ESPON

EUROPEAN UNION

Co-financed by the European Regional Development Fund

Inspire Policy Making with Territorial Evidence

CASE STUDY REPORT //

ESPON-TITAN Territorial Impacts of Natural Disasters

Alpine Region

Applied Research // June 2021

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Abbreviations

AG	Action Group
ALCOTRA	Alpes Latines Coopération Transfrontalière
ARGE ALP	Arbeitsgemeinschaft Alpenländer
ASP	Alpine Space Programme
CAPA	Climate Change Adaptation Platform for the Alps
CCA	Climate Change Adaptation
CIPRA	Commission internationale pour la protection des Alpes (International Commission for the Protection of the Alps)
CRED	Centre for Research on the Epidemiology of Disasters
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EGTC	European Grouping of Territorial Cooperation
EM-DAT	Emergency Events Database
ERDF	European Fund for Regional Development
EUSALP	EU Strategy for the Alpine Space
FRMD	Flood Risk Management Directive
MAP	Multi-Annual Work Programme

1 Introduction to the Alpine region case study area

1.1 Scope and objective

The purpose of this case study was to elaborate the question if and how the cooperation between countries and regions can support Disaster Risk Management (DRM) and Climate Change Adaptation (CCA). Thus, this case study does not primarily look at how DRM and CCA are organised and implemented in the countries and regions but how transnational and transregional institutions and activities can unfold positive effects and may have an added value for DRM and CCA. The Alpine region was selected because the Alps' hazard profile is characterised by multiple natural hazards in combination with high intensity of land use and a high social, economic and environmental vulnerability against natural hazards and climate change.

The delimitation of what exactly belongs to the Alps is not exactly clear (Bätzing W. 1993). Due to the fact that the contracting states of the Alpine Convention defined those areas belonging to the convention, the most common delimitation is the area that is covered by the Alpine Convention. In general, this delimitation is regarded as reasonable and understandable, especially with regard to the political aim of the Alpine Convention (Bätzing W. 2001: 34). However, as described further below, there are also other concepts and narratives that describe an area that can be understood as the Alpine region. So, whenever we talk about the Alpine region, we mainly refer to the core area covered by the Alpine Convention but at the same time implicitly also take into account other transnational cooperation that exist in the Alps.

Originally, within this case study report transnational cooperation in the Alpine region should be addressed. However, during the initial research it became clear that a more generalist approach would have significant added value. Hence, it is elaborated how countries, that face similar natural hazards and future impacts of climate change, cooperate and what organisations and structures have been established in this context.

1.2 Main characteristics of the Alpine region and its changing environment

The Alpine region – according to the area of the Alpine Convention – covers an area of about 200,000 km² and represents a unique natural space in Central Europe. It is a place of residence for about 14 million inhabitants from eight countries (EEA 2016). The Alpine countries include Austria, France, Germany, Italy, Liechtenstein, Monaco, Slovenia and Switzerland (German Environment Agency 2018: 6).

The Alpine climate manifests itself in a high complexity with four climate zones: polar, Atlantic, Mediterranean and continental (Veyret & Diem n. d). The mountainous nature of the Alps together with the climatic conditions determines the availability of soil resources. This makes the Alps much more sensitive in contrast to lowlands. Due to different climatic and topographic conditions, there are more or less suitable areas for living. The distribution of the population is characterised by a high concentration in valleys and cities due to topographic specificities. At the same time, migration to the peripheral areas takes place (German Environment Agency 2018: 6).

In the last three decades, the Alpine region has experienced a rapid economic development. While employment rates in agriculture and forestry are declining, the tourism industry is taking the leading position in the economic sector (Veyret & Diem n. d). However, tourism is highly dependent on seasonal weather conditions. Low snowfall in winter and high precipitation in summer result in negative capital investments for the Alpine region. This issue grows considerably as the climate continues to change (ibid.).

Over the last 120 years, temperatures in the Alps have risen by two degrees Celsius, which is twice as fast as the global average. According to climate scenarios the temperature will continue to rise. The EU White Paper on Adaptation ranks mountain territories like the Alps as the most vulnerable areas to climate change in Europe, ranging from the melting of glaciers to increasing water scarcity, forest fires and changes in flora and fauna (Platform on Natural Hazards of the Alpine Convention: 4). The influence of climate change is most clearly visible on Alpine glaciers. The glaciers have been melting for decades and fears that they will melt completely by the end of this century are growing. The melting of glaciers and the decline in permafrost will increase slope instability, which will result in rockslides. And the redistribution of rainfall leads to more debris flows in summer as a result (CIPRA 2012). A significant negative consequence of climate change is

the increase of magnitude and and frequency of natural hazards. And since the Alpine region is particularly vulnerable to climate change, its vulnerability to natural hazards is also very high. As climate change progresses, the settlements, population and infrastructure of the Alps will become increasingly vulnerable to such natural events as avalanches, landslides, floods and more. Risk minimisation through preventive and adaptation measures in the Alpine region is therefore an essential condition for sustainable and safe development (CHEERS and Interreg Alpine Space: 15-16).

1.3 Economic impacts of natural disasters in the Alpine region

Mountain areas, such as the Alpine region, are highly vulnerable to climate change and related natural disasters (Platform on Natural Hazards of the Alpine Convention: 3). Floods, droughts, landslides, avalanches or wildfires – each of these natural phenomena occur more and more frequently in Alpine region, to some extent due to changing climatic conditions. In addition, also earthquakes are significant hazards in some of the Alpine areas. It is assumed that the part of the countries belonging to the Alps is more threatened by multiple and in many cases interconnected natural hazards than the other parts of the countries, which do not belong to the mountain territory. Nevertheless, there is a lack of information on the vulnerability of the actual Alpine region to natural hazards. In most cases there is no explicit separation between the Alpine part of a country and the non-alpine part. This results in a large number of studies in which entire countries are assessed for their vulnerability to natural hazards without taking into account the aforementioned separation. There are only a few older studies, such as the Geo Risks Research of the Munich Reinsurance Company, where an explicit analysis of the Alpine region was carried out according to the percentage distribution of natural disasters from 1980 to 2005 (Berz 2006). Other examples have been taken up for individual countries as Switzerland and Germany, whereby only the Alpine part of the country has been taken into account and tested for vulnerability to natural hazards (Bavarian State Ministry for the Environment and Consumer Protection (StMUV) 2018: 5).

However, some examples can be given where only the vulnerability of parts of the countries belonging to the Alpine Space is presented. Between 2009 and 2018, the Slovenian part of the Alps saw 20 percent more landslides, around 45 percent more ice storms and 17 percent more strong winds and hail than the other non-alpine parts of Slovenia. In the Italian Alps there is a high risk of landslides. An above-average hydrogeological hazard covers about 8 percent of the total area of Italy (Cheers & Interreg Alpine Space 2019: 38). The risk of forest fires is also high. Between 1981 and 2014 there were over 20,000 forest fires in the Italian Alps (ibid.: 41). Switzerland also has a higher vulnerability to natural hazards. Especially in the mountainous parts of the country, events such as avalanches and landslides with the loss of life are more frequent (ibid.: 45).

Some shortcomings also concern information on the economic impact of natural disasters in the Alpine region. According to the CRED EM-DAT database, over the last 60 years around 150 catastrophes in Germany, Austria, France, Italy, Switzerland and Slovenia have caused direct damage amounting to 50 billion US dollars. However, only a part of this is caused by Alpine natural events. And this part has not been separated from the total value. For this reason, much more thorough and in-depth data are needed for the Alpine region in relation to natural hazards (CONHAZ Report 2011: 7).

2 Administrative structures and cooperation formats

2.1 Main characteristics of administrative structures and planning systems in the Alpine region

The Member States have different policies and practices, largely as a result of the differentiated administrative structure. The aim of this case study, however, is not a cross-country analysis about how the Alpine countries address natural hazards but how they interact across borders. Nevertheless, as a basis for understanding the national backgrounds, the main characteristics of the individual administrative and planning systems of the eight Alpine countries are presented. Regarding natural hazards, some relations to the planning instruments of the respective country are made, however, these are presented in a rather general way. The aim is only to get an impression of how the handling of some natural hazards is shaped by spatial planning. Where appropriate, reference is made to the national level of the respective Alpine country as good practice in following chapters.

This general characterisation, of course, does not explain in detail the different mechanisms and processes how the coordination between spatial planning and sectoral policies takes place in all countries at different levels. In addition to the administrative structure, however, the small-scale structure is a decisive criterion; Municipalities in valleys may be quite large in terms of area, but usually have a very small population and thus different governance structures than municipalities in the foothills of the Alps (Schindelegger A. 2020).

Germany is a federal parliamentary republic with a highly decentralized character. The hierarchy in the administrative structure of Germany is divided into: The Federation, the states and the municipalities. Responsibilities at the national level include the preparing of spatial planning law, guiding principles and action strategies for spatial development, urban planning law. Responsibilities at the state level include the elaboration of the state-wide spatial development plans and land use planning laws. The responsibility at the regional level is the elaboration of regional spatial development plans. At least the level of municipality is responsible for the land use plan, zoning plans and regulation of urban planning (Schindelegger & Kanonier 2019: 34-35). When it comes to the role of spatial planning in dealing with natural hazards, the state planning instrument Alpine Plan should be mentioned here, which ensures sustainable development in the Bavarian Alpine region. Its task is since 1972 to balance different land uses and bring them into harmony with each other. The mitigation of natural hazards plays an important role in this process (Werthmüller 2018: 41-42). Regarding one of the relevant natural hazards, flooding, flood areas are officially designated in Bavaria as part of flood prevention. This provides public information about the danger of flooding and restricts the use of undeveloped areas in order to prevent future flood damage. The undeveloped risk areas are to serve as retention areas, to which a special preventive function is assigned in the case of a flood (Bavarian State Department for the Environment 2020).

Austria is a federal parliamentary republic and its administrative structure is divided into the Federal State, provinces, municipalities. The national level has only limited functions. There is no overall federal planning authority, but many sectoral laws on national level. The tasks at the federal level include the Austrian Conference on Spatial Planning. Spatial planning is primarily regulated at the state level by the nine federal states and at the local level by the municipalities. The province level can independently decide about the sectoral concepts and programmes and municipalities are responsible for the local spatial planning, land use plans and development programmes (Schindelegger & Kanonier 2019: 30-31). The key task of spatial planning is the protection of the population as well as the living and settlement areas against natural hazards and is firmly anchored in most Austrian spatial planning laws. However, there are also major differences in risk management within the country. Especially with regard to the design of hazard protection concepts. The determination of the weighting of the protection of future development and the protection of the existing building stock and building land differs in parts of the Austria (Pütz & Kruse 2011).

France is a unitary semi-presidential constitutional republic (centralized republic). The country is subdivided into state, regions and municipalities. At the national level, the responsibilities are the formation of the legal framework, management of finances, infrastructure projects. The regional level participates in planning, development and finance of major infrastructure projects. Municipalities are responsible for local land use plans (Schindelegger & Kanonier 2019: 32-33). One of the most important tools in land use planning is the Flood

Risk Prevention Plan. Its role is reflected in the legal building restrictions in risk areas. Until 2018, flood management was strictly the responsibility of the national level, which allowed control over the local level and over spatial planning. Since 2018, some flood management competencies have been transferred to local authorities, reinforcing their political legitimacy and technical capacity (Gralepois M 2020: 7).

Italy is unitary parliamentary constitutional republic and also centralised. Italy is subdivided into state, regions, provinces and municipalities. The state has the legislative power and determine about the Urban Planning Law since 1942. Spatial and land use Planning is carried out at the regional and municipal level. At the level of the municipalities, various plans are developed (Schindelegger & Kanonier 2019: 36-37). Municipalities have developed hazard zone plans that map the degree of hazard in their areas. Each municipality has identified areas prone to avalanches, landslides, permanent ground shifts, debris flows, rockfalls and floods. The hazard zones are integrated into the land use plan and are legally binding.

Liechtenstein is unitary parliamentary constitutional monarchy. The country is divided into the State and municipalities. The State coordinates planning activities in general. The municipalities elaborate land-use plans and detailed development plans (Schindelegger & Kanonier 2019: 38-39). The municipal land use plan is prepared by each of the 11 municipalities and approved by the national government. It establishes zones for specific land use categories that are overlaid by hazard zones at the municipal level. The hazard zone designates the areas threatened by natural hazards such as floods, geological hazards, landslides and avalanches (Amt für Bau und Infrastruktur 2020: 45).

Slovenia is a unitary parliamentary constitutional republic and also centralised. Slovenia's administrative system includes state and municipality levels. The state coordinates spatial planning in the country and determines the planning guidelines for all administrative levels. National government provide for a spatial planning legislation, spatial planning documents (National Spatial Development Strategy, Spatial Order, Detailed Spatial Plans for significant infrastructures), while municipalities are responsible for local spatial strategic and land use plans, and detailed planning. Municipal plans have to be reconciliated with the spatial plans of the higher level (Schindelegger & Kanonier 2019: 39-40). The most relevant sectoral planning instruments in relation to climate adaptation are the Water management plan, Biodiversity Strategy of Slovenia and Spatial Development Strategy of Slovenia (2004) (Pütz & Kruse 2011: 36; Ministry of the Environment, Spatial Planning and Energy, Spatial Planning Directorate, Office for Spatial Development 2004). The Spatial Development Strategy defined restrictions for development in the areas of potential natural and other disasters and in water deficient areas (ibid: 66; 71).

Switzerland is divided into the state, cantons and municipalities. The state is responsible for the framework legislation on spatial planning and has all planning competences. In relation to natural hazards all Swiss cantons are legally obliged to identify areas at risk from natural hazards and to assess the extent of the risk. The regional level or the cantons are responsible for the practical implementation of planning. These include, for example, the preparation of risk maps for each natural hazard, which provide a basis for communal and cantonal spatial planning processes. The municipalities have scope of action in terms of spatial planning, but their plans must correspond to the higher-level plans (Schindelegger & Kanonier 2019: 41-42).

From the information given, it can be derived that the domestic level of the individual national states is diversified and complex. According to the ESPON Alps2050 report (2018), two aspects are particularly decisive for the national level. On the one hand the "country size and the share of the mountainous area within the national territory" (ESPON 2018: 17) is a determining factor for the political handling of issues related to the Alpine area and its politics. Countries with a rather large share of Alpine territory tend to prioritise it on their political agenda, while in countries that only have a little share of Alpine territory, it is only one of several other topics of regional policy (ESPON 2018: 17). On the other hand, the "politico-administrative context matters" (ESPON 2018: 17). Simplified, the planning traditions of the various Alpine states can be distinguished into centralist (France, Italy, Slovenia), federalist (Austria, Germany, Switzerland) and small state (Liechtenstein, Monaco). The regional level, which describes the administrative level between the state and the local authorities, can be provided with stronger or weaker planning and development competences, depending on the different administrative structures. Although smaller states often do not have a strong need for a regional level in the form of additional administrative level they nevertheless need a regional planning level between the state and municipalities, especially for those issues that would be better defined/solved above the local level (Bartol 2020). Further, the number of involved persons and stakeholders in smaller countries is quite low, while the relationship between them is close as well as the transboundary cooperation with neighbouring states (ESPON 2018: 18).

2.2 Cooperation formats in the Alpine region

Following the overview of the different national planning and administrative systems of the Alpine states, the focus is now on cooperation formats in the Alpine region at different scales, as such cooperation exist since several decades.

Numerous national states and their respective administrative and political systems come together in the Alpine region, resulting in a highly diversified and complex area. This diversity is reflected by the manifold institutions and the density of the cooperation frameworks and goes back in history (ESPON 2018: 16f). Favoured by the low cultural differences despite the many national borders, a high amount of different cross-border and transnational cooperation formats has been able to emerge in recent decades (ESPON 2018: 16). Moreover, the territories of the macroregional strategies Danube and Adriatic-Ionian as well as the transnational cooperation programmes Central Europe, Danube, Adriatic-Ionian, Northwest Europe and Mediterranean Area meet and mostly overlap in the Alpine region (ESPON 2019: 69). Besides those cooperation formats, programmes specially tailored for the Alpine region were introduced.

The Alpine Convention, the Interreg Alpine Space Programme, as well as the EUSALP macro-regional strategy can be seen as basic structures that can function as a framework for cooperation within the area (see Fig. 1). Therefore, these three cooperation formats will be explained in detail in the following paragraph and the entire report as well. The territory of the Alpine Convention is limited to the mountainous parts, while the Interreg Alpine Space Programme also includes surrounding settlements and EUSALP is based on regional boundaries (ESPON 2018: 1f)

Fig. 1: The territory covered by the EU Alpine Strategy in comparison to the funding area of the Interreg Alpine Space Programme and the Alpine Convention (EC 2021)

The Alpine Convention, which came into force in 1995, is a framework instrument that ranks cooperation and partnership between the Alpine countries as the most important objective. The Alpine Convention includes all Alpine member states and covers the territory of 43 regions, 5,800 municipalities and 13 million inhabitants living in the Alpine Space. The purpose of the Alpine Convention is to ensure a safe and sustainable development of the Alpine Space (Swiss Federal Office for Spatial Development ARE n.d.). Only in a cooperative way, solutions can be found jointly for top priority issues such as sustainability through the composition of all contracting parties. The partnership approach of the Alpine Convention is an indispensable condition for living together in such a geographically special region. The Convention emphasises the importance of cooperation between the local, national and international level (Alpine Convention 2021). At the end of 2020, the XVI Alpine Conference took place and the two-year French presidency was handed over to Switzerland. Latter announced to prioritise the topic of climate change as well as focus on spatial planning

and spatial development in the Alps during their presidency. Further, the ministers passed the 8th Report on the State of the Alps and highlighted the urgency to tackle the problem of air quality in the Alpine region. Also, the updated version of the Climate Action Plan was passed, which was prepared on the basis of the Alpine Climate Target System 2050 that was approved by the XV Alpine Conference under Austrian presidency (Alpine Convention 2019). Moreover, a declaration on integrated and sustainable water management in the Alps was passed to improve the protection of natural river courses and the use of water resources (Alpine Convention 2020).

In 2000, the first transnational cooperation programme was launched under the name Interreg III B Alpine Space Programme. This European programme brings together actors from the national, regional and local level of the Alpine countries and provides a platform for comprehensive cooperation on several transnational projects. Overall, it creates a framework for exchange and cooperation between economic, environmental and social groups of actors in the Alpine Space by bringing together science, politics, business and innovation. Under several thematic areas, the Alpine countries are also working together to protect their inhabitants and infrastructure against natural hazards and to develop appropriate preventive measures. After Interreg III, two further transnational Interreg programmes have been adopted, each with a duration of seven years. The third and current Interreg V-B programme, which runs from 2014 to 2020, uses ERDF funding of around 140 million Euros to finance numerous projects that contribute to solving Alpine problems and challenges (Interreg online).

By 2015, the EU Strategy for the Alpine Space (EUSALP) was developed as a transnational initiative of the Alpine states and regions with the aim of strengthening cooperation and jointly tackling challenges specific to the Alps. EUSALP comprises seven Alpine countries and 48 regions. Action Group 8 of EUSALP focuses on climate change adaptation and risk management. The Action Group is concerned with the analysis and improvement of governance structures in the field of natural disasters. There are interlinkages between EUSALP (and its Action Group 8) and projects funded under the Interreg B Alpine Space Programme (ASP): The Co-Leaders of Action Group 8 are project partners in an ASP project (AlpGov, AlpGov2) and some of the members of the Action Group engage in other ASP projects (GreenRisk4Alps, Rock the Alps, etc.). Especially the AlpGov projects support the EUSALP governance process (CLIMATE ADAPT Alpine Space; Heil 2020; Bartol 2020).

Cooperation programmes that started before the launch of the first EU programme in 2000 can be distinguished regarding their intergovernmental logic. A couple of them were developed with a more sectoral focus which shifted over time to a rather integrated and universal perspective on regional development, for instance the High Rhine Commission. While other formats, like ARGE ALP, had a broader approach and integrated *higher politics* at regional level (ESPON 2019: 70). More recent cross-border or transnational cooperation formats are based on frameworks of EU policies like Interreg A or B. As part of the research of ESPON Alps2050 (2018) a map (see Fig. 2) was created displaying cross-border cooperation at the EU cross-border scale (Interreg A) and further international (bi- and multilateral) cooperation formats in the Alpine area. One cross-border Interreg A programme is ALCOTRA (Alpes Latines Coopération Transfrontalière), which consists of French and Italian territory. It exists since the 1990s in various programming periods and is financed by the ERDF (European Fund for Regional Development). One of the current thematic objectives and investment priorities is the combating of climate change (Interreg ALCOTRA n.d.). Further, regions like Trentino, Tyrol and Southern Tyrol formed legal entities in form of a European Grouping of Territorial Cooperation (EGTC) (ESPON 2019: 70f).

As some of the Alpine countries are no member states of the European Union, special agreements exist to enhance cooperation and secure common objectives (like the application of the European Protection Mechanism). For instance, in Switzerland, which is no EU-member state, Swiss project partners have no direct access to EU funds, but they can apply for federal or/ and cantonal funding. The first option is only possible, when regional policy objectives are pursued (Regiosuisse n.d.).

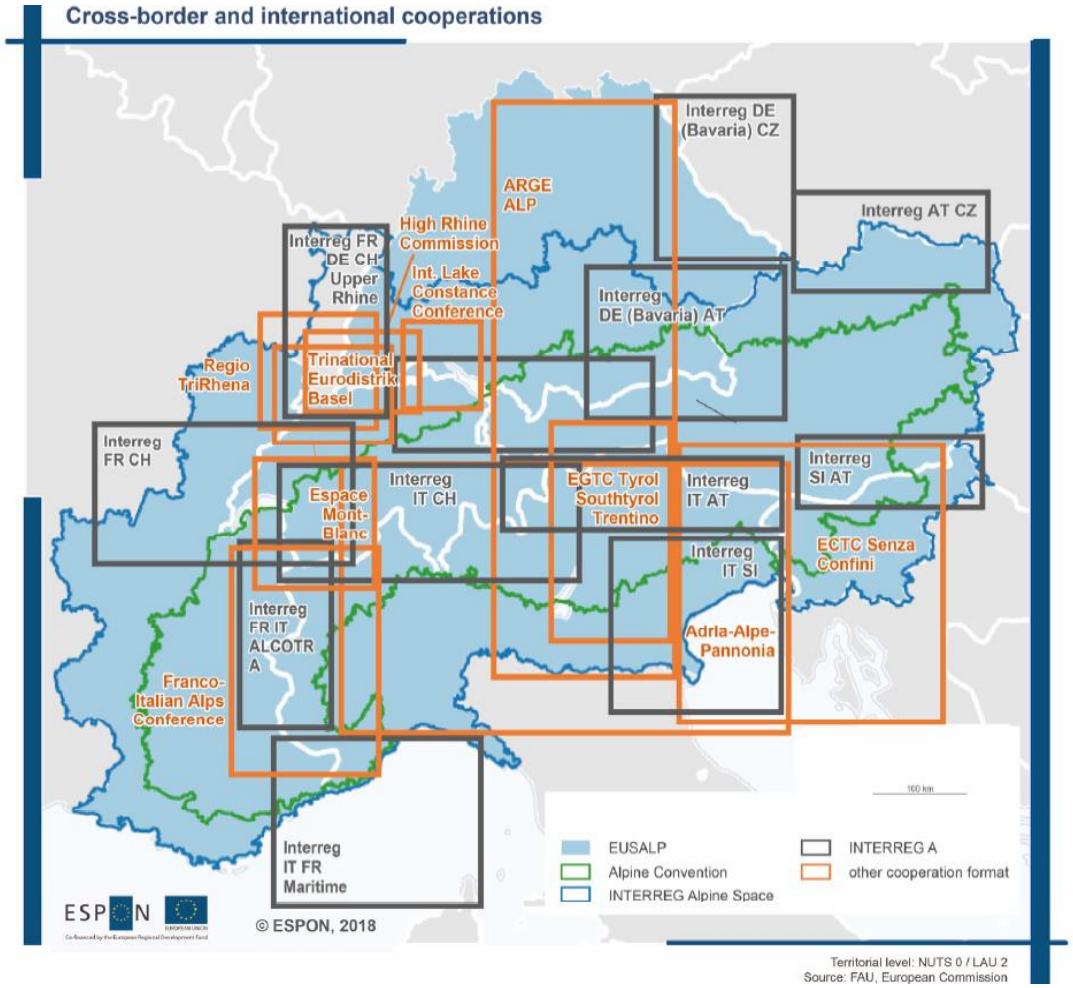

Fig. 2: Cross-border and international cooperation in the Alpine region. The spatial extent of the cooperation formats is shown in a simplified way (ESPON 2018: 16)

In the following table (Tab. 1) some individual examples of transnational cooperation formats in the Alpine region are presented to give a general overview. Besides the listed programmes there are also numerous other associations, networks, organisations or projects, which operate on a smaller scale but also bring together the Alpine countries for cooperation in common fields. These also have different approaches, principles, and perceptions of the Alps and usually a specific focus.

There is a lot of information about individual transnational programs and cooperation in the Alpine region, but the limitation to the most important aspects about those has been chosen deliberately. In addition, the most relevant transnational cooperation with reference to natural hazards will be presented in more detail in another chapter (see chapter 3.1)

Alpine Convention	
Type	International agreement, regular meeting of a political decision-maker, supported by a Permanent Secretariat and working groups/platforms. The highest body of is the Alpine Conference, which meets at ministerial level and is in charge of political decision-making
Ideas of cooperation	Sustainable and prudent use of resources, applying the principle of prevention ("polluter pays" principle) The aim is to preserve and protect the Alpine areas through commitment and obligation and the implementation of common rules (Alpine Convention 2021).
Cooperation principle	The work of the Alpine Convention is divided among several bodies. Each of them is responsible for specific aspects of the Convention. Together they contribute to the implementation of the Convention. The Permanent Secretariat supports the bodies of the Alpine Convention technically and administratively and has a coordinating function. The executive body of the Alpine Conference is the Permanent Committee, which is set up by delegates of the Alpine states. It gets together twice a year and makes sure that the ideas, principles and objectives of the Convention are practically implemented. The highest ranking body of the Alpine Convention is the "Conference of the Contracting States" is called the Alpine Conference and consists of representatives of all Alpine states and organisations with the observer status of the Alpine Convention, such as the UN and its specialised agencies, the Council of Europe, cross-border Alpine authorities and further relevant NGOs (Ständiges Sekretariat der Alpenkonvention 2019: 8 and cf. Alpine Convention, 2021). Latter have to be admitted as official observers and then they can participate in and support the work of the Alpine Conference and the Permanent Committee, e.g. CIPRA, CAA, Euromontana, Interreg Alpine Space, WWF, Alparc, Allicance in the Alps, Arge Alp etc. (Alpine Convention 2021)
Added value for the Alps and a wider area	Provides a basis for argumentation and discussion. Has demonstrated the need for a proactive approach to multi-level and cross-sectoral governance of Alpine issues (Alpine Convention 2021).
EU Strategy for the Alpine Region (EUSALP)	
Type	Integrated framework between Alpine states and regions to address common challenges in the Alpine region (EC 2021).
Ideas of cooperation	EUSALP is based on a joint initiative of Alpine states and regions to strengthen cooperation between them and to address common challenges in a more effective way. It involves seven countries (Austria, France, Italy, Germany, Slovenia, Liechtenstein and Switzerland), 48 regions and covers a slightly larger area than the Interreg Alpine Space Programme area (Interreg Alpine Space 2021).
Cooperation principle	At the level of implementation, nine Action Groups (AG) and its leaders are decisive for the success of the EUSALP Strategy. Each AG pursues a specific mission and corresponding objectives, but synergies exists between the individual AGs. AG 8 (Risk governance) is interconnected with other AGs (such as AG 7: Green Infrastructure) and belongs to “environment and energy”, one of the three thematic policy areas of EUSALP (EUSALP 2021a).
Added value for the Alps and a wider area	An Alpine macro-regional strategy would provide an opportunity to improve cross-border cooperation in the Alpine States as well as identifying common goals and implementing them more effectively through transnational collaboration (EUSALP 2021a).

Interreg Alpine Space Programme	
Type	European transnational cooperation programme for the Alpine region. Interreg III B, Interreg IVB, Interreg VB (Interreg Alpine Space 2021a).
Ideas of cooperation	It provides a framework to facilitate the cooperation between economic, social and environmental key players in seven Alpine countries, as well as between various institutional levels such as: academia, administration, business and innovation sector, and policy making (Interreg Alpine Space 2021a). Current objectives: In 2014 the current Interreg VB edition was launched for the programme period 2014 until 2020 and four thematic fields have been prioritised (Interreg Alpine Space 2021): - Innovative Alpine Space - Low Carbon Alpine Space - Liveable Alpine Space - Well-Governed Alpine Space
Cooperation principle	In this programme national, regional and local stakeholder from the participating countries in the Alpine space cooperate on various transnational projects. The major objective of the Programme is to make the cooperation area more attractive and competitive through joint activities in those subject areas in which transnational cooperation is required for sustainable solutions (Interreg Alpine Space 2021a).
Added value for the Alps and a wider area	As a transnational Interreg programme, it brings together project partners from different countries in the Alpine Space to jointly solve challenges beyond borders (Interreg Alpine Space).
CIPRA	
Type	International Commission for the Protection of the Alps: It is an autonomous non-governmental and non-profit umbrella organisation which promotes the protection and sustainable development of the Alps
Ideas of cooperation	Linking the activities of different stakeholders. It embraces a large network of Alpine organisations and institutions as well as representatives of seven Alpine states (Interreg Alpine Space 2021b).
Cooperation principle	Information platforms are discussion forums for the exchange of knowledge about the Alps, cooperation with other Alpine Space initiatives (Interreg Alpine Space 2021b).
Added value for the Alps and a wider area	Discussion forum, reports, numerous concrete measures already initiated (Interreg Alpine Space 2021b).
Alliance in the Alps	
Type	Network of almost 300 municipalities from seven countries (Alliance in the Alps 2021).
Ideas of cooperation	Implementation of the principles of the Alpine Convention at local level, where individual members are given the opportunity to develop their environment and participate in initiatives and projects. (Alliance in the Alps 2021).
Cooperation principle	Sharing experiences and information across linguistic and cultural borders. The work of the network of municipalities is based on the principles of the Alpine Convention, an international agreement between the Alpine countries and the EU for the sustainable development of the Alpine region. (Alliance in the Alps 2021).
Added value for the Alps and a wider area	Joint concrete activities with a variety of initiatives and programmes in the Alpine Space (at local, regional and transnational level)

ARGE ALP	
Type	The Working Community of Alpine Countries. Europe's first comparable association of autonomous units at the level below the national and federal states (ARGE ALP 2021).
Ideas of cooperation	10 regions, provinces, cantons or federal states from Austria, Germany, Italy and Switzerland work together. ARGE ALP has set itself the goal of addressing common concerns and problems in the ecological, cultural, social and economic fields (ARGE ALP 2021).
Cooperation principle	ARGE ALP is to carry out selectively those tasks which it can carry out better than other institutions on the basis of its decades of experience. Respective parliaments, governments, administrations, associations and organisations of the economy, nature conservation and environmental protection, but also every citizen are called upon to implement this. (ARGE ALP 2021).
Added value for the Alps and a wider area	With its "Common Model for the Development and Protection of the Alpine Region", ARGE ALP was once able to present the most comprehensive and concrete catalogue of objectives in the entire Alpine region (ARGE ALP 2021).

Tab. 1: Cooperation formats in the Alpine region

Overall, from the information above on different mayor actors and institutions in the Alpine region, it can be derived that on the one hand they somehow differ regarding their influence, form of governance, tasks or ideological/ institutional basis. On the other hand, synergies are recognisable as well as common objectives and interconnections (e.g. legitimised observer status in the Alpine Conference of some NGOs or observer status of the Alpine Convention in the General Assembly of EUSALP and the Alpine Convention plus the Alpine Space Transnational Programme in the Executive Board of EUSALP).

Also, with regard to the political context in the Alpine region, the high degree of complexity of the territorial structures becomes visible. Besides common goals like the enhancement of sustainable development and similar approaches and instruments, discussions or conflicts in objectives, concepts and aims can occur due to manifold different instruments and institutional settings (ESPON 2018: 23ff).

3 Disaster risk management in the Alpine region

There are various approaches to assessing and managing natural disasters in the Alpine region. These differences and the individual situation at the national level of all Alpine countries are not examined in this study. Instead, the focus is on varied forms of cooperation and collaboration between the Alpine countries that deal with natural hazards, especially disaster risk prevention, in the Alpine region. Of course, cooperation formats and also the objectives of transnational cooperation can be of various character and content, ranging from mapping, data, analysis and management approaches to specific actions on certain hazards and risks to the exchange of information and experience.

Due to the fact that natural hazards are of very different characteristic (e. g. from local rock fall hazards to large-scale extreme flooding scenarios), transnational cooperation for sure is not needed for every and each case of a natural hazard. In fact, there are general frameworks that set common approaches, objectives and procedures (e. g. the Flood Risk Management Directive), however, with regard to implementation there are significant differences between Member States with implications on the effectiveness of DRM (e. g. limited funding for cross-border investments, generally not quantified or time-bound objectives, especially commonly agreed protection goals, in the flood risk management plans; ECA 2018: 2). Thus, we would like to hypothesize that there are certain benefits and added values to preventive Disaster Risk Management when countries or regions cooperate.

3.1 Cooperation formats in preventive disaster risk management

Contracting parties to the **Alpine Convention** have all contractually committed themselves to adopt specific measures in protocols for the implementation of the principles laid down in the framework convention (e. g. on spatial planning and sustainable development). An important feature of the Alpine Convention is thus the partnership approach. This enables cooperation between the local, regional and national levels. The purpose is to increase the efficiency of the Alpine Convention at the local and regional levels. The “Multiannual Work Programme of the Alpine Conference 2017-2022” also emphasises the importance of this approach.

The Alpine Convention is an international treaty and its aim since 1991 is to ensure a sustainable and stable development of the Alps and to overcome common challenges. Among many other areas these include the two major topics climate change and natural hazards. In 2004 the Alpine Convention founded the PLANALP platform as an attempt to better manage these risks. Since then, this platform has provided a basis for an international exchange between all participating countries and the possibility of developing a common risk approach (Schindelegger 2019, Schindelegger & Kanonier 2019, Alpine Convention 2021).

A series of formal documents together form a framework for dealing with natural hazards in the Alpine region. These are the abovementioned protocols, which support the goals of the Alpine Convention (Federal Environment Ministry, BMU). The objectives of spatial planning and sustainable development policy include safeguarding the ecological balance in the Alpine region, protection of special natural landscapes, protection against natural hazards, and many other aspects in consideration with environmental protection. In this context, spatial planning and sustainable development considers the protection against natural hazards to be one of the most important objectives of spatial planning policy. In achieving these objectives, international cooperation between local and regional players in the Alpine region must be strengthened and promoted (Alpine Convention n. d.). The Protocols on Mountain Farming and Mountain Forests consider the issue of natural hazards with a view to safeguarding and promoting mountain farming. It emphasises the importance of forests and their role in the prevention of natural hazards (Alpine Convention n. d.). The Protocol on Soil Conservation also strengthens prevention of natural hazards by means of international cooperation in the preparation of soil registers, the designation of protected areas and hazard zones, which significantly improves risk management (Alpine Convention n. d.).

The macro-regional **EU Strategy for the Alpine Region** (EUSALP) aims at introducing innovative initiatives in the areas of trade, industry and energy, infrastructure, traffic and environmental and resource protection through cooperation between the Alpine states and regions, but also with non-state actors. Disaster Risk Management and Climate Change Adaptation are the two core topics within EUSALP Action Group 8, which sets its common objective in the current medium-term work plan (up to mid-2019): to map, analyse and

enhance governance mechanisms in the fields of natural hazard management and adaptation to climate change, including enhanced coherence between both policy fields (EUSALP 2021b). The AG 8 further aims at international cooperation, networking and knowledge exchange (Heil 2020).

PLANALP and Action Group 8 of EUSALP contribute to transnational risk management by information and knowledge exchange (Bartol 2020, Schindelegger 2020, Heil 2020). A good example of cooperation in terms of governance processes are the Interreg projects AlpGov and AlpGov 2. AlpGov 2 is currently in force, it has the time-period from 2020 to June 2022 and expresses a close partnership between the Alpine Convention and EUSALP. The aim of the project is to improve the EUSALP governance structures and mechanisms and thus to bring the embedding of the strategy into the mainstream policy for regional development and cohesion. The project has an integrated approach by including all relevant actors in the process, providing a comprehensive exchange of knowledge, and taking into account all topics of the EUSALP action plan. AlpGov 2 focuses on improving and strengthening the nine EUSALP action groups (including action group 8: To improve risk management and to better manage climate change).

Apart from these transnational and macro-regional perspective, there is also the perspective of cross-border cooperation, especially with regard to specific hazards.

During the Interreg V-A Slovenia-Austria programme period 2014-2020, the platform "**CROSSRISK** – snow and avalanche conditions" (http://crossrisk.eu/en/) was launched. Slovenia and Austria are facing similar problems due to high amounts of rainfall and snow that cause damage and pose a threat for the population. The CROSSRISK project aims to reduce the risks associated with that by intensifying the cross-border cooperation and developing multilingual and uniform warning systems. Austrian and Slovenian warning services as well as scientific partners are involved (Land Steiermark n.d., CROSSRISK n.d.).

Several institutions in France, Italy and Switzerland also worked together and created the cross-border platform **RiskNET** on natural hazards to improve the information of the public, to develop new methodologies and to launch good practice pilot actions. The start of the project roots back to the Alps-ALCOTRA operational programme of Italy-France, during the Interreg programming period 2007-2013 and was funded through the ERDF (European Commission n.d.).

The international research company **INTERPRAEVENT** is another interesting form of cooperation. The network provides preventive protection against extreme natural events such as floods, avalanches, torrents and mass movements and promotes interdisciplinary research. INTERPRAEVENT serves as a platform for a mutual exchange of knowledge and experience in the field of natural hazards. Experts and members from 10 countries including the partners from Alpine countries such as Slovenia, Switzerland, Austria (South Tyrol) and Germany (Bavaria) promote an exchange of information, for example through the international interdisciplinary events, congress, that take place every 4 years. The congress is a meeting point for scientists and decision-makers to work in the entire field of natural hazard risk reduction: from integrated management and the causes of disasters to mitigation measures, preventive measures and the effects of climate change (INTERPRAEVENT 2020).

3.2 Disaster risk assessment – the transnational perspective

At the transnational/supranational level, no guidelines have yet been found that lead to the standardisation of risk assessment of the Alpine countries. Rather, obstacles arise from the fact that these assessments are carried out individually at the national level and are therefore not comparable: "All member states of the Alpine Convention have developed certain types of hazard and risk maps using different colour codes and reference events as a basis. This makes it difficult to compare them" (Schindelegger 2019: 40). Harmonisation of methods and data are seen to be difficult because each country has its own hazard and risk profile and designs own approach and logic behind, according to own hazard profile or needs or national system and legislation (often result of a historic development), thus all countries have their own DRM and CCA methods which makes a comparison of assessment results difficult (Schindelegger 2020, Heil 2020).

Each Member State has drawn up its own risk maps, taking into account its own vulnerability to natural hazards. For flood risk management, however, there is a common approach among the EU Member States due to the implementation of the EU Flood Risk Management Directive. This Directive aims to protect against floods and reduce flood risks. It requires management procedures to be implemented by each EU Member State, including those in the Alps. This process includes a flood risk assessment and associated flood risk maps and flood hazard maps, as well as the preparation of flood risk management plans (CIPRA n. d: 35). The implementation of the directive also differs from country to country, for example with regard to the design

of the risk maps. Nevertheless, this is an essential step in the risk assessment, especially for such a homogeneous area as the Alpine region. However, it must be mentioned that risk assessment and management are natural hazard dependent. This means that in case of flood hazards a transboundary but also a transnational cooperation in relation to hazard assessment or hazard management is very important, but in case of natural hazards like avalanches or landslides only a transboundary cooperation would be relevant due to their local character.

3.3 Disaster risk management – general observations from Alpine countries

Disaster risk management implies spatial planning, organisational, structural and non-structural measures. Most authorities responsible for the constructional measures (technical preventive measures) also implement the “soft” measures such as hazard mapping. This makes the authorities the most important actors in risk prevention and risk reduction. The protection of settlements and infrastructure is costly but is one of the most important tasks of the states (Schindelegger & Kanonier 2019: 82-83).

Spatial planning plays a particularly important role with regard to natural hazards management. Spatial planning authorities at national, regional and local level can implement preventive measures against the effects of natural hazards by means of strategic instruments and through the land use regulations (Schindelegger & Kanonier 2019: 29).

At the **local level**, the land use plan is regarded as the most important allocation for the municipalities, whereby the risks and hazards are taken into account and the definitions in the land use plan are adjusted accordingly (Schindelegger & Kanonier 2019: 78). Local authorities can only make decisions within the prescribed framework of binding legal provisions and with the use of discretion. Planning decisions at the local level are typically checked for compliance with the law at superordinated planning levels and must also be in line with supra-local planning requirements. The Alpine municipalities have limited land resources due to the topography. This fact limits the actions of the municipalities when pressure from landowners or developers requires them to designate construction areas in the hazard zones. This increases the number of buildings in the hazard zones, which is associated with an increasing risk (Schindelegger & Kanonier 2019: 79).

The basis for information on potential natural hazards is provided by hazard and risk maps and hazard zone plans, which are prepared by the higher-level authorities and must be taken into account by the municipal level. By the example of Switzerland, it can be shown how information about hazards can be provided (from the national to the local level) and how this information can inform spatial planning/land use planning processes. Switzerland has produced comprehensive hazard maps, risk reference maps and intensity maps (BAFU 2020).

Fig. 3 shows for the whole of Switzerland potential areas vulnerable to avalanches and rockfalls. The extensive hazard maps have been compiled by the cantons with the support of the federal government using web GIS (BAFU 2020). The Federal Laws on Forests and Hydraulic Engineering oblige the cantons to take the hazard maps into account for all activities with spatial relevance.

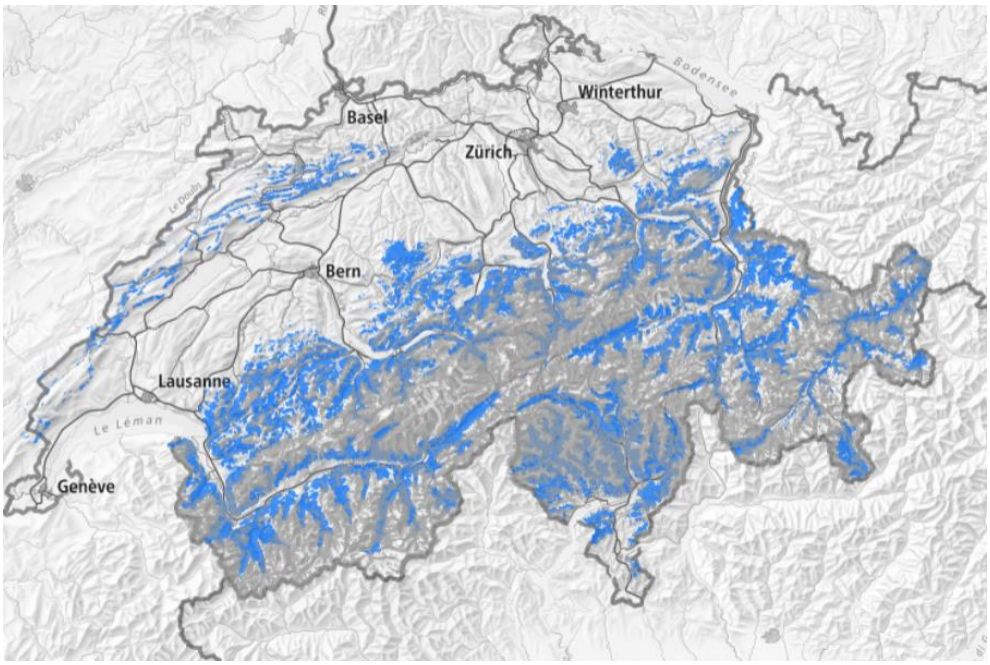

Fig. 3: Swiss potential areas that could be endangered by avalanches and rockfalls (Bundesamt für Umwelt BAFU, available at: https://www.bafu.admin.ch/bafu/de/home/zustand.html)

At the local level risk and hazard maps are produced that are used as a basis for spatial planning decisions (Schindelegger & Kanonier 2019: 67, 75). The hazard maps that are provided for the local level illustrate the settlements and transport routes threatened by floods, avalanches and other natural disasters relevant to the country. The hazard map is divided into four hazard levels and thus provides a basis for hazard zones in the land use planning process. Areas marked in red are areas of high danger, so building is generally prohibited. At the same time, building is possible in yellow marked areas, because the risk of the mentioned dangers is low there (Overbeck et al. 2008: 369).

A challenge for the role of spatial planning in Disaster Risk Management is the fact that binding decisions in must be factual and proportionate. Apparently, clear zones can be defined for flood and avalanche hazards, and in these cases, planning can refer to evidence. For hazard processes that have less clear spatial delimitations such planning statements are much more difficult to make. Overall, spatial planning has not yet satisfactorily resolved the conflict of a processes (see climate change effects) as a basis for decision-making (Schindelegger 2020). This observation is supported by the EUSALP Action Group 8 assessment of the existence of appropriate spatial planning measures and regulations with regard to natural hazards. The assessment showed that floods and avalanches are well covered by planning instruments in the Alpine countries. At the same time, natural hazards such as torrents and rockfall are not sufficiently linked to the spatial planning measures (Schindelegger & Kanonier 2019: 79).

At the **regional level** there are planning policies with a strategic orientation and development programmes with a binding character. Nevertheless, natural hazards and risk minimisation are rarely among the most important topics of such policies and programmes. The two fields are more likely to concern settlement development policies.

Higher probabilities of the occurrence of natural hazards in the Alpine region require even more effective risk management. All member states of the EUSALPs programme have established a state-run disaster risk management system. The system includes a variety of tasks, which are carried out by the authorities. It is based on the top-down principle for the planning and implementation of various measures (Schindelegger & Kanonier 2019: 19). It should be mentioned that every DRM/DRR system in the area of disaster management has a clear top-down structure borrowed from the military area. The actual implementation is, however, much more complex depending on the country and is also strongly based on the integration of local skills and resources; In this area in particular, cross-border exercises, common standards and data collection as well as assistance in the event of a disaster also play a major role (Schindelegger 2020).

4 Climate change adaptation in the Alpine region

4.1 Transnational cooperation in climate change adaptation

The above-mentioned Platform on Natural Hazards of the Alpine Convention (PLANALP) is not only a basis for integrated risk management, but also the first pan-Alpine framework for natural hazards with regard to climate change adaptation. It develops strategic objectives and recommendations, which follow an integrated approach and provide for risk management strategies under changing climate conditions.

The Alpine Convention, which entered into force in 1995 and has the sustainable development of the Alps as its main objective, has taken climate change into account in many ways for this purpose. In 2009, the Alpine Convention adopted the Climate Action Plan. The Climate Action Plan is a transnational strategy and ensures the strengthening of the Alpine Convention by promoting the adaptation of the Alpine region to climate change. The Action Plan is thus the only politically significant transnational policy document to date that covers both adaptation to climate change and mitigation options. Although the document has no legally binding character, the Plan supports the objectives of the Alpine Convention and therefore the implementation of its measures is mandatory for the Member States (Probst, T., Hohmann, R. 2019: 8).

The Multi-Annual Work Programme (MAP) is an instrument for the long-term implementation of the Alpine Convention. The XIV Alpine Conference (2016) adopted the “Multi-Annual Work Programme of the Alpine Conference 2017 to 2022” (Permanent Secretariat of the Alpine Convention 2017: 3). It serves as a common cooperation of the Alpine states with regard to the most important priorities in the Alpine region. The tasks of joint cooperation include the elaboration of measures to mitigate and adapt to climate change. The approaches to minimise the consequences of climate change are integrated into different policy areas. These include agriculture, transport, spatial planning and economic development. The MAP is an instrument to fight against challenges in the Alpine Space and to use the opportunities that the Alpine region has to offer. The idea behind MAP is that the challenges facing the Alpine area can best be identified through a bottom-up approach. This is done by taking the opinion of the inhabitants by communicating the main challenges from their point of view (Permanent Secretariat of the Alpine Convention 2017: 4 ff.).

Currently, the most important strategic document at the European level is the European Union Strategy on adaptation to climate change. The basis for it is the white paper titled “Adapting to climate change”. The transnational strategy calls on the EU Member States to adopt adaptation strategies. Spatial planning is seen as a tool to achieve long-term adaptation to climate change (Pütz &Kruse 2011: 47).

The Alpine Conference has established the Alpine Climate Board in 2016 (AlpineClimate2050 n.d.). It bundles all relevant activities on climate change and thus promotes a successful implementation of the Alpine Convention. The Alpine Climate Board has been working on a target system for the climate-neutral Alpine region up to the year 2050, whereby the defined targets from the climate target system are to be implemented through the Multi-Annual Work Programme of the Alpine Conference (MAP) for the period 2017-2022 (Ständiges Sekretariat der Alpenkonvention 2019: 2, 8). Within the Alpine Climate Target System 2050, the following ten different implementations pathways with individual targets and challenges have been defined: ecosystems and biodiversity, energy, mountain agriculture, mountain forests, natural hazards, soil, spatial planning, tourism, transport, water. In addition, a community platform was launched to ease communication between experts and the information flow of news and events (AlpineClimate2050 n.d. and Alpine Convention 2021).

At the end of 2020, the updated version of the Climate Action Plan, that entails implementation paths for achieving the Alpine Climate Objective 2050, was passed by the ministers during the XVI Alpine Conference (Alpine Convention 2020).

4.2 Climate change impact assessment – the transnational perspective

Based on the knowledge gained, it can be stated that climate change assessment is independently drawn up by each of the Alpine region states. Indications that these national climate impact assessments were developed in cooperation with other Alpine countries are hardly present. There are several programs from the Alpine countries that have made independent climate assessments and have developed scenarios for further development (Journal of Alpine Research 2015). However, these programs are limited to the national level and no information has been found on whether they have a transnational approach or whether they have been legitimised as formal documents. In total there are no set uniform steps in the assessment. This applies to the risk maps and maps to vulnerability to climate change. No uniform framework for the design and implementation of climate impact assessments has been identified.

4.3 Climate change adaptation – general observations from Alpine countries

All alpine countries have developed their own adaptation strategies at the national level. The adaptation strategies differ according to the degree of vulnerability, the expected impacts, the type and intensity of possible events. Each adaptation strategy reflects the legal, political, financial, institutional and cultural framework of the respective Alpine country. The assessment and perception of climate change also influences the decision for one or the other strategy (Plattform Naturgefahren der Alpenkonvention: 7).

However, under the Interreg B programme “Alpine Space” two projects were initiated that substantially promoted transnational cooperation in the Alps regarding climate change adaptation: The strategic project “ClimChAlp – Climate Change, Impacts and Adaptation Strategies in the Alpine Space” was carried out from 2006 to 2008 as a part of the EU-Community Initiative “Interreg III B Alpine Space”. The seven Alpine countries cooperated with each other to jointly counteract the effects of climate change and develop adaptation measures. The project is an example of a comprehensive cooperation of the Alpine countries, which has created a basis for climate adaptation on a transnational level by developing the Flexible Response Network. The Flexible Response Network set up in ClimChAlp promotes the efficient use of available knowledge and experience for the further development of integrated natural hazard management on a transnational basis in the Alpine region. In two years, a methodological basis for adaptation to climate change in the Alpine Space was established and a set of recommendations on how to further intensify the transnational cooperation have been elaborated (Bayerisches Staatsministerium für Umwelt, Gesundheit und Verbraucherschutz, Referat Klimaschutz n. d.: 30).

The question of the role of spatial planning for climate adaptation in the Alpine Space is based on the results of the project “CLISP – Climate Change Adaptation by Spatial Planning in the Alpine Space”, another project in the Alpine Space (Interreg IV B, Alpine Space, 2008-2011). With regard to the question of sufficiency for all Alpine states, only the German partners have described the instruments of spatial planning for adaptation to climate change as sufficient. Numerous adaptation activities are possible thanks to the spatial planning law anchored at national level in Germany. At the time, the other Alpine countries claimed that the existing spatial planning instruments for adaptation to climate change were either insufficient or the problem was due to incorrect implementation of these (Pütz & Kruse 2011: 50). In the comprehensive surveys, some partners indicated that informal planning practices for climate adaptation are not yet widely used. However, their role in adaptation to climate change has been recognised by Member States. Such informal planning practices include those involving cooperation at regional level. These include regional agreements, spatial development concepts at national, regional or local level. Another group of informal planning practice includes close cooperation, which includes participation procedures and exchange between different stakeholders. Systematic assessment procedures such as spatial impact assessment and spatial development scenarios are considered important informal practices for climate adaptation. Sectoral instruments in the field of adaptation to climate change that are widely used at national and regional levels in the Member States include water management, soil protection, forestry and natural hazards. Other relevant sectoral areas related to adaptation activities include agriculture, nature conservation, environmental impact assessment, energy and others. As a result, horizontal cooperation between spatial planning and sectoral planning is one of the most important ways of action regarding the adaptability of planning systems (Pütz & Kruse 2011: 51).

A number of relevant documents relating to climate adaptation also devote a role to spatial planning. The European Commission’s White Paper emphasises the role of spatial planning in climate adaptation issues.

Spatial planning, with its strategic and long-term approach, has a high capacity for coordination, which can link sectors such as the economy, transport, regional development, environment, industry and others.

The Climate Action Plan sees spatial planning as a suitable instrument for defining risk areas and thus strengthening resilience and disaster risk management. One of the most important objectives is to adapt the capabilities of planning instruments to changing conditions and to integrate risk prevention and vulnerability reduction expertise at all levels of planning (Tagung der Alpenkonferenz 2009: 11).

A notable example of climate change adaptation in the study area is also the Climate Change Adaptation Platform for the Alps (CAPA). CAPA is the only knowledge portal on climate adaptation that covers the entire alpine macro-region. It focuses on the specific knowledge needs of Alpine areas from the transnational to the local level. CAPA collects knowledge, experiences, existing best-practice examples and projects on climate change adaptation in the Alpine region. The central transnational online directory of climate change adaptation resources contains in its database knowledge resources covering all climate change impacts, adaptation-relevant sectors and adaptation measures of different types, the most important target groups and all knowledge spheres for the area (Heil 2020).

5 Conclusions

The Alpine countries differ greatly in their institutional character, in their share of the Alpine part in the overall territory of the Alpine region, the constellation and number of actors, instruments and their implementation. European instruments such as directives, strategies, agendas, and international agreements together with transnational strategies within the Alpine region as well as cross-border cooperation form the building blocks to balance the complexity and diversity of the Alpine area.

Recognition of transnational challenges as starting point: The Alpine macro-region itself has recognised the challenges and opportunities that it must share – this was the basis for creating the Alpine Convention. Over the years, a cooperation like the Alpine Convention has proven its worth. As it was the first legitimised form of transnational cooperation in the Alpine area, it paved the way for multiple subsequent projects and is still today an important actor. The members of all Alpine countries work together on issues such as climate change and natural hazards, which has strengthened the exchange for several years. The same is valid for the PLANAP platform, where common strategies for the prevention of natural hazards in the Alps are elaborated. Important to mention is also the latest cooperation between the Alpine Convention and EUSALP in the field of governance structures. This will improve the implementation of the EUSALP (including natural hazards risk governance), bring the multi-level governance approach into action and thus realise the communication among different planning levels, stakeholders and population in various thematic fields.

Role of European policies: A large number of transnational activities can be found in the Alpine region. Such cooperation, like the Interreg Alpine Space Programme and EUSALP together with the EU Floods Directive, show the great influence of European Union policies and funding on the development of the Alpine macro-region. The existence of transnational programs and agendas such as EUSALP and the Interreg Alpine Space Programme, but also various cross-border and international cooperation is a strength in dealing with natural hazards and climate change. The Interreg Programme, with a large variety of funded projects, involves a close exchange between the countries of the Alpine region with regard to questions of climate change adaptation and risk reduction. However, the majority of these projects is often limited to a specific time frame and the results of the cooperation have hardly been transferred into national policies.

Common transnational approaches not yet on the agenda: A common transnational approach to natural hazard assessment as well as climate change impact assessment is lacking. Rather, all member states of the Alps follow national and approaches to hazard and risk assessment and there is no existing common approach to dealing with natural hazards (Schindelegger 2019, Alpine Convention 2021). One might argue that there is no need for a harmonised approach, but some examples showed that an alignment of approaches, data and methods can increase the comparability and mutual understanding of assessment results as a basis for management decisions. Further, no uniform framework for the design and implementation of climate impact assessments has yet been established. Each Alpine state has carried out its own climate change impact assessment and there is little to no evidence that it was developed in cooperation with other Alpine countries. In older literature, several notes and recommendations include the remark that it is important for a natural and cultural area like the Alps, which is particularly exposed to climate change, to implement a uniform transnational climate change assessment.

Multiple approaches put together the package of transnational cooperation benefits: The overview of transnational cooperation makes clear that there is no particular form of cooperation in the field of natural hazards in the Alpine area, which was sought at the beginning of the case study. Instead, there are different approaches to cooperation, which differ in formal and informal terms, the composition of actors and different priorities in cooperation topics.

- *Hazard-specific cooperation:* In the course of the elaboration it has become clear that a transnational approach is not necessary for all types of hazards, especially when EU directives such as the FRMD exist, which all countries have adopted and therefore similar structures exist. However, the implementation of the directive in the Alpine region shows differences.
- *Cross-border cooperation:* Further, the cooperation at cross-border level is important in the Alpine region. This is particularly relevant in the case of natural hazards such as avalanches, as in the case of the CROSSRISK platform. However, although there is many cross-border cooperation the

topic of natural hazards is rarely addressed. The tendency is rather towards cooperation with economic or social objectives. Overall, the cross-border cooperation has a great potential for intensification with regard to natural hazards in the Alpine region.

- *Cooperation to exchange of knowledge and experiences:* Especially with regard to the exchange of experience between Alpine countries, transnational cooperation can have positive effects. A comprehensive exchange of knowledge in the field of natural hazards in the Alpine Space on a transnational level would lead to a better understanding of the risks and to the elaboration of common solutions. This would allow experts from all Alpine countries to adopt good practice examples from each other and possibly transfer them into national strategies. A few examples already contribute to a comprehensive exchange of information and experience in the Alpine region and can be further developed and strengthened in the future. Climate Change Adaptation Platform for the Alps in the field of climate adaptation and the international research company INTERPRAEVENT as well as the PLANALP Platform create a framework for an exchange of experts in the field of natural hazards in the Alpine region and beyond its borders.

In summary it can be said that the huge impact of EU funding on the formation and development of cooperation formats at different levels is striking. Several long-lasting cooperation root back to EU funded projects and are still renewed each programming period. Therefore, it can be said that the EU funding in the macro-regions like Alps has a great impact on the cooperation contexts. It has certainly more or less broken down the borders within the Alpine region, which has possibly launched the further cooperation and collaborations in the case study region.

Overall, the case study analysis showed that long-lasting, sustainable and effective cooperation has to be built on formal agreements but can only be filled with life in an atmosphere of personal connections, mutual trust as well as open-mindedness to share experiences and learn from others (Papež 2020, Schindelegger 2020, Heil 2020).

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