REPORT

CROSS-CUTTING BIODIVERSITY ISSUES
2024

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PREFACE

This Report is carried out by the Italian's chair of the Alpine Biodiversity board as part of Priority Objective I "Biodiversity and Ecosystems" of the Multiannual **Work Plan (MAP) 2023-2030**[1].

Its main purpose is to provide an overview of the various cross-cutting implications to the theme of mountain biodiversity, and particularly Alpine biodiversity. Together with the **Policy Brief** "Biodiversity in the Alps" of the Slovenian Presidency and the latest **Conference on Alpine Biodiversity** in **Kranjska Gora**[2] 2024, they will be useful to the implementation of the ABB next mandate. This mandate will help the achievement of monitoring (through AlpsLife project), connectivity, restoration and conservation objectives through the elaboration of **the Alpine Biodiversity.**

The data and considerations presented in this document have mainly emerged from reports of the Convention's activities since its foundation, from the five years of the ABB's previous mandates and from thematic and/or joint works and workshops that the Alpine Biodiversity Board has carried out in the last years with other **Thematic Working Groups (TWBs)** of the Convention.

[1] https://www.alpconv.org/fileadmin/user_upload/Organisation/AC/XVII/AC_MAP_2023-2030_en_web.pdf

[2] https://padlet.com/Alpine_Convention/alpine-biodiversity-conference-vd97x1w73op6t4x3

INTRODUCTION

Already in 1994-1995 within the framework of the Alpine Convention, the Contracting Parties (except Switzerland) politically signed the **Protocol "Nature Protection and Landscape Conservation[3]",** underlining the need to establish standards in order to protect and restore wild species and their habitats, to guarantee the proper functionality of ecosystems and their ability to provide ecosystem services, and to protect the landscape diversity of the Alpine arc.

A Working Group, named "Specific environmental quality objectives for the Alps"[4] was in charge of identifying valuable environmental quality objectives for the Alps starting from 1998. Later the group received a second mandate by **the Sixth Alpine Conference in Lucerne** (October 2000). This led to the development of contributions for the use of environmental quality objectives in the implementation of national environmental policies aimed at implementing sustainable development models. The most important, drawn up with the coordination of the Umweltbundesamt, was the report, presented at the VII CoP in Merano, "Environmental objectives in the Alpine arc and monitoring proposals through indicators" with the following outputs:

1. Systematic analysis of cause/effect chains for the Alpine Convention Protocols
2. Research on the objectives of the Alpine Convention
3. Detailed assessment of the inventory, analysis and synoptic representation of existing objectives based on contributions from individual countries
4. Preparation of proposals for the verification of the achievement of the objectives based on indicators and results of environmental monitoring
5. Evaluation of existing pilot projects at regional level for the implementation of the objectives of the Alpine Convention.

It was clear, from this work, that it was important to further develop and integrate the proposed system, especially about the requirements described. In fact, the publication was not set up as a complete document but rather as a guideline for future research. It also indicated the need to use existing datasets and metadata banks to reduce the complexity and the costs of operations. The ambitious expectation was to achieve a uniform collection of environmental data representative of all alpine territorial realities.

Following the implementation of the Protocol "Nature Protection and Landscape Conservation", the Alpine Network of Protected Areas (**ALPARC**[5]) has also collaborated with the Convention. This association, initialized by France and its Environmental Minister Michel Barnier during the 1994 Alpine Conference of Chambery and then started, carries out its actions in three main areas:

1. Biodiversity and ecological connectivity
2. Regional development and quality of life

[3] https://www.alpconv.org/fileadmin/user_upload/Convention/EN/Protocol_Conservation_of_Nature_EN.pdf

[4] Ed. Freely translated from "Obiettivi di qualità ambientale specifici per le Alpi", "Objectifs environnementaux dans l'espace alpin et propositions pour assurer leur suivi à l'aide d'indicateurs", "Umweltziele im Alpenraum und Ansätze zu einem Monitoring durch Indikatoren" and "Okoljski cilji v alpskem prostoru in pristopi zamonitoring s pomoãjo kazalcev". English was not a language used by the Convention in those years.

[5] The main purpose of the association is to promote the **exchange of skills**, **techniques** and **practices** between the managers of **all large Alpine protected areas** that have a special protection status. https://alparc.org/

3. Education for sustainable development in the Alps.

The first of these points has been further explored over the years with the joint proposal of research projects and the elaboration of reports and dossiers. Still now, this knowledge remains the solid basis of the activities of the Alpine Convention and the ABB, especially in transnational contexts.

The topic was further articulated with the establishment, during the **XV Alpine Conference** held in Innsbruck on 4 April 2019, of **the Alpine Biodiversity Board (ABB).** Its main tasks were and still are: "1) to carry out an inventory analysis of strategies, guidelines and policy recommendations relevant to Alpine countries in the field of biodiversity and landscape, including the Convention on Biological Diversity, relevant EU legislation and biodiversity strategies, as well as the results of recent research and 2) to develop a system of priorities and objectives for joint action, also in the field of ecological connectivity. The Board should, among other things, organize workshops that bring together the different stakeholders to allow a dialogue between the different interests".

During its five years of activity, ABB has been working:

- To detect and highlight gaps[6] and problems related to biodiversity in the National Strategies of the Contracting Parties, underlining the lack of references to the proven specificity of mountain and Alpine biodiversity. The main aim was to define objectives for Alpine biodiversity based on insight about the state of implementation and the potential effectiveness of existing instruments at pan-Alpine level
- To identify a preliminary set of specific common indicators[7] for mountain biodiversity's monitoring
- To conceive biodiversity in the most transversal way possible, placing it in relation to other macro-issues of absolute interest for the environment and the society included in it, such as water, spatial planning and land use, climate and mountain agriculture, forestry and quality of life. This process has been fostered by extensive collaboration with all the various Thematic Working Bodies[8] of the Convention that in their activities addressed aspects related to biodiversity, its conservation or the maintenance of a good ecological connectivity.
- Work on the application of the Interreg Alpine Space-AlpsLife project proposal[9], focused on the interoperability of biodiversity monitoring schemes in the Alps and the identification of urgent-to-act areas for environmental restoration on a pan-Alpine scale.

[6] The report of the "survey on main policies and instruments for Alpine biodiversity" published in October 2020 (https://rb.gy/6jra9y) aimed to provide a concise overview of the various tools (policies, strategies, programmes, etc.) available in Alpine countries in the field of biodiversity (terrestrial and freshwater). The aim was to initiate an informed debate on critical areas and the potential of existing knowledge and possible actions for biodiversity, to be implemented at the Alpine scale. The report aimed to enable the ABB to identify critical issues and areas to be investigated, in order to define joint actions aimed at improving knowledge and conservation of biodiversity in the Alpine region. The report offered some useful additions to the survey, the result of the analysis of the National Biodiversity Strategies of the Alpine countries. It also outlined trends on the conservation status of species and habitats set out in the Directive, as well as providing some final guidance on existing challenges and recommendations.

[7] During the 2021-2022 mandate, the ABB, following the indications of the XVII COP of the Alps, favoured the publication of a set of ecological indicators (Massimo Santolini, 2022 https://rb.gy/e7mlje), relevant for mountain biodiversity, integrating and updating the indicators of the "Ecological Network" platform. Their identification was deemed necessary to highlight the specificity of the biodiversity of mountain and alpine areas and to protect nature from climate change and its impacts. The integration of indicators that promote the value of mountain biodiversity conservation contributes to realizing the CBD's vision of "Living in harmony with nature" by 2050 and to strengthen coherence between international frameworks and science-based decision-making processes.

[8] WISO; Mountain Agriculture and Mountain Forests, Spatial Planning and Soil Defence, Quality of Life, Alpine Climate Board

[9] https://www.alpine-space.eu/project/alpslife/

Mountain biodiversity shared issues in different contexts

Starting from 2019, one of the pillars of the Alpine Biodiversity Board's activity has been synergized with other international scientific and negotiation contexts, sharing knowledge and identifying general guidelines/good practices related to the issue of the specificity of mountain biodiversity.

Since its institution, there has been a close collaboration with the Carpathian Convention[10], useful to establish a solid confrontation between national and international experts belonging to different transnational and cross-border contexts but united in the challenges to be faced. This cooperation was further developed on **15-16 December 2021** with the organization of the **Alpine and Carpathian Biodiversity Forum[11].** During the event, which highlighted the main critical issues to consider concerning the conservation and restoration of mountain biological diversity, the main conclusions were:

- Identification of the **altitudinal gradient** as a characterization factor of mountain ecosystems and associated life
- The urgent need for more targeted measures and policies, the harmonization of **monitoring schemes**, interoperability between data shared by various providers and the use of a **cartography** as common understanding for the entire Alpine arc (es. Carta Natura, Alpine Atlas).
- Consideration of the role of biodiversity and the quality of life in all strategies for economic and territorial development.
- Recommendation on how to approach **climate change impacts** through mitigation and adaptation (e.g. proper management of mountain forests)
- Intensify the studies on **ecological connectivity,** on the maintenance of ecosystem functionality and therefore on the **services** they provide.

The same challenges were also taken up during the celebratory Forum **"Mountains Biodiversity 2002-2022",[12]** in presence of the Carpathian Convention and the Mountain Partnership. During this anniversary, **cooperation** in the form of knowledge exchange, **cross-border collaboration** and the desire **to bring mountain biodiversity to international tables** such as the Convention of Biological Diversity-CBD[13] and the Post-2020 Global Biodiversity Framework[14], were further sought and promoted. Particular attention was also paid to the emerging issue of **water (melting glaciers and permafrost, drought, fragility of ecosystems, etc.).** and the relationship between biodiversity and **quality of life.**

During the first Workshop of ABB mandate 2023-2024 **"Addressing the Loss of Biodiversity in the Alpine region: Exchange on Implementation of National, European and Global Biodiversity Strategies" (17th April 2023),** the role of biodiversity in addressing the multiple challenges of the Alpine region was highlighted. Existing or ongoing National Biodiversity Strategies and Action Plans (NBSAPs) of the Contracting Parties were compared, for a better understanding of

[10] The Framework Convention on the Protection and Sustainable Development of the Carpathians (Carpathian Convention) was adopted in May 2003 in Kyiv, Ukraine, entering into force in January 2006. It aims to improve the quality of life, to strengthen local economies and communities, and to conserve the natural values and cultural heritage in the Carpathian area.
[11] https://www.alpconv.org/fileadmin/user_upload/Organisation/TWB/ABB/Alpine_and_Carpathian_Biodiversity_Forum_15-16_December_2021_-_Conclusions_and_Recommendations.pdf
[12] The aim of this event was to contribute to the implementation of the directives for the United Nations "International Year of Sustainable Mountain Development, 2022", by raising common awareness on the importance of protecting mountain ecosystems, providing an overview of the main achievements achieved in recent years and offering a discussion on the way forward and the main challenges related to the protection of mountain biodiversity. https://rb.gy/hbjvjx
13 A Memorandum of Understanding was signed in 2023 https://www.cbd.int/doc/agreements/agmt-alpine-2008-05-29-mou-web-en.pdf
14 https://www.cbd.int/doc/c/409e/19ae/369752b245f05e88f760aeb3/wg2020-05-l-02-en.pdf

the priorities, approaches and objectives of each country. Also, it emerged that mountain areas are not usually explicitly addressed in NBSAPs. However, most of the proposed objectives and actions address issues and themes that are also relevant to biodiversity in mountains. These include specific **conservation** themes such as: the protection of endangered native species and the management of invasive species, as well as cross-cutting issues such as: ecological connectivity, urban biodiversity, green infrastructure, land use change and the impact on and of agriculture. Habitat **restoration** and the promotion of **Nature-Based Solutions (NbS)** have often been indicated as priority approaches to address and halt biodiversity loss in the Alpine region.

Nature based Solutions and Ecosystem based Approaches

Biodiversity is a typically transversal issue. Its protection can only be based on a scientific approach that considers not only the relationships between its ecological components, but also the interconnections with social and economic needs. So today in many international agreements and negotiations such as the G20 Environment[15] (November 2021) and UNESCO[16], Nature based Solutions (NbS), solutions that contribute to human benefit working in harmony with natural dynamics, are increasingly encouraged. According to the IUCN,[17] they have the potential to reduce the conflict of interest between **man and nature,** linked to **ecosystem services.** They have the possibility, if supported, to reverse negative trends related to biodiversity and soil loss or resilience to climate change.

Ecosystem based Approaches (EbA) are defined by the Convention of Biological Diversity (CBD) as comprehensive strategies aimed at the integrated management of land, water, and living resources. They emphasize conservation, sustainable use, and equitable sharing of benefits derived from natural resources. These approaches align with some of the main objectives of the Alpine Convention such as conserving biological diversity and sustainable use and development of landscape. They also recognize that, given the complex and dynamic nature of ecosystems, adaptive management is essential. This often should involve responding to uncertainties and learning from experience, even when not all cause-and-effect relationships are fully understood. In addition, all these approaches rely on appropriate scientific methods that focus on biological organization levels, including the structure, processes, functions, and interactions among organisms (humans included) and their environments.

Nature-based Solutions and Ecosystem based Approaches are considered as "umbrella concepts", focused on scientific and integrated study on a global landscape scale rather than a punctual one. They serve as a foundational framework for managing biodiversity sustainably while balancing ecological health with human needs. By promoting an integrated management strategy that recognizes the interconnectedness of ecosystems and human activities, it aims to foster a sustainable future for both nature and humanity. Under this light, both can draw up useful guidelines to face the challenges in the Alps, ensuring the maintenance of a correct balance between the needs of all parties involved. Maintaining the environment healthy while ensuring sustainable development for the Alpine arc is key.

15 https://www.isprambiente.gov.it/files2021/notizie/final-g20-workshop-nbs-eba-29-nov-2021.pdf
16 " Nature-based solutions (NBS) and water", UNESCO World Water Assestment Programme 2018
17 https://www.iucn.org/theme/nature-based-solutions/about/iucn-global-standard-nbs

CROSS CUTTING ISSUES

Cross-Cutting Issues are those issues of such importance that their consideration and integration in all interventions and policies cannot be ignored. Their level of interconnectedness is such that they could hardly be isolated and considered individually, since measures and projects related to different topics would also end up directly or indirectly influencing others. Therefore, all actions should pay attention to these aspects, both in the formulation phase and in the implementation and subsequent evaluation phase. It is intended that the specific measures make a positive contribution to the development of each cross-cutting theme so a balanced situation can be achieved.

The Convention on Biological Diversity (CBD)[18] , in the 2021 Conference of Parties, started to work on key issues relevant to all thematic areas linked to mountain biodiversity (e.g. climate, invasive species, health, ecosystems., etc.). These challenges correspond to those addressed in the substantive provisions of the Convention in Art.6-Art.20 and provide links between thematic programmes.

Following these indications, the Alpine Convention and the Alpine Biodiversity Board have continued, trying to engage all the TWB in its implementation. Following the **"Crossroads Biodiversity"** workshop held in Milan on 10-11 October 2023 for the conclusion of EU project Gestire2020, an Alpine network was created, with ABB, ERSAF and EUSALP's Action Groups 6 (Environmental and Cultural Resources) and 7 (Connectivity and Green Infrastructure) as nodes. Addressing technical suggestions from experts on how to improve and simplify the protection and safeguarding of biodiversity, the main outputs of the event were enclosed in a **Final Message**[19]**,** sharing guidelines for national and European policies to follow for the implementation of projects concerning the protection of biodiversity. These can be traced back to four major areas, namely: governance, conservation, restoration and monitoring. The Slovenian Presidency has also continued to move in this direction with the drafting of its Policy Brief "Biodiversity in the Alps" which has reiterated the importance of the four pillars monitoring, connectivity, restoration and conservation in the Alpine context.

The following section summarizes gaps of awareness to be filled to proceed in an integrated manner to a satisfying elaboration of an Action Plan, as requested with a specific mandate by the XVII Alpine Conference[20] (Briga 2022) and outlined by the Policy Brief of the Slovenian Presidency. In this sense, a review of some important international projects and specific workshops was carried out. It resulted in highlighting the pressures on biodiversity in the context of:

- Ecological connectivity
- Soil, with specific reference to issues related to Spatial Planning and relevant habitats such as peatlands and wetlands
- Forestry and Mountain Agriculture
- Climate change and the latest considerations on the renewable energy sector
- Water, with insights related to the implications of melting glaciers and permafrost
- Quality of life

18 https://www.cbd.int/programmes
19 https://naturachevale.it/wp-content/uploads/2023/12/Crossroads-Biodiversity-Message.pdf
20 https://www.alpconv.org/fileadmin/user_upload/Organisation/TWB/ABB/ABB_Mandate2023-2024_fin_it.pdf

Connectivity

Ecological connectivity is "that condition in nature that makes possible the free movement of species and the free flow of natural processes that guarantee life on Earth" (Convention on the Conservation of Migratory Species of Wild Animals). The term can also refer to the continuity between ecosystems connected by ecological corridors. There are two types of connectivity (Updated Glossary of the Global Biodiversity Framework Project, 2022):

- **Structural,** in which the continuity between ecosystems is verified
- **Functional,** in which the displacements of species or processes are verified

This definition comes from a progressive evolution which, starting from a more generalist concept, linked purely to the range of individual species, now encompasses within it the very trans-sectoriality of biodiversity on an ecological and biological scale. Therefore, today it is preferred to refer to ecological networks, natural or semi-natural systems that are managed with the aim of maintaining the correct functions for the conservation/restoration of fauna and/or biological processes. These systems can also provide opportunities for sustainable use of resources and responses to habitat fragmentation and isolation. Currently, ensuring the development of an adequate network of corridors for adequate connectivity is a strategic challenge in contexts of rapid climate change (IPCC) and environmental degradation (IPBS).

The centrality of this theme for the Alpine Convention has been evident since 2005, the year in which ALPARC was commissioned to carry out a study on ecological corridors and the cross-border areas most deserving of protection. The following year, ALPARC supported the Permanent Secretariat by setting up the "Protected Areas Task Force" and coordinating the activities of the Convention's "Ecological Networks" platform. The foundations for the long-term implementation of a coherent ecological network in the Alps were strengthened the following year (2007) by the **"Ecological Continuum Initiative"** of the ALPARC-CIPRA-WWF-ISCAR consortium (all official observers of the Alpine Convention). Funded by the Swiss MAVA foundation, among the main objectives were the desire to provide interactive tools and easily accessible.

Meanwhile the Ecological Network Platform of the Alpine Convention was set up by the IX Alpine Conference in 2006 as an expert forum to develop common strategies in order to contribute to the preservation of biodiversity in the Alps, mainly through the design and support of measures ensuring the connectivity between natural habitats. It inspired and supported transboundary, alpine-wide and national projects on ecological connectivity and participated in the elaboration of various publications. Among them:

- Determination of the areas of particular importance for the alpine ecological network - connectivity analysis (2012)
- Evaluation of the Pilot Regions for Ecological Connectivity of the Alpine Convention (2016)
- Statement "The Important Role of Ecological Connectivity for Adaptation to Climate Change Impacts in the Alps" (2016)
- The Statement - PLACE Report on Spatial Planning and Ecological Connectivity (2019)

The Platform analysed, presented and communicated the role of ecological networks and connectivity in the implementation of a green Alpine economy, through best practices, mainstreaming ecological connectivity into other sectors (especially spatial planning). Since 2011, the Ecological Network Platform has designated 10 Pilot Regions of the Alpine Convention for Ecological Connectivity. These are territories, often cross-border, where specific activities are undertaken to develop ecological connectivity, and which have been officially recognized and concretely supported by organising opportunities to

share experiences. The Platform followed also EU policy and activities on Green Infrastructure, in close cooperation with the EUSALP Action Group 7. Beyond the Alps, it supported the Memorandum of Cooperation signed between the Alpine Convention and the Carpathians Convention and the one between both the former and the CBD. Finally, in the 2016-2019 mandate, it has also specifically analysed how ecological connectivity is or can be included in spatial planning. In its activity period the Presidency of the platform was jointly or alternatively held by Germany and France.

Based on the Continuum Initiative the **EConnect** project proposal was formulated and supported in 2008 as a candidate for European funding in the Alpine Space Program. Active in the three-year period **2008-2011,** the EConnect project was mainly focused on protecting biodiversity and improving ecological connectivity through an integrated and multidisciplinary approach. Its main achievements were:

- Create a structured data repository through an online mapping tool to assess and visualise landscape attributes, barriers and corridors for selected key species. To this end, the project referred to the **JECAMI** (Joint Ecological Continuum Analyzing and Mapping Initiative) web application for the analisys and visualization of connectivity in the project's Pilot areas. It combined three different approaches: the analysis of the landscape in a Continuum Suitability Index (CSI), the distribution and movements of specific key species with the Species Map Application (SMA) and the Connectivity Analysis of Riverine Landscapes (CARL).
- Identify the **main barriers** in the Alps and understand how they affect species. Researchers found that altitude and forest availability are the main factors influencing species distribution. Physical barriers are almost never total barriers and animals are still able to move in many cases. However, it is essential to provide species with green bridges to overcome barriers such as those that occur in Alpine valleys, characterized by strong anthropization.
- The promotion of a **common legal framework.**
- Launch **concrete actions** for the creation of ecological networks. Several actions have been implemented in the Pilot Regions, such as improving water and air connectivity, creating agreements with local stakeholders and decision-makers and raising public awareness.
- **Awareness of** ecological networks.

In continuity with EConnect, in 2013-2014, the GreenAlps (http://www.greenalps-project.eu/) project formed a framework for a sustainable and efficient European nature and biodiversity conservation policy for the Alps. The most important outputs resulted:

- A long-term perspective for biodiversity in the Alps that highlighted the importance of "networks," providing for cross-sectoral cooperation between stakeholders at all levels
- An examination of the role of ecosystem services as a basis for nature protection tools. The benefits provided to humans by Alpine ecosystems were highlighted and the debate on the quantification of the economic value of nature was discussed, presenting pragmatic approaches to concretely illustrate the real community value of ecosystems to stakeholders in other sectors.

In 2013 ALPARC and the Alpine Convention signed a further Memorandum of Cooperation for lasting foundations and mutual enhancement of every possible synergy well highlighted by the results between 2016 and 2019 in the **AlpBionet2030** project funded by the European Interreg Alpine Space Program. The main objectives of this project were:

- To provide standardised and cross-cutting institutional procedures for UE coordination and planning at the Alpine level (EUSALP perimeter[21]).
- To create a new and better understanding of spatial cooperation for biodiversity and ecological connectivity among Alpine countries with the **Strategic Alpine Connectivity Areas (**SACA[22]) classification, to support the elaboration of a transnational wildlife strategy.
- To define priorities and contribute to the implementation of existing planning criteria for ecological connectivity between the Alps and the EUSALP area

In this case, the outputs that emerged were:

1. Development of a multi-stakeholder and cross-border concept for integrated wildlife management in the Alps,
2. Mapping of the Alpine situation; integration of the first wildlife strategy at Alpine level and recommendations for its implementation
3. Further identification of the most important barriers around the Alps and ecological connectivity corridors between the EUSALP perimeter and the Alps.
4. Recommendations for the large-scale implementation of Green Connectivity in EUSALP (AG6 and AG7)
5. Alpine-wide toolbox with technical recommendations for strengthening ecological connectivity through a user-friendly Alpine GIS system (JECAMI 2.0).
6. Alpine Conflict Resolution Strategy and Coexistence Toolbox

Both JECAMI platforms drew up guidelines to respond to the practical needs related to the mapping of ecological corridors, highlighted some critical issues. One consisted in a certain level of heterogeneity between the monitoring schemes of the various countries active on the platform; in some cases, this determined a lack of harmony (es. results for the same species difficult to compare in transnational contexts not geographically too distant). Then, there was the need for an improvement in consideration of the value of the water-river network in terms of ecological connectivity. Last the dynamics for Large Carnivores were not well represented by the models as these could not be affected, given their great "resolving power", by some obstacles (roads) that the software catalogued as barriers but in some cases (e.g. wolf) could prove to be elements of connection. In the next mandate, ABB plans to collaborate closely with the WISO and Transport Groups for a modernization of knowledge and a desirable policy enhancement of ecological bridges and green infrastructure. Skills that will then flow into the support to the AlpsLife project, having as its cornerstone the achievement of interoperability between data and monitoring schemes in the Alps.

Ecological connectivity has progressively found more space also at a legal level. In Art3 of the **Habitats Directive** (Council Directive 92/43/EEC) it was considered "necessary to improve the ecological coherence of the Natura 2000 Network by maintaining and developing the landscape functions of greatest importance for wild fauna and flora" and in Art.10 of the same that these functions "are those which, by virtue of their linear and continuous structure (such as rivers with their banks or traditional field delimitation systems) or their function of milestones (such as ponds or small woodlands), are essential for the

[21] The Alpine macro-regional strategy EUSALP (2015) was launched to improve cross-border collaboration, identify common objectives and interventions and implement them in the most effective way, through better cooperation between regions and states. The strategy is implemented by seven countries (Austria, France, Germany, Italy, Liechtenstein, Slovenia and Switzerland) and 48 regions. EUSALP's thematic priorities are (1) economic growth and innovation, (2) mobility and connectivity, and (3) environment and energy, and nine Action Groups (AGs) deal with them. The EUSALP area, amounting to about 400,000 km2, expands and fully includes the area of the Alpine Convention. https://alpine-region.eu/

[22] The SACA classification, based on a set of 5 ecological indicators, divides the EUSALP area (and therefore the Alpine Convention) into three categories requiring different types of measures in relation to ecological connectivity. **SACA1**: Areas where connectivity is in good condition-> **Storage**; **SACA2**: Important areas between SACA1 where connectivity exists but would benefit from enhancement->Development; **SACA3**: Areas where barriers to connectivity arise and which need to be restored as a priority -> **Restoration/Mitigation**

migration, dispersal and genetic exchange of wild species". Connectivity is also expressly mentioned in the **III Target of the 2002 Global Biodiversity Framework** "Protect and conserve areas" which states that areas of particular importance for biodiversity, its functions and ecosystem services must be effectively conserved and managed through ecologically representative, well-connected and equitably governed protected area systems.

During the last thematic workshop **"Connectivity in the Alps"** held on **4 June 2024** during the **Alpine Biodiversity Conference** in Kranjska Gora, the **spatial aspects** of connectivity were mainly taken into account, illustrated by the experiences and proposals of two studies from the Alpine area (the PlanToConnect[23] model of priority connectivity areas and the WISO survey on the main barriers to connectivity) and **the implementation of green and blue infrastructures** in (international) policies and spatial planning frameworks. **Recommendations** were also provided for the refinement of the Policy Brief on biodiversity, outlining the guidelines that the future Action Plan on Alpine Biodiversity will follow. **Some of them[24]:**

- **Define priority corridors at international level**, include connectivity objectives in national and regional programmes and strategies, use participatory approaches to raise awareness at local level (with mediation) and make joint implementation decisions at all relevant levels.
- Integrate the use of up-to-date spatial information, data visualization, and modeling (e.g. maps, GIS) into decision-making, including connectivity between areas without security status.
- Work on upgrading existing corridors

In conclusion, starting from 2022, the Interreg PlanToConnect project (https://www.alpine-space.eu/project/plantoconnect) will be active until the end of 2025 to fill the gaps in the spatial planning of connectivity between protected areas, through the enhancement or establishment of new green and blue infrastructures. As there is currently no general concept of connectivity planning to guide the implementation of the corridors in the Alpine arc; regional networks must be harmonised. Planning systems must be updated too, allowing an efficient transition from conventional land use planning to more ecosystem-oriented approaches. PlantoConnect will apply and test the know-how and experience developed by previous projects (e.g. ALPBIONET2030, EConnect) funded in the EU program Alpine Space.

23 https://www.alpine-space.eu/project/plantoconnect/
24 https://padlet.com/Alpine_Convention/alpine-biodiversity-conference-vd97x1w73op6t4x3/wish/zV61Q6l8050AWO98

Soil

One of the main challenges for Alpine communities is to achieve self-sufficiency in the fields of energy and the supply of raw materials and water. Recent Eurobarometers[25] have revealed the community's understanding of the key role of biodiversity, and related ecosystem services, in the fight against climate change, supply, medicine and the establishment of economically sound long-term supply chains. Soil is recognized as a determining factor in the set of biotic and abiotic systems that contribute to the provision and maintenance of these services and functionalities.

The Alps are home to about 30,000 animal species and 10,000 plant species with some ecosystems, such as wetlands, which despite constituting a limited part of the earth's surface host about 10% of the known species. In this sense, the soil acts: both as a promoter of the processes that guarantee the minimum conditions for the subsistence of this biodiversity; and as a refuge for many species, some even microscopic, fundamental for the totality of the ecosystem services necessary for human life. We can talk about a real **geodiversity[26],** the protection of which takes on increasing importance over time and therefore requires an increasingly multidisciplinary approach.

Mountains are among the places particularly subject to environmental pressures related to the soil, accentuated by the fact that different pressures (agriculture, natural phenomena, climate change...) interact in specific ways with the various types of Land-Use or Spatial Planning adopted locally.

- The Soil Protection Working Group has drawn up a long-term Action Plan in which the importance of understanding and restoring the dynamics of wetlands has been highlighted with the promotion of re-wetting activities and the publication of good management practices
- Studies, projects and the use of good practices are underway to reverse the trend of degradation of geodiversity[27] with solutions that are as Nature Based as possible.
- A handbook for sustainable adaptation of forests will be published as an annex to the "Long-term Action Plan for the implementation of the provisions and declarations on soil protection in the specific context of the Alpine region" (2022)[28] . It implements measures aimed at maintaining healthy "living soils", capable of guaranteeing a certain level of functionality and services (CO2 storage; maintenance of fungal mycorrhizae, the formation of humus and organic fertilizer material).

In accordance with the objectives relating to collaboration with other bodies within the Convention and with international experts to promote the transversality of the biodiversity issue expressed in its current mandate[29], on **4 December 2023** in

25 The "Eurobarometer" (http://ec.europa.eu/commfrontoffice/publicopinion/index.cfm) is of the opinion addressed to the citizens of the European Union.
The surveys in question (2015-2023) had focused on citizens' perceptions and expectations of the state of the natural world (biodiversity, CC, energy...). These were strongly based on citizens' perceptions and expectations of the European Union's actions and the main challenges that the European Union was and is facing in this area.

26 The heterogeneity of the Earth's abiotic surface and subsurface, including geological, geomorphological, hydrological and pedological components (**Gray M. 2013** *Geodiversity: valuing and conserving abiotic nature*)

27 Geodiversity is deteriorating rapidly due to natural processes (e.g. floods, soil erosion, permafrost loss, terraces, landslides) that are increasingly amplified by climate change, and due to direct human activities (e.g. mining, groundwater extraction, overexploitation of sands, bottom trawling...) (**The status and future of essential geodiversity variables;** Schrodt et al. 2024)

28 "Sustainable is a form of management and use of forests and forest land that allows to preserve their biodiversity, productivity, renewal capacity, vitality and the potential to fulfil, today and in the future, relevant ecological, economic and social functions, both locally and globally, without causing damage to ecosystems" (**PEFC**, Programme for the Endorsement of Forest Certification.

29 https://www.alpconv.org/fileadmin/user_upload/Organisation/TWB/ABB/ABB_Mandate2023-2024_fin_en.pdf

Rome the ABB co-organized together with the WG Soil Protection the workshop "**Biodiversity, Soil and Land Use Planning**". During the event, it was possible to share the monitoring data of fauna and mesofauna and to investigate the extent of the biodiversity/soil health dependency relationship and the dynamics of anthropization (extensive vs. intensive agriculture, habitat types) of the latter. It also addressed issues such as soil sealing and soil reversal processes (project GroundBreak) and the need to establish legal frameworks that precisely regulate land-taking actions and spatial planning. An in-depth study was also dedicated, by the WWF, to the state of peatlands with a focus on their mapping and restoration.

Biodiversity and soil

Mountains are home to 25% of global biodiversity, indicative values that do not also consider the intrinsic diversity of the soil itself.

Soil organisms, even those invisible to the naked eye, have the particularity of being able to be analysed at different scales and compartments, but above all of being strongly influenced in number and composition by temporal (seasonality) and spatial factors. In addition, soils subjected to extreme conditions over time (altitude, ice) harbor highly specialized trophic networks, populated by unique organisms specifically adapted to these environments.

In the Alps, various types of ecosystems can be identified, and monitoring (where possible) has confirmed a great variability in the number of species, even rare ones, in relation to the large number of habitats identified. The largest number of individuals, more homogeneous in composition, can be found in stable grassland environments while the smallest in dry pastures which are the most heterogeneous and host a greater number of specialized organisms. However, **the abundance of individuals does not correspond to greater biodiversity**. High biodiversity indices are found on the other hand, in environments managed extensively by humans, where low impacts and low inputs guarantee more favourable conditions. (**Effects of land-use change in mountain soil biodiversity**, *Michael Steinwandter*). These can constitute ecotone/buffer zones that increase connectivity and increase the resilience of species.

Land-take and Spatial Planning

If it is possible to find from monitoring that human action can to a certain extent be beneficial for biodiversity, it is equally true that, in cases where anthropogenic alteration takes on **intensive connotations,** this potentially becomes one of the most severe impacts on biological and soil diversity. The **transformation** of grasslands, forests and pastures to obtain artificial areas, more efficient in the immediate future for economic purposes (intensive monocultures, non-native or genetically modified species) or for residential purposes, significantly lowers the functionality of ecosystems in the long term and impoverishes the number and value of the resulting services. Severe *land-taking* actions are powerful drivers of soil degradation and biodiversity. Although not all Member States of the Convention have national laws relating to land consumption, the workshop revealed the possibility of obtaining substantial improvements even just by raising awareness among political decision-makers the benefit of a traditionalist, active albeit low-impact approach. In fact, the possibility of preserving buffer areas between fields and forests by acting on the functionality of the organisms that populate them would support not only biodiversity, but also the economic return of farmers through the sale of better-quality products.

On the other hand, when not properly planned, urbanization arises. This directly involves many environments, natural and artificial, and through soil sealing inhibits many biological processes, based on the presence and flow of water.

In Europe, it is not uncommon for artificial land to constitute part or a fair part of the territory of individual nations, including in some cases also protected areas (Di Leginio, 2023). In the Alps, on the other hand, the total 3.65% of artificial areas are equally distributed among the various states, standing at less than half of the individual national averages. They are a potential virtuous example of a very low land consumption (0.5%), which is concentrated almost exclusively in the foothills within 600 meters. In the perimeter of the Alpine Convention, not only consumption is kept to a minimum but impermeabilization and restoration actions are underway.

In the context of the Sustainable Development Goals[30], the XV refers directly to soil and the need by 2050 to halt its loss and restore its degradation to neutrality, possibly through urbanization plans that are as sustainable as possible. Some specific indicators such as the percentage of degradation and the ratio of degradation/population growth have been selected to accentuate the social connotation that soil loss could assume. Guidelines have also taken hold to include meso-fauna[31] in monitoring campaigns (possible introduction of the QBS-ar Index[32] as an indicator of soil health).

The SPSD thematic WB of the Alpine Convention and the EUSALP Action Groups are also active on the issue. Their work focuses on the 2030 Agenda, the 2030 Territorial Agenda or the EU Green Deal. These groups jointly aim to develop policies that, fostered by cross-border collaborations within and outside the Alpine territory, are able to set standards relating to sustainable development. The mandate of the Spatial Planning Group is, specifically, to develop by 2024 an **Alpine Spatial Planning Perspective (ASPP)**. It will provide a common vision and perspective for the long-term territorial development of the Alpine area, sharing policy recommendations and outlining how to implement the priorities in the practice of national planning, regional and local. The Perspective will include practical guidelines for joint Alpine spatial planning (Articles 8 and 9 of the Protocol to the Alpine Convention on the SPSD) and these will be addressed to regional and municipal authorities and policy makers. The recommendations of the Alpine Convention report on economic land use and the related report of the Compliance Committee, as well as existing implementation guidelines, will also be considered. For its part, EUSALP, following the strategic objectives set out in its "Joint Paper on Spatial Planning", will contribute to the development of good practices and recommendations and with a roadmap for the implementation of the JPSP through actions and pilot projects.

Peatlands

Peatlands are environments characterized by a large amount of water in slow motion and at low temperature. In the Alps (3% of the alpine surface is made of peat) they are considered a key habitat[33] for water balance, biodiversity, landscape and climate regulation. They are a peculiar ecosystem, based on the progressive accumulation of spongy and not completely decomposed

30 The Sustainable Development Goals (SDGs) are a set of 17 interconnected goals, defined by the United Nations Organization as a strategy "to achieve a better and more sustainable future for all". They are also known as the 2030 Agenda for Sustainable Development [*Transforming our world: the 2030 Agenda for Sustainable Development*, ***United Nations – Sustainable Development knowledge platform***]. It recognizes the close link between human well-being, the health of natural systems and the presence of challenges common to all states

31 Soil mesofauna consists of invertebrates between 0.1 and 2 mm in size that live in the soil or in a layer of leaf litter on its surface ("Macrofauna and Mesofauna"). **National Soil Resources Centre, UK, 2012**). Members of this group include roundworms, mites, springtails, proturans, pauropods, rotifers, earthworms, tardigrades, small spiders, pseudoscorpions, opilions, enchytraeidae such as worms, insect larvae, small isopods, and myriapods. These animals play an important role in the carbon cycle and are likely to be negatively affected by climate change (Seeber, J.; 2012). "Drought-induced reduction in uptake of recently photosynthesized carbon by springtails and mites in alpine grassland).

32 It is a metric Index based on the concept that the number of microarthropod groups morphologically well adapted to the soil is higher in high quality soils than in low quality soils. QBS-ar considers soil microarthropods, invertebrates belonging to the Arthropoda phylum, having a range size between 0.2 and 2 mm or mesofauna (**Parisi et al.; 2001-2005**)

33 Habitats Directive – Article 9 Soil Protection Protocol

organic debris, which is home to extremely adapted animal and plant species, generally rare. The **IUCN** estimates, using the example of Switzerland, that wetlands are home to about 1/4 of the endangered plant species in the Alps and that to regress or reverse the trend of degradation and disappearance of these habitats. It would be necessary to extend them by more than 70% than the current one. Therefore, they are classified as among the most endangered areas in the **European Red List of Habitats**[34]. The great multifunctionality of Peatlands is also reflected in the high and diversified range of Ecosystem Services that they can offer. They store about 30% of the world's soil carbon, sequestering **150-250 million** tons of atmospheric CO2 annually; also helping to mitigate the climate and limiting the impacts of climate change on a local scale. In addition, the dense network of fibers made up of peats is essential in filtering water and its absorption. Among the cultural services are mentioned the enrichment of the landscape and the recreational value due to their strong attraction for "eco-tourism".

The main threats to these habitats are represented by the drainage (in the past or ongoing) of soils for redevelopment to grasslands or agricultural land and destruction due to fuel extraction activities. These involve a severe loss of specialized biodiversity, the irreversible loss of spaces and relative ecological balances and a massive re-emission into the atmosphere of the large quantities of greenhouse gases accumulated over the years.

Currently, there is no comprehensive spatial mapping of Alpine peatlands and monitoring data are absent or lacking both qualitatively and quantitatively. In addition, there are differences between soil legislation and national objectives of conservation strategies in Member States. A common implementation of the various international and EU indications or laws of protection is difficult.

The indications of the Working Groups of the Convention in this regard are:

- To give greater prominence to individual initiatives and to support local administrations through transnational and cross-border coordination and cooperation.
- To support with a careful **spatial planning** the Strategies aimed at filling knowledge gaps and promoting the dissemination of information about peatlands at a transnational level.
- Promote the implementation of peatland mapping projects along the Alpine arc

For its part, the **Compliance Group** of the Alpine Convention reiterated in its XXXIV and XXXV sessions that the Protocol on **Soil Protection (Art. 9**) commits the Contracting Parties to conserve the soils of wetlands and peatlands. The Protocol states that:

- the use of peat should be stopped and that drainage actions should be limited to the maintenance of existing networks.
- Wetlands should not be used or, if necessary, must be managed to keep their ecological characteristics intact.
- Alpine countries should be invited to invest in the inventory of their peatlands and to use unambiguous terms of reference, to make a distinction between marsh/peatland/wetland habitats and organic soils in general.
- By the end of 2026, the framework of knowledge acquired at political level should be transferred, promoting the reception and implementation of the legislation drafted.

34 The European Red List of Habitats provides an assessment of the risk of collapse of marine, terrestrial and freshwater natural and semi-natural habitats based on a consistent set of criteria and categories and detailed data and expertise. The geographical coverage is the European Union and adjacent regions. The European Red List of Habitats project was funded by the European Commission (https://www.iucnredlist.org/regions/european-red-list).

Some examples of ongoing activities are, in Austria, the redevelopment, through water buffalo grazing, of old monocultural areas with wetlands and the creation of "artificial" barriers aimed at stagnating water and the formation of new peat.

Mountain forests

Forests cover about **40% of the Alpine territory**. These play a fundamental role in climate regulation, carbon storage, prevention of natural risk and conservation of biodiversity, of which they are real ***hotspots***. They are home to extremely specific ecosystems and ecological niches (e.g. soil, insects, saproxylic communities...) favoured in their establishment by the close correlation between altitudinal gradient and degree of naturalness present in mountainous areas. The great intrinsic biological diversity gives healthy forests and neighbouring areas a certain **resilience** to disturbances, such as climate change and hydrogeological instability, ensuring a constant provision of **Ecosystem** Services

The Alpine Convention, as an international body, has been active in the field of sustainable management and protection of forest biodiversity since 1996, with the ratification of a Protocol on Forests. This, in a pioneering way, in addition to specifying the importance of the functionality of Alpine forests, already opened the door to the issues of climate balance and water resources. In addition, the Convention's Thematic Working Body (**TWB**), **Mountain Agriculture and Mountain Forests (MAMF),** works in this area to identify opportunities for Alpine areas in terms of agricultural/forestry production and encourage the spread of management approaches that promote the circular economy and ecological transition. The collaboration between this group with **ABB** makes it possible to integrate the concepts of environmental protection and restoration with the implementation of management measures that are as complete and relevant as possible to the **first priority of the MAP 2030**. Finally, the **European Strategy for the Alpine Macro-Region (EUSALP, 2015),** emphasizes economic development, innovation and energy and environmental sustainability, including multifunctionality of forests and wood management.

The growing attention of the EU to the economic potential of forests and their biodiversity, also as a result of the Convention's shrewd awareness-raising work regarding the Alpine arc, culminated on 8 April 2024 in Turin with the "**Workshop on Biodiversity-Friendly Forest Management in the Alpine Biogeographic Region**", which ABB and the Permanent Secretariat coordinated with the Piedmont Region and Milieu. This has made it possible to obtain an overview of the state of health/functionality of Alpine forests and what are the main national and general management systems. The main problems relating to this type of habitat were also identified, with possible risk factors, proceeding to provide ideas for possible guidelines aimed at reducing its impacts.

Currently, about 85% of European forests are destined for timber revenue, with a great increase in the trend towards **the privatization of the resource** (about 60%) and a progressive **decrease** of those areas recognized as primary forests (in which the vital functions and ecosystems exist in their original state) or old growth forests[35] which are the richest structures in naturalness and biodiversity. These two specificities have a particular value because they not only support the establishment of micro-ecosystems in each of their components but are also those capable (growing at a very slow rate) of storing more carbon. It should also be mentioned the great importance of the so-called **protection forests**, generally consisting of a single prevalent tree species, which are responsible for mitigating geological risk.

Overexploitation and **natural disturbance**, internal or induced, are the main pressures on these environments and determine a progressive biological impoverishment with limitation of their functionality. Some difficulties derive from the need to

[35] An old-growth forest is a primary or secondary forest that has reached an age at which species and structural attributes normally associated with senescent primary forests of the same type have sufficiently accumulated to make it distinct as an ecosystem from younger forests (UNEP/CBD/SBSTTA 2001).

standardize **the use of** specific terms (e.g. old, primary) and the great heterogeneity of **management policies** at the local/regional/national level of the Member States; others concern the process in the transition from intensive systems (**monocultures)** to models focused on conservation and sustainability rather than on quantitative production.

The growing interest in ecosystem services, especially in terms of water purification and climate mitigation, provided by woods and forests has led to an advancement of national and EU policies, as well as promoting communication and coordination between interested parties. There is currently consensus on trying to adopt more "close to nature" forest management approaches that aim to mimic natural processes within forests, maintaining their structural complexity and biodiversity. These are accompanied by mapping and protection campaigns for primary and old-growth forests, which strive to ensure that, once identified, these areas are considered **strictly protected** and managed in a **sustainable** way. In addition, it is recognized as essential to adopt policies that incentivize the payment of Ecosystem Services as a correspondence, including monetary, to the owners and administrators of the resource to manage their land in a way that should consider the opportunities that biodiversity can represent. Europe recognizes that it is a duty, in maintaining sylvan biological complexity, to integrate spatial planning concepts and consider measures for the maintenance and restoration of processes that are as natural as possible, focusing on what remains in the forest more than what is taken from it. Current challenges remain to be addressed, such as:

- the absence of common standard definitions for old growth forests
- mapping and monitoring of biodiversity
- the abandonment of forests in some states
- The prevalence of coppice forests
- management based on natural disturbances and maintaining a balance between the environment, economy and society.
- the importance of stakeholder involvement in the decision-making process
- Intensify preparatory actions for training and assistance to forest managers.

Dialogue and collaboration are priorities in the implementation of the European Forest Strategy 2030 in the Alpine region. Continuous collaboration between the European Commission, the Alpine Convention and the various stakeholders is encouraged to promote sustainable management policies in the Alpine biogeographical region, respecting the specificity of mountain biodiversity.

Mountain agriculture

The two-way relationship between biodiversity and agriculture was already mentioned in **the "Declaration on Mountain Agriculture"** drawn up by the Alpine Convention in 2011. In this, it is not only reiterated that the Alpine territory can all be assimilated to a biodiversity hotspot, but also mainly emphasizes the contribution that mountain agriculture makes, in the general interest, to the conservation and maintenance of the natural and cultural landscape.

In the XV Alpine CoP in Innsbruck 2019, the **Mountain Agriculture and Mountain Forestry (MAMF)** working group was also established, aligned with the three priorities of MAP 23-30: "Conserving and enhancing biodiversity and Alpine ecosystems", "Undertaking ambitious climate initiatives" and "Offering a good quality of life to people in the Alps". This has incorporated and continued the activities previously launched by the TWB Mountain Forests and the Mountain Agriculture Platform, first of all the Green Economy Action Programme (**GEAP).** Throughout its activity, the MAMF has closely collaborated and still collaborates with the Alpine Biodiversity Board:

- Supporting initiatives and projects that facilitate the flow of knowledge about the interrelationship between agriculture-biodiversity-tourism
- By enhancing, through the implementation of the GEAP, mountain biodiversity and alpine ecosystems
- Involving and raising awareness among stakeholders to maintain a good status of biodiversity in relation to agricultural production and livestock

This cooperation has resulted in important works that have contributed to bringing out the key role of biodiversity even in processes more directly linked to the productivity and economic performance of the territory. Organic farming and its benefits also for biodiversity have been the main thread of the ever-growing understanding between TWBs that are so complementary.

With the **2018 project "Adopt an organic valley",** submitted to the evaluation of the XV CoP, organic farming began to be evaluated as the most suitable production model in the Alps also in relation to its ability to involve, anchoring the presence of small companies and local producers to the territory, ecological processes (soil fertility, climate change mitigation through attention to riverbeds and river banks) functional to the maintenance and protection of biodiversity. In this context, the organic farming, regulated by **EU 2018/848** of the European Parliament states that "organic production is a comprehensive system of farm management and food production based on the interaction between best practices in the field of environment and climate action, a high level of biodiversity, the preservation of natural resources and the application of strict animal welfare criteria and high production standards that meet the preferences of a growing number of consumers for products made from natural substances and processes". Organic production is therefore understood as a tool with a dual social function: respond to growing consumer demand and, at the same time distribute biological goods that contribute to environmental protection, animal welfare and rural development.

The MAMF published in 2022 the "Organic farming in the Alps: a first analysis and some development scenarios"[36] **Report.** The aim of this work was to present useful data to describe the situation of organic farming in the Alpine territories included in the perimeter of the Convention, to facilitate the identification of actions, projects and policies useful for its promotion and expansion. The Alps, in fact, represent a territory rich in ecosystems and biodiversity but also increasingly

[36]https://www.alpconv.org/fileadmin/user_upload/Organisation/TWB/MAMF/MAMF_Report_task1_2_ORGANIC_AGRICULTURE_MAMF_2021-2022.pdf

characterized by great fragility due to ongoing climate change and more unfavorable socio-economic conditions. Biological diversity, inherent not only in habitats, but also in the traditional cultivation and breeding practices of our mountains, has proved to be a highly threatened value, which should be preserved with targeted actions preventing an irreversible loss. The biodiversity represented in plant cultivars and animal breeds characterizes traditional Alpine agriculture (Sturaro et al., 2013). It constitutes not only an important genetic pool but also represents the first step from which important value chains (fruit and vegetables, milk, meat, wood and their processed products) are developed, activating important collateral economies (districts), often based on ecotourism. Some externalities involving mountain agriculture, identified in the report as in relation to biodiversity, are:

1. the possible damage to farmers, consumers and the environment (mainly entomofauna) due to the **use of pesticides** (World Health Organization, 1990; Hayes et al., 2006)
2. **impoverishment of ecosystem biodiversity due to the abandonment of traditional practices, the use of pesticides and the use of non-native varieties/breeds due to their higher productivity.**

Organic farming excludes the use of genetically modified organisms and discourages intensive farming. On the contrary, it requires considering the specific behavioural needs of animals in terms of space and movement, thus promoting a high standard of welfare. The advantages offered by this production method are dedicated to consumers, to producers and the environment. Organic farming improves the maintenance of biodiversity and water quality, the enhancement of soil fertility, the preservation of local ecological balances, the responsible use of energy and natural resources. Therefore, among the main recommendations is the need to involve different stakeholders (universities, local authorities, research centers) to highlight the new role that Alpine farms can play in safeguarding biodiversity. An example is provided in the selection and domestication of ecotypes of spontaneous plants, used at the traditional level, whose indiscriminate collection in the past has put natural populations and habitats at risk.

The 2022 report "Value chains in Alpine regions and selected sectors of agriculture and forestry" (https://rb.gy/wlhbht) **is dedicated to the importance that new or newfound value chains can assume for both the economic and ecological spheres in the Alpine arc.** Some positive effects caused by the presence of value chains in Alpine areas concern the environmental ecosystem functions related to the agricultural and forestry sectors. Through the presence of farmers, breeders, foresters on the land, value chains indirectly allow for the correct management of landscapes, biodiversity (plants, birds, insects, small reptiles) and ecological balances. Traditional agricultural practices in the mountains are based on low-input processes and the continuous recycling of by-products (manure, stubble, crop residues, dry leaves); extensive agriculture and pastoral practices are common and widespread. In addition, in the Alps, especially where strong value chains are established, forest resources are traditionally managed sustainably, providing material for construction, agriculture and bedding (e.g. fences, stables, shelters) or biomass for heating. Hence the need and the indication to recognize and enhance the services guaranteed by the operation of the chains themselves. As the report describes, value chains in mountain areas ensure the maintenance of environmental heritage. In this regard, ecosystem services such as landscape and biodiversity protection and climate change mitigation should be included in the correct assessment of the price paid to mountain products.

More recently, the WS in March 2024 ""Circular economy and smart technologies for Mountain agriculture and forestry: an overview of the current trend in the Alpine countries" and the one in June 2024 ""Circular economy and smart technologies for Mountain agriculture and forestry: an overview of the current trend in the Alpine countries". The aim of the first was to understand to what extent and with which strategies it is possible to increase the implementation of virtuous economic choices and smart technologies to reduce the impact (also on biodiversity) and increase the production of agricultural and forestry

activities. Among the most interesting outputs, relating to intelligent technologies applied to crops, is the estimated reduction in the use of chemical inputs and environmental impact. In the June session, on the other hand, more attention was paid to the ecological value of mountain forests and the role of forestry in their eco-sustainable management, with practices that support health, longevity and biodiversity, maximizing economic and ecological benefits, also for future generations.

Climate change

In the Alpine Convention perimeter, temperatures are rising twice as fast as in the rest of the northern hemisphere. The rise in temperatures of almost +2 °C since the end of the nineteenth century has already had a significant impact on the Alpine environment: reduction in the habitat of endemic animal and plant species, changes in the availability of water resources, stressed forests as well as an increase in the risk and unpredictability of natural hazards with repercussions on almost all human activities. For years, starting with the 2006 **Declaration on Climate Change**, the Convention has been addressing the issue of mitigation and adaptation to climate change in a modern and integrated way.

In order to better direct and group climate actions in the Alpine framework, the establishment of an **Alpine** Climate Board (ACB) was also decided in 2016. The Board supports the creation of a strong Alpine community that takes charge of the implementation paths through a series of exchange, promotion and monitoring activities. His work focuses on promoting networks and cooperation between specific sectors, to create and strengthen synergies and propose solutions to potential conflicts. It also promotes exchange and cooperation on climate change challenges between the Contracting Parties, the Observers, all the relevant Thematic Working Body and international organisations, other mountain regions and other potential partners. Even though the climate, with its variations, is an extremely cross-sectoral issue, only recently the climate-biodiversity link begun to be formalized both within the Alpine Convention and by the main global tables.

Starting with the aforementioned Climate Declaration, which focused more on the dynamics of prevention and adaptation to CC, a 2050 Climate Goal System was also drawn up in the two-year period 2019-2020 and was adopted by the XV Alpine Conference within the framework of the Innsbruck Declaration "Climate Neutral and Resilient Alps 2050". In the next CoP, the XVI, the **Climate Action Plan (CAP) 2.0**[37] was presented. The focus is on the **pathways**, (short- and medium-term measures in ten different areas of activity) which have been identified in close cooperation with the other thematic working bodies of the Alpine Convention and other experts.

The Alpine territory should remain liveable for the species that populate it through the protection and proper management of the specific Alpine ecosystems. In addition, to ensure a constant exchange of genetic material, ecological connectivity and the efficiency of green and blue infrastructures should be strengthened. The ACB recognises the high value of ecosystem services and the ecological and cultural importance of Alpine landscapes. In this sense, the ACB has also made use of the close collaboration with the ABB in drafting the two pathways **"Protection and management of vulnerable and specific Alpine landscapes and ecosystems"** and **"Cross-border collaboration on ecological connectivity".**

In the first case, it is assumed that the diversity of habitats and species in the Alps is the result of climatic and geological conditions at the micro-scale of the altitudinal gradient. The Alpine area, therefore, offers a wide range of specific landscapes of great importance for species that are often threatened or vulnerable. These are subject to different types of impacts and require specific actions for restoration. This implementation pathway is regulated by pre-existing European legislations as well as by the UNESCO Man and Biosphere Programme. At the same time, it considers the Sustainable Development Goals of the 2030 Agenda, the Alpine Convention Protocol on Nature Protection (ratified by Contracting Parties of the Alpine Convention (CH, FR, IT, SI)).

37 https://www.alpconv.org/fileadmin/user_upload/Organisation/TWB/ACB/AlpineConvention_ClimateActionPlan2.0_EN.pdf

A three-step implementation is assumed:

1) Collection, cataloguing, analysis and revision of data on ecosystems, landscapes and services in the Alpine arc

1b) Overview and data collection relating to reserves and natural areas, with a focus also on invasive species identified and reported in the Alpine macro-region

2) Collection of management and conservation recommendations for specific Alpine habitats
3) Monitoring (2023-2027) on the implementation of regulations in the Alpine arc

The desirable results, in relation to climate change, should take the form of an exhaustive cataloguing of specific Alpine ecosystems and natural areas; the monitoring and awareness of the distribution status of invasive species; the formulation of new and general recommendations to plan (also spatially) the protection, restoration and management of ecosystems through Nature Based approaches; recommendations for the management of *neobiota (invasive and alloctones species)*.

As far as the "**Enhance transboundary cooperation on ecological connectivity" pathway** is concerned, it is taken into account that while the environment has no borders, spatial planning can and must set itself. This implementation process is already an active topic, on which a great effort has already been made to improve collaboration between the Contracting Parties. With a view to climate change, the urgency of proper management of the areas (protected or neighbouring) already identified and those to be identified to include species, ecosystems and ecological processes that would otherwise be isolated and fragmented is maximum. The pathway traces possible steps to be followed with the help of biodiversity experts and spatial planning:

- Definition and cataloguing of protected areas and cross-border buffer zones
- Definition of a network of stakeholders who should find ways to better include aspects of adaptation and mitigation in management policies
- Recommendations in creation of tools for the Spatial Planning that better integrate ecological connectivity, starting from a solid knowledge base related to the influence of climate change on it

It follows that connectivity between, and outside protected areas needs to be maintained and further developed, in order to increase the resilience of ecosystems and enable favourable conditions for alpine species, habitats, ecological processes and process protection.

Based on these indications, exchanges between Working Bodies have progressively intensified and in October 2023 the **workshop "Alpine Biodiversity through Climate Lens"** focused on the first two key objectives of the MAP and the greater inclusion of NbS in national and EU strategies through guidelines. On the agenda was an analysis on Climate Change in the National Biodiversity Strategies (NBSAP's). There were mainly two cases:

- The use of climate change and adaptation to it as a justification for the identification of objectives and measures (e.g. Monaco)
- NbS treated as an independent field of action or in any case of implementation of climate policies (e.g. Germany).

An in-depth analysis was then carried out on the main EU policies or indications that emerged on joint climate-biodiversity issues. Biodiversity appears to be one of the areas most affected by climate change (MBW et al. 2019), to such an extent that COP26, the **Glasgow Climate Pact**, in 2021 stated that "climate crises and the biodiversity crisis are closely connected". Therefore, the critical role of protecting, conserving and restoring nature and ecosystems is recognized in order to benefit climate change mitigation and adaptation" and, in **paragraph 21**, emphasized "the importance of protecting certain key

ecosystems (e.g. forests) to achieve the long-term objectives of the Convention, ensuring that they retain their role as sequesters and sinks of greenhouse gases, protecting biodiversity.

The **G20 Italy 2021** had also identified, in its Target 8, the urgency of reducing the impacts of climate change on biodiversity. It also recommended increasing resilience with mitigation actions or encouraging adaptation and reducing natural risk by integrating the use of NbS and EbS to maximize positive impacts and minimize negative ones.

At the end of the workshop, a plenary discussion was held taking up the pathways of CAP 2.0. The question was asked about what types of climate-related data could be included in the monitoring and mapping of biodiversity. Some of the proposed ideas: Precipitation index; Temperature on the ground or in bodies of water; Temperature range and adaptation data derived from fire brigade surveys.

Renewable Energies

The publication "Sectoral Energy Governance - How cross-sectoral and integrated governance approaches can accelerate the transition towards climate-neutral and climate-resilient Alps", published by the ACB and delivered on 3 September 2024, assesses the influences that new energy policies have or could have on the transition to climate-neutral environments (MAP ob.2) and, albeit marginally, on the implications that these could have on biodiversity. To assess the roll-out on renewable energy in November 2022, the EU adopted an "emergency regulation". This introduced the concept of "over riding public interest" which some interpreted as the possibility that renewable energy projects would be prioritized over all other environmental projects such as biodiversity or landscape.

From these considerations came the need to think about biodiversity also in conjunction with a previously little-considered issue, such as the energy transition. To facilitate this process, the topic has begun to be dealt with in restricted realities but precisely for this reason extremely important to protect such as Protected Areas. Some preliminary guidelines were the adoption of sustainable solutions and the greater upstream involvement of stakeholders with a view to planning focused not only on economic benefits, but also on the conservation of natural heritage. Good governance is once again necessary to reconcile a fast transition to Renewable Energy without compromising the achievement of other important EU and Alpine objectives, such as the conservation of biological diversity and the protection of protected areas (ALPARC 2023, Renewable Energies in Alpine Protected Areas)[38].

38 230908 RE Report VD.pdf

Water

Water is a fundamental resource for life, of man and ecosystems, but at the same time its accessibility is constantly decreasing. The recent G7 Climate, Energy and Environment[39] in Turin in April 2024 and the workshop "Who Needs Water" presented in its schedule on April addressed the significance of the topic also specifically for the Alps. Their main conclusions:

- Finding the balance between environmental and anthropogenic needs, reiterating that only accurate water management guarantees the protection of production chains and biodiversity
- Recognize that the areas in which aquatic ecosystems of naturalistic value fall constitute a common good of the community. They must be removed from uses that compromise their integrity or conservation, in order to maintain their value, as a common and shared good.
- Excessive water consumption and pollution are the main causes of biodiversity loss and ecosystem degradation. They alter their resilience and affect the quantity and quality of ecosystem services provided
- Optimize the use of available financial resources by combining, whenever possible, measures for ecological purposes with those aimed at reducing hydraulic risk.
- Increasing the efficiency and effectiveness of Nature Based Solutions

The Alps have always been considered rich in water and this has historically been used for irrigation, energy production or the maintenance and provision of ecosystem services. In addition, the large number of rivers, basins and wetlands contributes to making mountain areas Alpine hotspots of a specific biodiversity and in some cases ephemeral. The mountain is the environment where changes due to climate change are recorded in greater numbers and occur at the greatest speed. It is estimated that the net loss of glaciers, permafrost and the impoverishment of regimes due to extreme drought events will continue to alter runoff regimes, triggering a chain of droughts and causing floods, landslides and other potential damage attributable to hydrogeological instability. The lack of water and the consequent desertification destroy entire territories, erode the soil and increase the risk of fires. To ensure constant updating on these dynamics, the EU project ADO[40] (Alpine Drought Observatory) has launched a drought monitoring and forecasting platform, which can be used for better policy implementation and to create coordinated governance tools for a more efficient use of water resources.

Water is also affected by the increase in temperature at a chemical level. The reduction in the amount of dissolved oxygen impairs the self-purification capacity of fresh water. The anomalous increase in regimes that occurs during floods also amplifies the effects of pollution and puts into circulation an increasing amount of pathogenic, toxic or eutrophicating agents. Water scarcity and pollution are the main causes of biodiversity loss and ecosystem degradation, which in turn reduce environmental resilience, causing society to become more vulnerable to climate and non-climate risks. An interesting in-depth study on the hydrobiology and biodiversity of freshwater streams in the Alps, focused on the monitoring of the latter and the identification of the areas where climate change and contaminants have the greatest influence on the survival of species, is constituted by the recent (2018-2021) project Eco-AlpsWater - Innovative Ecological Assessment and Water Management Strategy for the Protection of Ecosystem Services in Alpine Lakes and Rivers, led by the E. Mach Foundation of Trento (https://www.alpine-space.eu/project/eco-alpswater/). The project aimed to analyse environmental DNA (eDNA) in water bodies, using Next Generation Sequencing (NGS) technology, which enables rapid and low-cost identification of aquatic organisms, from bacteria

[39] https://rb.gy/aosd79
[40] https://ado.eurac.edu/

to fish. These results integrate traditional freshwater monitoring approaches in the Alpine region and at European level (Water Framework Directive-WFD and, in Switzerland, Water Protection Ordinance-WPO) with advanced and innovative technologies, providing a solid basis to support water management plans. One of the main objectives was to identify and overcome gaps in the classical monitoring approach in all Alpine regions, which include over fifty large Alpine lakes, smaller water bodies and key rivers. The main results were the presentation of tools and related guides for the use of innovative metagenomic tools and bioinformatics technologies capable of monitoring the ecological status of waters and the related biodiversity. The data obtained made it possible to identify areas where the presence of toxic cyanobacteria, pathogenic bacteria and invasive organisms constitutes a serious risk.

The main solutions proposed at the internal level consist in the activation of "Nature Based Solutions" to allow better adaptation to climate change, improve the efficiency, effectiveness and robustness of water management infrastructures and contribute to climate change mitigation. With the Declaration of the XVI Alpine Conference on Integrated and Sustainable Water Management in the Alps[41] in 2020, the Alpine Convention has combined the issue of water management with that of biodiversity. "Referring to the Alpine Climate Goals 2050 on water, in particular the implementation pathways on water, natural hazards, ecosystems and biodiversity" and, in point (7) of the declaration itself, to the Sustainable Development Goals (SDG 6), the European Green Deal and the EU's biodiversity strategy for 2030, the Contracting Parties committed to:

- Ensure that watercourses function as naturally as possible, conducive to the conservation of water resources, biodiversity and related ecosystem services, including at a cross-border level
- Promote climate change adaptation in Alpine water basins, possibly prioritising the use of green and blue infrastructure

Glaciers and Permafrost

Glaciers, as well as post-glacial ecosystems, play a fundamental role in adapting and mitigating to climate change, connecting to the dynamics of the water cycle, regulating and containing excessive sea level rise and thus directly or indirectly buffering biodiversity loss. In the same way**, permafrost** (a lithospheric material that remains at or below 0°C for more than two consecutive years), in addition to storing water, plays an invisible but key role in biodiversity. It promotes the growth of plant substrate; it generates circumscribed lake ecosystems and constitutes a reservoir of ancient and extremely adapted microbiomes (viruses, bacteria). The approach to these two extremely specific systems requires the achievement of an interdisciplinary knowledge upstream of an efficient monitoring and *data collection* scheme that can keep track of both existing glaciers and permafrost, and the development and emergence of new post-glacial ecosystems.

To this end, the Alpine Space project "PermaNET" was launched in 2010-2012[42] to develop a common strategy to address the topic of permafrost/Alpine ice and the related natural hazards under changing climatic conditions. The project aimed to apply good governance practices based on a common knowledge gain, a jointly developed database and a commonly accepted strategy. The main results of PermaNET were:

1. The creation of a network for monitoring the permafrost of the Alpine Space through the collection and schematizations of data collected in the field.

[41] https://www.alpconv.org/fileadmin/user_upload/Organisation/AC/XVI/ACXVI_WaterDeclaration_en.pdf
[42] https://www.permanet-alpinespace.eu/partners.html

2. The study of the distribution of permafrost in the Alps to provide a map of the distribution of permafrost in the Alps. The map consisted of two combined datasets, the permafrost evidence inventory and a modeled map of the permafrost distribution.
3. Assessing different methods for detecting and monitoring permafrost-related slope movements and making recommendations for risk management in areas affected by current permafrost degradation.
4. Expanding knowledge about the impact of climate change on Alpine permafrost and how increased permafrost ice melt alters runoff patterns and water quality from Alpine springs is still scarce.

On **October 4, 2023**, the **Alpine Climate Board** presented updates on the monitoring of permafrost and natural hazards related to its degradation during the online webinar **"Permafrost thawing in the Alps"**. From both PermaNET and the webinar, however, scarce or no mention of biodiversity issues arose.

More conspicuous data are available, however, on the relationship between the status of glaciers and bio/geo-diversity. The melting of solid water masses, in fact, can greatly modify the landscape and consequently the quantity and diversity of species capable of populating it (e.g. colonization of new plant species, microorganisms and phytoplankton in postglacial lakes or pools of water). New post-glacial ecosystems could constitute a refuge for species dispersed due to climate change and so worth of protection. For this reason, in their study and conservation, it is necessary to ensure the presence of adaptive ecological corridors, which consider, for example, factors such as the altitudinal gradient and the variation of temperatures in ensuring the transit of species.

Various activities and projects aimed at the conservation of Alpine ice are underway nationwide in all its states[43]. From this work, a **Roadmap** was derived to prevent conflicts of interest between States and stakeholders and a "Toolkit **for protection**" which in its pillars mentions the need to protect glacial systems from excessive exposure to light and the duty to leave nature in the wild, influencing it to a minimum. The growing interest and attention to water and its reservoirs, as well as to the biodiversity related to it, have favored the establishment by the United Nations in **2025 of the International Year for the Conservation of Glaciers**[44]. Along these lines, France has also announced that by 2030 it will declare all its glaciers as strictly protected.

At present, the issue of glacier conservation has not been addressed in depth by the plenary of the Alpine Convention. The term "glacier" itself appears only in the preface of the Protocol on the Conservation of Nature, cited as a habitat of significant importance. During the III Annual Meeting held in Gorizia on 30 January, the ABB and its members showed a strong focus on this theme that involves many transversal aspects of biodiversity. In anticipation of 2025, therefore, work is underway for the organization, sponsored by the French Directorate and the Italian Ministry of the Environment and Energy Security (MASE), as incoming presidency in the two-year period 2025-2026, of a joint **workshop.** That will emphasize this issue and collect the current state of knowledge and future research on the subject. It will be accompanied by constant support, for aspects related to biodiversity, of the *ad hoc WG* for the drafting of the **11th RSA**, which will focus on the conservation of ice and permafrost in the Alpine environment.

[43] For example, in France there are currently 17 active projects to develop a proactive in situ protection system while in Italy for 4 years the Glaciological Committee, Legambiente and CIPRA have been producing annual reports on the condition of glaciers

[44] 77th session of the United Nations General Assembly, 21 March 2024

Quality of life

Biodiversity can contribute to improving the quality of life, to the point that it can be considered one of the factors underlying life and work. This can be seen both considering the role it plays primarily in food production and the close link with the quality of the landscape. These two aspects contribute to human well-being both physically and psychologically/culturally. In addition, biodiversity is able to influence and shape the environment, increasing its resilience to climate change, internal and external stresses, increasing its carrying capacity and consequently raising the value of the ecosystem services offered. In fact, tourism is mainly concentrated in those areas, protected or not, that offer the greatest number of species and habitats of the best quality, making the conservation and restoration of these realities a priority also from an economic point of view. However, the increase in use also corresponds proportionality to an increase in pressures on the environment that apply mainly to soil and water. Both elements are equally important for the primary needs of nature and man himself.

In accordance with Goals 2,3,4 identified in its 2023-2024 mandate[45], the Alpine Biodiversity Board organized **a joint workshop** with the ad hoc group *for the* 10th RSA entitled [46]"Biodiversity & Quality of Life" on **27 September 2023** in Bolzano with the aim of deepening concepts useful for cross-fertilization between the two thematic areas and exploiting the synergies deriving from the mutual work.

Based on the conclusions of the latter, it was possible to consider the role of biodiversity in relation to QoL articulated on three different levels:

- **Environmental** with the implications for ecosystem services across all major MEA categories[47] of support, procurement, regulation and culture
- **Socio-economic,** focusing on the production chains of food and raw materials or focusing on the advantages that measures for biodiversity such as infrastructures can also represent for humans
- **Cultural** with the consideration that only a conscious society recognizes the advantages that a healthy, diverse and accessible landscape provides to mental health while the loss of biodiversity undermines its delicate balance.

A potential measure of rapid execution and great impact has been identified, preliminarily, in enhancing accessibility to green spaces. In fact, despite considering green spaces in urban areas to be subjected to greater pressures than their rural counterparts, the link between QoL and Biodiversity is consistent in equal measure in the perception of the inhabitants/visitors of both contexts. Since the role of biodiversity in conferring resilience to the environment and mitigating the effects of *climate change* is well known, these considerations have led to the desire to propose and develop specific protection, restoration and conservation plans for both these realities.

Quantitative and comparative evaluations were considered of interest to stakeholders, which could highlight the differences between environments with rich biodiversity and intensive monocultures, providing **clear data** on water consumption and productivity. This also underlines the **economic efficiency** that, in the long term, biodiversity can guarantee. Involving local

[45] https://rb.gy/9m0e2l

[46] The 10th State of the Alps Report "Quality of Life" will illustrate the status quo of quality of life in the Alps using quantitative and qualitative indicators that can contribute to the implementation of the Multiannual Work Programme. It will also provide recommendations for future activities and policies in this area.

[47] The **Millennium Ecosystem Assessment** (MEA) is an international research project developed with the aim of identifying the state of global ecosystems, assessing the consequences of changes in ecosystems on human well-being and providing a valid scientific basis for the formulation of actions necessary for the conservation and sustainable use of ecosystems. [https://www.millenniumassessment.org/en/Global.html]

communities or environmental associations (e.g. fundraising) in Citizen Science work has been judged functional to research and understanding of how biodiversity is perceived.

Finally, at the governance level, initiatives such as the UNESCO Biosphere Reserves[48] contribute to increasing cross-border collaboration, accentuating the cultural dimension and involving local communities to strive to harmonize human development and biodiversity conservation. Therefore, the qualitative or quantitative assessment of ecosystem services should be a first step in achieving a useful base of arguments to promote biodiversity conservation as a key factor for maintaining or improving the quality of life.

The final objective hoped for in the workshop was the prospect of an experiment aimed at reliably measuring the levels at which biodiversity is linked to the quality of life, influencing it; by selecting valid indicators (e.g. distance from green areas/infrastructures) to address problems related to the human-environment union. In this way, it will become possible to implement transversal biodiversity conservation measures that are also useful for those who, daily, use or live from the services that derive from them.

48 Biosphere reserves are areas of terrestrial, coastal and marine ez cosystems where, through appropriate land management, the conservation of the ecosystem and its biodiversity is combined with the sustainable use of natural resources for the benefit of local communities: this includes research, monitoring, education and training activities (http://www.unesco.org/mab/)