necessary to raise awareness and increase knowledge among citizens and decision makers on the importance of actions preventing climate disasters through adaptation measures. Revenues resulting from adaptation measures deployment are mainly related to social and environmental aspects, also because it's not easy to economically estimate the impact of climate disaster prevention. Risk insurance companies can be attracted by this procedures but penalties must be introduced if they do not respect agreements. Once again, raising the lack of a "building/urban certification on local

adaptation level" which would stimulate the funding mechanisms for the implementation of climate adaptation measures at local level.

Session 2b

- *What role can public-private partnerships play in funding and implementing climate adaptation projects, and how it is possible to encourage their formation and success?*
- *How can innovation and local collaboration to develop creative and sustainable financial solutions for climate adaptation, actively involving communities, businesses and the public sector be promoted?*

Public-private partnership can positively accelerate the implementation of climate adaptation at local, regional, national and transnational level, without distinction since this cooperation can work at any spatial level. A fruitful partnership is based on long-term needs that impact on surroundings, which take into account community requirements and sector-based demands on climate change adaptation. Having the different roles played by the private part and the public one clear is fundamental to guarantee a long-term cooperation; in most cases the private component raise the economic capital starting the process while the public subject is responsible for ensuring the revenues due to the actions implemented. Obviously, spreading and raising awareness on climate adaptation strategies, on benefits and potential coming from them, is fundamental to guarantee a proactive cooperation, trust and visibility on climate actions to be implemented. This trustworthiness grows when adaptation strategies are implemented immediately after catastrophic weather events, since they are immediately recognised as essential for the territory; anyway, the trust in climate adaptation actions is also strictly connected to the degree of awareness of all the interested parties, citizens included.

Based on that, the introduction of a **"new generation of climate resilience urban and building certificates"** at regional and national level, **can speed up the recognition of the importance of climate adaptation strategies and stimulate the private market in financing this kind of measures**, by increasing the knowledge on that topic, it makes it more familiar and easily recognized.

These procedures can generate tax discount for citizens but also for the private sectors involved in the process. Clearly, **misleading communication and *greenwashing* must be completely prevented** to ensure an active involvement of the private companies together with the citizens, and the development of a sustainable financial solutions.

Session 2c

- *How can authorities establish effective mechanisms for revenue generation at the local level to support climate adaptation efforts, without imposing undue financial burdens on residents or businesses?*

Local authorities can **leverage on transnational funds** to support climate adaptation efforts since, in most cases, funds available for small municipalities are very low and, unfit to support climate actions. It is paramount **to educate and make local municipalities aware on how to get and use the existing available**

funds, at regional and national level, due to potential misinformation and lack of awareness about financing opportunities.

Further obstacles on accessing national funds might be the lack of human resources at local level. **Improving the municipal task force in quantity and, above all, in quality** can increase the possibility to get economic resources to accomplish adaptation efforts without imposing taxes on residents.

Another virtuous solution to avoid undue financial burdens on residents for climate commitment might be to **get revenues from the installation of energy efficiency devices in public spaces** (for example: Led public lighting, PV panels on public buildings, etc.). The cost resulting from energy savings can serve as promoter of climate adaptation strategies at local level, avoiding further cost for the municipality inhabitants.

Anyway, **private companies interested in climate adaptation improvement, can also represent a valuable source of capital to support climate adaptation strategies at local level.**

6.1 WHAT ARE THE CONCLUSIONS OF THE WORKSHOP?

It is clear that the improvement of the awareness about climate change adaptation must be applied transversally since we are all affected by it. Both from the methodological side and the financial one, the implementation of a "certification on local adaptation level" can be a good balance for local authorities to act, being aware about the risks affecting the local contest and, for private certification companies, to stimulate the adaptation certification market, to date poorly developed and known. This new generation of adaptation certification can speed up the recognition of the importance of climate adaptation strategies and stimulate the private market in financing adaptation measures.

Climate change adaptation methodologies and strategies must always be based on an integrated approach following multi-level governance, multi thematic approach, data integration procedures and an effective implementation monitoring; always verifying the implementation feasibility and identifying appropriate financial and funding mechanisms to finance their execution.

Concerning financial schemes, long term funding mechanisms for the implementation of climate adaptation measures at local level are the most suitable because adaptation measures need time to be implemented and benefits resulting from their realisation are not always apparent immediately. Local level authorities must be educated and aware on how to get and use the existing available funds, both at regional and national level, giving also the possibility to leverage on transnational funds.

A virtuous solution to avoid undue financial burdens on residents for climate commitment can be represented by the possibility to get revenues from the implementation of adaptation strategies. The cost savings resulting from the introduction of the measures can serve as promoter of climate adaptation strategies at local level, avoiding further cost for the municipality inhabitants. This mechanism is known as intracting or Energy Savings Fund (ESV). More information on how get trained on intracting is available through Prospect+ and Prospect CUBE.

Clearly, a fruitful private-public partnership is based on long-term needs that impact on surroundings, which considers community requirements and sector-based demands on climate change adaptation.

7.1 HOW CAN MUNICIPALITIES USE THIS INFORMATION TO INCREASE/IMPROVE/DEPLOY THE SHOWCASE ACTIONS/TOOLS/METHODOLOGIES IDENTIFIED WITHIN THE WORKSHOP?

Suggestions revealed during the workshop, focused on methodologies and strategies, allow municipalities to locally promote and facilitate the development of the climate adaptation measures within their territories. Thanks to the hints highlighted on financial and funding mechanism, municipalities can use the input on how to establish effective mechanisms for revenue generation at the local level to support climate adaptation efforts, without imposing undue financial burdens on residents.

Public-private partnerships have also been deepened; municipalities got information on how to guarantee a long-term and fruitful cooperation between the two.

8.1 WHAT FORMAT SHOULD BE USED TO PRESENT CONCLUSIONS TO MUNICIPALITIES (AT REGIONAL EVENTS)?

The best way to present results of the workshop is by producing a short and concise brochure, including the key hints and recommendations highlighted during the opinion exchange activity.

This project is co-financed by the European Regional Development Fund
through the Interreg Alpine Space programme

3. THEMATIC WORKSHOP 3 - COMMUNITY ENGAGEMENT AND COMMUNICATION

Workshop description

Figure 5: Project group is testing ClimaSTORY, a pedagogical support for collective reflection

9.1 DESCRIPTION OF THE CONCEPT:

The second workshop began with an introduction to the topic, highlighting the importance of active citizen participation in the planning, implementation and promotion of climate adaptation measures. The motivation for the workshop topic stems primarily from the understanding that people are generally not inherently opposed to climate change mitigation and adaptation measures. However, a major problem is the prevalence of disinformation, fake news and the distortion of scientific facts, especially on climate adaptation themes.

Nowadays, effective countermeasures to the effects of climate change and the resulting natural hazards must be based on ecologically sound, nature-based solutions. It is also essential to promote self-sufficiency and communicate the residual risks that remain despite comprehensive measures. Overall, there's a drive to establish a culture of risk awareness, using targeted multimodal risk communication. This includes communication techniques such as storytelling to illustrate how society can cope with natural hazards based on collective experience.

Early education of children, adolescents and young adults about natural hazards, their potential damage and associated risks is essential. This education should include schools, action days and training courses to promote awareness and preparedness. However, the same issue, in particular raising awareness, is crucial for all stakeholders and decision-makers.

The public needs to be made aware of the residual risks of natural hazards, but this should be done without instilling fear. Instead, the focus should be on empowering individuals and communities to understand and effectively mitigate risks.

This project is co-financed by the European Regional Development Fund
through the Interreg Alpine Space programme

The project group first discussed disinformation, barriers, obstacles and excuses. This was done through group work aimed at making an inventory of typical arguments used by climate change deniers, common excuses for not acknowledging climate change impacts or implementing adaptation/mitigation measures, as well as barriers and obstacles encountered in the respective territories. These points were discussed in depth within the group, allowing for an exchange of experiences. The group then wrote down the inventory points on moderation cards. The results were then presented to the project group using these moderation cards.

Part 2 focused on strategies and convincing in relation to the barriers, obstacles and excuses discussed earlier. The project group broke into smaller groups to brainstorm solutions to the barriers, obstacles and excuses listed on the moderation cards. This process resulted in an inventory of approved ideas for constructive reactions, actions and possible responses to counter-arguments from deniers. It also identified strategies for convincing people, examples of effective methods and best practice. This enabled the group to overcome disinformation, obstacles, barriers and excuses, leading to a final discussion with the project group. Through this process, the project group increased its collective understanding and knowledge. Each project partner was then able to take this experience back to their respective territories, facilitating further progress and action.

In part 3 of the workshop, the project group had the opportunity to explore and test different models, tools, games and simulators for communicating and activating community engagement. The aim was to evaluate their effectiveness, usefulness and potential applications in the context of the project. The focus was on understanding how the pilots could benefit from these tools. Through practical experimentation and evaluation, the project partners were able to gain insights into the practical implications of using these resources in their respective initiatives, such as regional events, round tables, action days.

The introduced tools are the following:

Interactive Natural Hazard Model:

With the assistance of an Alpine model landscape, various natural hazards and the effect of protection and prevention measures can be discovered in an entertaining way. The natural hazard model shows a fictitious, populated, pre-alpine landscape with a river flowing through it. Within the village, a torrent from the mountain region flows into the river and the effects of protection and prevention measures are visualised. The model is suitable for visualising the possible effects of climate change on an alpine community and thus creating risk awareness. Furthermore, practical measures in the event of an alpine natural disaster and the correct behaviour in an emergency can be discussed.

Flash flood model:

This model is used to safely and enjoyingly experience the effects of heavy rainfall and the resulting flash floods in urban areas. It raises important issues of self-preparedness of infrastructure and general adaptation to climate change.

Infiltration model:

The model shows the disadvantages of sealed surfaces and the advantages of permeable solutions. It helps to experimentally visualise the benefits of nature-based solutions for groundwater recharge, landscape water balance and climatic well-being in inhabited areas.

ClimaStory:

ClimaSTORY is a pedagogical support for collective reflection. Designed to be used by all types of territorial actors, ClimaSTORY proposes to look at a fictitious territory from the perspective of climate change and adaptation solutions for 5 themes of economic activities: Agriculture and forestry; Industry; Tourism, trade and crafts; Health and safety; Planning, resource management and biodiversity. Given the situation, the participants choose together the most relevant solutions with regard to the specificities of this territory.

Murgame:

MurGame is a playful debris flow simulation in which players defend a picturesque alpine village against huge debris flows.

The browser-based game is aimed at players with a preference for realistic data and behaviour, which is achieved in the game through the implementation of real debris flow modelling. MurGame is also used for educational purposes to raise awareness of the dangers and damage caused by debris flows and to show what protective measures can be taken.

StopDisaster!

With this serious browser-based game, the UN aims to build risk knowledge and strengthen disaster preparedness. This online game teaches children how to build safer villages and towns. Through play, children learn how the location and materials of houses make a difference when disasters strike, and how early warning systems, evacuation plans and education can save lives. Because children and young people tend to play games, such serious games have a strong target group appeal. Therefore, children and youth can easily be trained for more inclusive disaster risk reduction and resilience building strategies, which will lead to better prepared households, healthier children and youth, and safer communities in the future.

Crancy Uncle

The Cranky Uncle game uses cartoons and critical thinking to combat misinformation. Cranky Uncle uses cartoons, humour and critical thinking to expose the misleading techniques of science denial and build public resilience to misinformation. To explain why and how some people reject scientific evidence, the character of Cranky Uncle was created, the family member we all have who thinks he knows better than the world's scientists.

Discord Midjourney

Discord Midjourney is an emerging text-to-image AI that turns imagination into reality. By simply entering a text prompt, the AI bot creates an image in less than 60 seconds. Midjourney can be used to address the concerns and fears of people in the area by allowing them to create a prompt and then discuss the outcome

of the image together. It is a tried and tested method for starting intensive discussions with individuals or in the community. The latter can be done by initiating an exibition in the community.

10.1 WHAT ARE THE CONCLUSIONS OF THE WORKSHOP?

The group has identified that typical barriers, obstacles and excuses to addressing climate risks and the implementation of adaptations measures. Some of these result from the boundary conditions in the territories, while others have their origins in people's perceptions.

Barriers, obstacles due to boundary conditions in the territories:

- Lack of public awareness and knowledge about the impacts of climate risks hinders effective engagement and action
- Educational backwardness in majority of society: lack of trust in science, mixing climatology and meteorology; Educational system is teaching mainly theories but lacks practical realization methods
- Insufficient human resources for conducting awareness campaigns and implementing mitigation measures.
- Political obstacles, such as reluctance to allocate necessary funding for climate-related actions
- Limited financial resources in municipalities
- Identifying suitable experts with practical knowledge on specific climate-related topics can be challenging, impeding effective decision-making and response efforts.
- Inconsequent regulations for different sectors
- Difficulty in capturing citizens' attention amid competing priorities such as COVID-19, conflicts, inflation, energy prices, and refugee crises.
- Challenges in fostering cooperation among various institutions involved in climate resilience efforts.
- Often, infrastructure is not well-equipped to handle the impacts of severe weather events, exacerbating vulnerabilities.
- The presence of multiple hazards simultaneously affecting various sectors, such as storms, heatwaves, floods, gravitational events, and health crises, poses complex challenges.
- Problem of disinformation, fake news, distortion of scientific facts, fake experts
- technological backwardness even in industrialized countries.

Excuses and misleading people`s perception:

- perception of not being affected by extreme events or that they are not directly responsible for implementing measures
- Common mindset of “Not in my backyard!”
- Climate mitigation actions harm businesses, promoting weak countermeasures (“radical change is not necessary”)

- Emphasizing the disadvantages “'change will hurt us'”, e.g., shading the city is great but the falling leaves dirty the cars.
- The financial burden is too heavy for the population. People feel that the wealthy section of the population should bear the main burden for the financially costly measures. “Climate protection is only for rich people” (climate change effect split)
- There is a prevailing opinion (in some cases already substantiated) that there is climate change hysteria, and that climate change is the result of natural cycles: "It used to be warmer!".
- Redirecting responsibility to other polluters: People feel that their actions as individuals are not required or that the local impact is irrelevant if global players do not take action. (blame-shifting)
- People would participate in individual measures if a critical mass of active people were already acting (follower principle).
- Fear of the unknown, fear of changing lifestyles and declining standards of living. It is difficult to imagine what climate change and its practical effects on everyday life mean. Difference between climate - weather - weather conditions largely unknown. (Climate Monster)
- The feeling that one is already doing a lot, or that one is at the limit of what is possible for their own household. "Why is recycling not enough?"
- Feeling of technosolutionism: The focus on the increasing use of technology to mitigate the consequences of climate change runs counter to the desire to reactivate natural resilience.
- prematurely capitulating, a feeling of "It's too late already!", “There is nothing more we can do anyway” (missed opportunity syndrome)
- Solving the climate crisis is a luxury problem for humanity. First of all, we must succeed in defeating war, hunger and poverty. Only when society has realised that challenging tasks can be tackled collectively can this be transferred to even more difficult problems such as climate change.
- The effects of climate change will not be drastic in our own lifetime. We can come to terms with the effects. Individual climate protection measures and personal investment in adaptation measures will only pay off for future generations. Personal improvements in the future through climate adaptation measures are not seen as necessary. However, a certain compulsion is felt to raise the financial resources today. Short-term financing vs. long-term improvement (egosimus barrier)
- People feel that measures are too closely linked to electoral cycles and that political decision-makers put their own political campaign intentions before the common good. Procrastination in the implementation of measures, decision-makers prioritise supposedly more urgent problems with a more positive external impact. In general, measures to reduce the impact of climate change are seen as a leftist issue, which leads to policitcal polarisation in the way society and the community deal with the consequences of climate change.
- The measures required to adapt to climate change are only seen by industry from the perspective of financial gain. Many people feel at the mercy of the end consumer. Lobbying for a not-change manipulating adaptions strategies.
- The effects of climate change, in particular the rise in temperature, are sometimes welcomed. The associated effects (extreme weather fluctuations, extreme events) are suppressed or underestimated. (Tropical Paradox)

Strategies for overcoming barriers, obstacles and excuses:

Although communicating risks and realizing 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. Research results can explain that ongoing climate changes are too rapid as been reliable by natural fluctuations.
- Encourage the sharing 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.
- Start mitigation and dissemination locally. Start by influencing friends and family.
- Do not compare your actions with global players. Start at a personal level. Start with a single seed if you want to plant a forest. Then start to scale up your actions at local, regional and national levels.
- Acting together will also affect global issues.
- Adaptation is for you, self-sufficiency and individual climate adaptation will bring health benefits.
- Reach others with emotional arguments. The impacts of climate change are already here.
- Adaptation is not an ego trip, but a responsibility for the next generation.
- Although climate change may have some short-term positive effects (warm temperatures), the side effects (tropical cyclones) will be worse.
- Use carbon footprint calculators: footprint calculator.
- Make more use of the positive carbon handprint
- Financial resources are important, but dealing with the consequences will be much more expensive than acting now.

11.1 HOW CAN MUNICIPALITIES USE THIS INFORMATION TO INCREASE/IMPROVE/DEPLOY THE SHOWCASE ACTIONS/TOOLS/METHODOLOGIES IDENTIFIED WITHIN THE WORKSHOP?

- Communities should be aware that the issue of climate change is increasingly overwhelming people. The issue is omnipresent and is already overburdening many people emotionally and financially. In some cases, people are already reacting with fear reactions (fight-flight-freeze).
- Use of multimodal media and physical models for raising awareness, sectorial view, trigger attention and as a starting point for further discussions.
- The ClimaStory tool in particular can be used for cross-sectoral work
- AI-based text to image software can be used to show visions and to develop and visualise a picture of the future together with people
- Physical models can be used at campaign days and open days to provide an easy introduction to the topic through interactivity and games.

12.1 WHAT FORMAT SHOULD BE USED TO PRESENT CONCLUSIONS TO MUNICIPALITIES (AT REGIONAL EVENTS)?

The advantages of the tools, simulator and planning tools should first be demonstrated under guidance at regional events, action days, etc. The municipalities should first be empowered so that they can then use the tools, simulator and planning tools independently.

This project is co-financed by the European Regional Development Fund
through the Interreg Alpine Space programme

4. THEMATIC WORKSHOP 4 - EXTREME, COMPOUND & CASCADING EVENTS

Workshop description

Figure 6: One group presenting their results to the plenary

13.1 DESCRIPTION OF THE CONCEPT

The fourth thematic workshop, focused on **extreme/compound/cascading events**, addressed the increasing complexity of climate-related challenges in the Alpine region. These events often arise from interconnected phenomena, such as extreme weather conditions triggering secondary/compound impacts and domino effects, like landslides, floods, or cascading infrastructure failures, which pose significant risks to alpine communities and ecosystems. And although scientific knowledge and evidence about the increasing intensity and frequency of such singular events is growing, there is still little awareness and knowledge about the management of such complex cascading/compound events and the respective integration in disaster risk- and adaptation planning at the different political levels. The overarching aim of the workshop was to create a common understanding for extreme/compound/cascading events and its impacts, identifying current gaps in the respective risk management and to elaborate tailored approaches how to overcome them and to communicate them at the local level.

In order to answer these questions, the workshop was co-organized together with the Alpine Space-project X-Risk-CC, which aims to help risk managers and policy makers across the alpine area to address the compound risks of climate change-related extremes by developing local actions and transnational guidelines.

The workshop itself combined expert-input on extreme weather events and risk management, a compilation of observed local extreme events in pilot areas and an interactive group work:

This project is co-financed by the European Regional Development Fund
through the Interreg Alpine Space programme

- At first, the development of a **common analytical framework for extreme events** tailored to the Alpine context was explored, for understanding current trends in future changes in weather extremes and assess future developments. Examples from Italy, Austria, Germany, France, and Slovenia were presented and a WebGIS tool designed for visualizing and assessing the spatial and temporal dimensions of risks, providing local authorities with a practical resource for planning and adaptation, was introduced.
- In an **interactive session**, project partners then provided real-world examples of extreme/compound/cascading events in their pilots, showcasing their direct impacts and applied approaches to overcome them, as well as the impacts on the adaptation-activities in those regions. These discussions provided insights into challenges such as resource limitations, stakeholder coordination, and public awareness, as well as successful strategies for resilience-building.
- To deepen the common understanding of the weather-impact-risk-nexus and the risk concept, cross-**linkages to the X-Risk-CC-project** and the applied methodological concepts – such as impact chains, risk questionnaires and climate risk storylines -, as well as experiences from a case study in the Wipptal (South Tyrol) area were highlighted. A **gap analysis** on risk management of extreme weather events by the Civil Protection Agency of Bolzano – project partner in X-Risk-CC – dived deeper into these experiences and fostered discussions on the missing aspects in risk management, with a special focus on the engagement of stakeholder and respective ways how to include them in the management of extreme events.

The interactive discussions in the following groupwork built on these different inputs and aimed at answering the following questions:

- *Which are the gaps in risk management of extreme events in your area, based on the presented results?*
- *How can your activity in CCA support the governance of risk management of extreme events?*
- *How can findings of this workshop be communicated at local level (e.g., Municipalities)?*

The outcomes of the workshop will be also considered in the policy recommendations from the ADAPTNOW project and in the risk manual from the X-Risk-CC project.

14.1 WHAT ARE THE CONCLUSIONS OF THE WORKSHOP?

The workshop on **Extreme, Compound & Cascading Events** highlighted critical gaps in risk management while providing actionable insights to improve local governance and adaptation practices. The discussions and group work centered around the three main questions:

Identified Gaps in Risk Management

Participants identified a range of deficiencies that hinder effective risk management:

- **Awareness and Perception**: Limited understanding, motivation and skills among citizens and policymakers about the risks associated with extreme and compound/cascading events. This includes

especially insufficient knowledge of vulnerabilities and the cascading effects of interconnected hazards.

- **Coordination and Governance**: Weak collaboration across multiple levels of governance (state, region, municipality) and key actors (isolated experts) → lacking holistic approaches (institutional constraints), unclear/inefficient distribution of roles and responsibilities (inter alia in civil protection), lacking legal obligation of regulations or plans (e.g. implementation of SECAP or updating procedures) to anticipate risks (especially in spatial planning), lacking willingness to introduce unpopular measures, lack of resources and staff, and lack of stakeholder integration (bring different fields and interests together).
- **Data and Forecasting**: Insufficient hazard mapping, outdated procedures, over-reliance on models without accounting for uncertainties or residual risks, knowledge of geological and ecological situation.
- **Urban Planning and Prevention**: Construction in high-risk areas, inadequate spatial planning and building legislation, and underutilized prevention measures such as relocation and adaptation of land use.
- **Communication**: Delayed or ineffective communication with citizens and tourists about risks and mitigation strategies.

Governance and Supportive Activities

The discussions emphasized how climate change adaptation (CCA) activities can enhance risk management:

- **Integration of Risk into Planning**: Mainstreaming climate risks into urban planning, building designs, and land-use strategies to mitigate vulnerabilities and cascading effects.
- **Capacity Building**: Organizing workshops, regional conferences, and interactive sessions to raise risk-awareness and improve technical knowledge among municipal policymakers, technicians and citizens.
- **Collaborative Efforts**: Facilitating cross-sectoral dialogue, peer-to-peer education (also among municipalities), and stakeholder cooperation to create a shared understanding and commitment to resilience.
- **Practical Tools and Methods**: Development and dissemination of tools like "ClimaStory" to raise awareness and foster proactive discussions on risks and solutions, precautionary checks for natural hazards in climate change, translate scientific findings into understandable, plain language.
- **Crisis Exercises**: Engaging stakeholders in simulation exercises to prepare for and manage extreme events effectively.

Communication of Findings

To effectively disseminate workshop insights to municipalities and stakeholders:

- **Localized Communication Strategies**: Highlight how extreme events impact daily life and use examples to make risks relatable. Proactively address concerns through accessible communication channels and a central contact point.

- **Interactive Tools and Visualizations**: Use tools like hazard maps and risk simulators to make the potential impacts tangible for decision-makers and communities.
- **Workshops and Peer Learning**: Host interactive sessions (between municipalities and beyond), multi-stakeholder action plans, and resilience communities to discuss findings and best practices.
- **Multimodal Media**: Employ newsletters, social media campaigns, and on-site demonstrations to ensure a broad reach and to highlight personal consternation.
- **Depoliticized Messaging**: Frame adaptation measures as practical necessities rather than politically charged actions, supported by monetary incentives and regulatory measures.

The workshop concluded that fostering **awareness, collaboration, and technical capacity** at all levels is essential for building resilience to extreme, compound, and cascading events. By addressing the identified gaps and implementing the proposed strategies, municipalities can better anticipate, manage, and recover from such complex climate challenges.

Detailed results of the workshops in group 1 and group 2:

Which are the gaps in risk management of extreme events in your area, based on the presented results?

- Know and forecast the potential extreme events; Process understanding of complex events; Underestimation of natural (rare) extreme events
- Geological and ecological situation are not enough known or taken into account
- Knowledge about vulnerability
- Lack of awareness; be aware about potential risks and consequences; Believing too much in models
- Sudden occurrence
- Institutional constraints and frameworks; Problems in the definition of roles, competencies and responsibilities at the local level
- Prevention and preparedness: updating of procedures, update of forecasting in procedures
- Lack of Sustainable Energy and Climate Action Plans implemented in municipalities
- Anticipation actions are not considered in planning instruments – e.g. spatial plans are not adapted
- Prevention: hazard zone mapping + adaptation, land use (private), relocation, consideration of residual risk/case of overload
- Impact of extreme events are not enough anticipated. Don’t imagine or don’t want to be imagined? → by all stakeholders
- Solidarity and good knowledge between stakeholders of risk management (finance, experience)
- Sectorial approach to the topic; no holistic view → bring different stakeholders together
- Lack of staff, knowledge and skills about climate risk by decision makers of the municipalities
- Political choices are more related to visibility and social acceptance; Motivation of the locals (other priorities)
- Organizational structure of civil protection (hierarchy and communication)
- Time to reflect on previous events in wider discussions with many stakeholders

This project is co-financed by the European Regional Development Fund
through the Interreg Alpine Space programme

How can your activity in CCA support the governance of risk management of extreme events? (and vice versa)	How can findings of this WS be communicated at local level (e.g., Municipalities)?
• Because of extreme events, people understand better climate adaptation • Are we really prepared as we think we are? Are competencies/responsibilities in adaptation and risk management clear? → precautionary checks for natural hazards in climate change • Help the people to meet each other to share knowledge, tools, and experiences • Involve territories in EU projects as ADAPTNOW or X-Risk-CC • Organize regional conferences in order to favor exchange of experience of territories • Propose tools to raise awareness in climate change and new conditions and data (territory) and to help own reflection of stakeholders (climastory) • Providing technical knowledge & exchange of knowledge • Enhance knowledge of vulnerability and include it in local policies • Raise awareness among policymakers in the municipalities and provide them with proper tools to raise their capacity to act • Help urban planning and building to adapt to climate change and risks • Reduction of risk/vulnerability (local level) • Translate scientific findings (+limitations) into plain language	• Shared and common aims for politicians/decision makers • Practices/exercises • "Depoliticize" adaptation decisions and actions → also by monetary incentives/regulatory restrictions • Do a "to do list" of what you need to face risks, climate change, and adaptation. Present it in the risk and resilience communities (with municipalities) → Multi-Stakeholder Action Plans • Introduce adaptation in planning tools; use good practice + exchange (example KLAR! - Regions) • Present hazard zones and the affected areas in the field • Newsletter of the project ADAPTNOW • Create/implement cooperation activities among municipalities; communicate concrete results • Peer-to-peer education (between municipalities and beyond) • "Team playing" among municipalities

Figure 7: Results of the groupwork - Group 1

Which are the gaps in risk management of extreme events in your area, based on the presented results?	How can your activity in CCA support the governance of risk management of extreme events? (and vice versa)	How can findings of this WS be communicated at local level (e.g., Municipalities)?
• Little awareness of possible dangers related to extreme events • Risk perception of policy/decision makers • Knowledge, awareness, and political will (other priorities) of local	• Hot spots: Mapping, definition; "updating" = weakness • Display examples • Crisis exercise with stakeholders • Working directly with municipal representatives	• Focusing communication on how these events can affect daily life • "Weather story" in the education of consulters • Proactive communication of what you know, what you don't know yet; 1 contact point (1.

authorities for prevention → Empowering needed • Communication happens often too late or there is no focus on it • Improvement of the communication for the citizen • Alert tourists • Implement lessons learned • Isolated experts: Wildbach (CC awareness and communication) • Number of stakeholders in crisis management • Responsibility profiles • Multiple decision levels between the state, region, or municipality • Urban planning – construction/building in high flood risk areas • Mapping: data, model, uncertainty? • Hazard plans • Extreme events are not foreseen (e.g., strong rain) • Cascading is not foreseen • Often lack of risk management plan → chaotic development	• Not let go of reaching out to stakeholders • Adaptation of building use strategy – no place without risk • Develop new methods and tools to mainstream climate risk in urban planning • Simplification of planning improvements • Prepare buildings and urban areas to potential risks and cascading effects • Workshops with technicians and politicians – hands-on school • Improve risk cognition and culture for municipalities/citizens • Workshops with all stakeholders to discuss problems & awareness • Awareness-raising, communication strategy to address citizens • Service for private people showing that property might be in danger	Anlaufstelle) → Address the worry • Example in Grenoble Alpes Metropole: risks and resilience community → gathering elected officials and technicians from municipalities • Proactive citizen participation; Social Media and Information during the event • Workshops by experts (agency on territory) → why does it interest YOU • Highlighting gaps and needs (questionnaires) on capacity to act • Communication tool/means; services and training to all

Figure 8: Results of the groupwork - Group 2

15.1 HOW CAN MUNICIPALITIES USE THIS INFORMATION TO INCREASE/IMPROVE/DEPLOY THE SHOWCASE ACTIONS/TOOLS/METHODOLOGIES IDENTIFIED WITHIN THE WORKSHOP?

Many of the direct connecting points for municipalities and the results stated above emerge by directly addressing the outlined gaps in risk management, as many responsibilities affect the local political level, be it regulatory aspects as well as sensibilization/information aspects, such as:

1. Integration of CCA and risk management aspects into Urban Planning and Policies
2. Capacity Building and Knowledge Sharing
3. Adopting Innovative Tools like hazard maps, WebGIS platforms, and interactive visualization resources

4. Improving Stakeholder Coordination and promoting Community Engagement
5. Enhancing Communication Strategies
6. Conducting Crisis Simulations
7. Leveraging Financial Incentives

16.1 WHAT FORMAT SHOULD BE USED TO PRESENT CONCLUSIONS TO MUNICIPALITIES (AT REGIONAL EVENTS)

To ensure municipalities effectively engage with and act upon the gaps in risk management, the following formats could be used:

1. Interactive Workshops where municipal representatives can discuss, practice, and apply the tools and methodologies introduced during the workshop, including networking events to share experiences.
2. Visual Presentations and digital formats, such as infographics, maps, and simulations, to clearly communicate risks and proposed solutions.
3. Policy Briefs, tailored to the needs and responsibilities of local governments.
4. Demonstration Projects to showcase pilot projects or best practice examples from other municipalities that successfully addressed similar risks (peer-to-peer learning).
5. Digital Platforms to provide online access to workshop materials
6. Multilingual Newsletters and Flyers to inform about new findings in risk management
7. On-Site Demonstrations and Field Visits

This project is co-financed by the European Regional Development Fund
through the Interreg Alpine Space programme