LONG-TERM ACTION PLAN

For the implementation of provisions and declarations on soil protection in the specific context of the Alpine region

Soil Protection Working Group of the Alpine Convention

Mandate 2021-2022

ALPENKONVENTION
CONVENTION ALPINE
ALPSKA KONVENCIJA
CONVENZIONE DELLE ALPI

IMPRINT

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Permanent Secretariat of the Alpine Convention, June 2022

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ABBREVIATIONS

AG – Action Group

AlpSP – Alpine Soil Partnership

BORIS – Bodeninformationssystem (Austrian digital soil information system)

DOMODIS – Documentation of Mountain Disasters

EAP – European Action Program

EFFI – European Forest Fire Information System

ESP – European Soil Partnership

EU – European Union

EUROSTAT – European Statistical Office

EUSALP – EU Strategy for the Alpine Region

EUSDAC – European Union Soil Data Centre

EUSO – European Union Soil Observatory

FAO – Food and Agriculture Organization of the United Nations

GHG – Greenhouse Gases

GIS – Geographical Information System

GSP – Global Soil Partnership

IP – Implementation Pathways of the Climate Action Plan 2.0 (reference to the pathways are given in this shape: IP_topic+pathway number_implementation step; topics are e.g. S = Soil, SP = Spatial Planning)

IPCC – Intergovernmental Panel on Climate Change

ITPS – Intergovernmental Technical Panel on Soils

IUCN – International Union for Conservation of Nature

JRC – Joint Research Centre of the European Commission

LUCAS - Land Use and Coverage Area frame Survey

NBS – Nature-Based Solutions

NGOs – Non-Governmental Organisations

PLANALP – Natural Hazards Working Group of the Alpine Convention

SDG – Sustainable Development Goal

S-DSS – Smart Decision Support System

UN – United Nations

UNCCD – United Nations Convention to Combat Desertification

VGSSM – Voluntary Guidelines on Sustainable Soil Management

WG – Working Group

WRB – World Reference Base for Soil Resources

WSD – World Soil Day

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1. INTRODUCTION

Soil as a valuable resource

As the living interface between vegetation cover and geological subsurface, soil forms the skin of our planet. The solid rock envelope, the biosphere, the atmosphere, and the hydrosphere overlap in soils. Compared to the skin of the human body, this soil layer is many times thinner and extremely vulnerable.

Soil is a limited resource and not renewable within the timespan of a few human generations. Soil provides numerous ecosystem services which are essential for human life and it forms the basis for a wide range of human activities. Despite its enormous importance for plant, animal, and human life, soil is a medium which has received far too little attention; for example, the immense abundance of soil life is still largely unexplored. A handful of vital soil contains more living organisms than there are humans living on earth.

Soil in mountain regions

The conservation of soils is therefore of utmost importance! This is especially true for mountainous regions such as the Alpine area, where soils are much more vulnerable and endangered due to the region's steep reliefs, shallow soils, and longer formation times. Another challenge for soil in Alpine areas is climate change, which is progressing more rapidly in mountainous areas and is much more noticeable than in other regions.

Soil is gaining more attention

Soil as an important resource is not noticed as much as air or water since it is mostly not visible. However, this limited perception of soil has changed in recent years. The International Year of Soil 2015, proclaimed by the FAO, was an occasion for many decision-makers, land users, interest groups, and indeed the entire population to take a closer look at soil issues. This increasing awareness is also reflected in various activities on soil protection at national, European, and international level. Multiple activities on soil protection have been taking place within the Alpine Convention since 2015, including the launch of the Soil Protection Working Group in 2019. The European Commission is also currently launching numerous initiatives on soil, which will result in voluntary and legally binding instruments.

The long-term action plan as a suitable instrument

Since results in the field of soil protection need perseverance and continuous efforts, long-term strategies for relevant cooperation partners are necessary. Successful first steps are important and long-term approaches are required for core aspects of soil protection. A structured approach is needed for the comprehensive and, above all, sustainable integration of soil protection into all affected thematic areas.

Thus, this long-term action plan for the implementation of provisions and declarations on soil protection in the specific context of the Alpine region was developed within the 2021-2022 mandate of the Soil Protection Working Group. It also considers the interaction of qualitative and quantitative aspects of soil protection and the effects of climate change.

A living document

This long-term action plan is designed as a living document to ensure that recent developments can be considered. Therefore, updating the action plan is envisaged after approximately every Alpine Convention mandate period.

The long-term action plan is based on:

- The Soil Conservation Protocol of the Alpine Convention
- The "Declaration Sustainable Land Use and Soil Protection – Joining Forces for Nature, People and the Economy" of EUSALP Action Group 6
- The implementation pathways on soil and related to soil of the Climate Action Plan 2.0 of the Alpine Convention
- The UN Sustainable Development Goals

and considers (non-exhaustive list):

- The European Green Deal including especially the EU Soil Strategy
- The EU Mission "A Soil Deal for Europe"

Added values at a glance:

- Continuity for the topic of soil protection (soil protection goals can seldomly be reached within two-year mandate periods)
- Longer term orientation for working groups as well as for projects and funding
- Triggering actions and synergies for future developments in the horizontal issue of soil protection in the Alpine Convention context
- Providing an overview of the respective focus topics (which measures, networks, legal regulations, guidelines, specifications, and associated objectives already exist)

Focus on actions and stakeholders

The plan focuses on actions which should be taken in the Alpine area. Each content chapter provides some background information, highlighting the significance of the issue in the Alpine region (and in Europe) and displaying the initial situation including legal frameworks, other provisions, targets, and starting points for action and relevant actors. The core of every content chapter is the envisaged actions, which are structured as short-term (until 2024), mid-term (until 2030), and long-term (until 2050) measures.

The long-term action plan was developed for all actors whose activities have an impact on soil in the Alps with the focus on stakeholders such as from the Alpine Convention bodies and partners, chambers (e.g. chamber of agriculture, chamber of economy, spatial planners etc.), municipality networks, regional networks etc.

Thus, everyone is invited and needed to adequately implement this action plan!

2. ECONOMICAL AND PRUDENT USE OF SOIL

Chapter authors: Thomas Peham (Government of Tyrol), Andrea Spanischberger (Austrian Federal Ministry for Agriculture and Forestry, Regions and Water Management), Christian Steiner (Lower Austria, Authority of Land Reform, Department for Rural Development).

2.1 Background

Soils are a major and non-renewable resource, and their protection requires a common framework for preserving soil quality and soil quantity. This even applies for reaching already set targets like “No net land take by 2050” (European Commission, 2011) and meeting ecological, economic, and social needs.

Significance of the issue in the Alpine region

The Alpine region reveals a heterogeneous dispersal of usages with urban agglomeration in the main valleys and depopulation in distant areas. The limited area for potential permanent settlement increases the competition for the different usages like settlement, transport and tourist infrastructure, agricultural production, environmental protection or measures for climate change adaptation.

Initial situation, including targets

- Soil Conservation Protocol Article 7(2), Spatial Planning and Sustainable Development Protocol Article 9(3), Climate Action Plan 2.0 (IPs, e.g., S2, S3, SP1), Compliance Committee report on Economical and prudent use of soil in the Alps (Permanent Secretariat of the Alpine Convention 2020), EUSALP AG6 “Declaration Sustainable Land Use and Soil Protection – Joining Forces for Nature, People and the Economy”.
- EU target “No net land take by 2050” and differing national targets.
- European Green Deal with special focus on EU Soil Strategy.
- Sustainable Development Goals, SDG 15.3. target “Land Degradation Neutrality”.

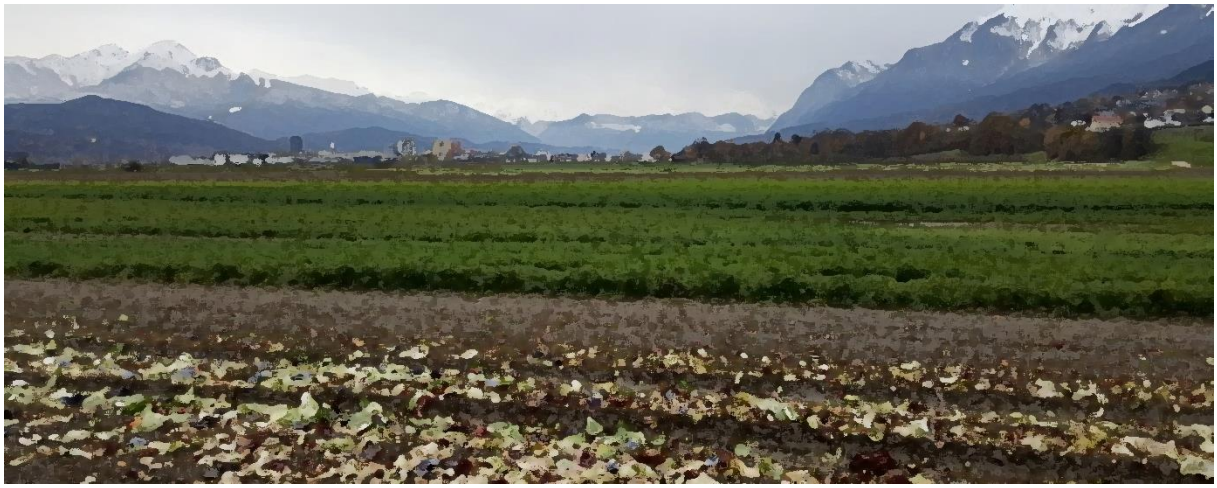
Starting points

- Working Group on Spatial Planning and Sustainable Development of the Alpine Convention.
- AlpPlanNetwork.
- Projects: OpenSpaceAlps (concluding June 2022) and Act4Soils (in application).
- EUSALP AG6: Study on preservation and valorisation of the diversity of Alpine natural and cultural landscapes in times of climate crisis.

2.2 Actions

Short-term actions (until 2024)	**Outputs/Indicators**
Link and improve soil management strategies and agricultural practices (IP_S3_3, e.g., management recommendations specific for the Alps with a special focus on wetland and peatland; recommendations should include agricultural practices to build up and maintain humus).	Develop and spread management recommendations for farmers (and other land users) specifically for the Alps
Provide statistical data on land consumption and No net land take (IP_SP1_1a).	Report on comparable data
Establish effective quantitative targets for soil/land use at local as well as at regional or supra-municipal level and to limit soil sealing and soil/land consumption also by prioritising uses according to qualitative aspects ("soil functions") (CC_2_c2_2, BMLFUW (2015): AT_3.5).	Quantitative targets are publicly available (e.g., report, GIS-system)
Define guidelines for land-use plans at the municipal level (IP_S2_3).	Guidelines are publicly available
Medium-term actions (until 2030)	**Outputs/Indicators**
Support the development and implementation of strategies to meet Net-0 by 2050.	Engagement in respective working groups
Develop Alpine-wide recommendations for an economic incentive system (IP_S2_2c), which should focus on No net land take and on land regeneration e.g., by subsidies for unsealing of land.	Recommendations are publicly available
Mapping soil functions in relation to potential uses (e.g., spatial planning) and ecosystem services (IP_S3_2).	Alpine-wide initiative to coordinate the implementation of maps concerning soil functions and ecosystem services in the respective national frameworks

Long-term actions (until 2050)	Outputs/Indicators
Support monitoring of the effects of climate change on Alpine soils.	Comparable monitoring network is established
Support of further Climate Action Plan implementation Steps.	Participation in respective working groups
Foster the implementation of a mandatory assessment of the impact on land take/soil sealing by existing laws and during creation of new laws (AT_3.1).	Impact report(s) Legislative adaptations



3. HIGHLIGHTING THE IMPORTANCE OF SOILS AND SOIL FERTILITY FOR CLIMATE MITIGATION AND ADAPTATION

Chapter authors: Petra Božič (Slovenian Ministry of Agriculture, Forestry and Food), Petra Karo Bešter (Slovenian Environmental Agency), Jože Ileršič (Slovenian Ministry of Agriculture, Forestry and Food).

3.1 Background

The world's soils are under threat in various aspects. The most frequently mentioned are soil organic matter reduction (loss), soil erosion, soil pollution, soil sealing, soil compaction, soil biodiversity loss, and soil salinisation. The importance of soil and soil fertility is becoming an increasingly relevant topic regarding different aspects, especially its role for climate mitigation and adaptation. Different organisations, NGOs, governments etc. are addressing the importance of soils and soil fertility particularly, more recently, in light of climate mitigation and adaptation.

Significance of the issue in the Alpine region

Alpine soils are highly vulnerable to climate change. The Climate Action Plan 2.0 of the Alpine Convention states in its soil chapter: "The preservation of Alpine soils is crucial for climate change mitigation, because only healthy soils can store humidity and carbon. The Alpine area includes many specifically carbon-rich soil types like peatland, moorland or wetland areas. Both quality and quantity of these soils need to be protected by reducing pressures originating from increasing demand for space for traffic, housing, economy and leisure and at the same time from agricultural and forestry practices which are a threat to soil preservation. Preservation of healthy soils is furthermore a precondition of many adaptation measures, e.g., in settlement areas to avoid heat island effects or to support flood management through retention areas."

Initial situation, including targets

The Soil Conservation Protocol of the Alpine Convention addresses this topic directly or indirectly in Article 3 in which the consideration of the objectives of the Protocol in other policies is addressed. Connecting various policies is important for soil protection as well as for climate change adaptation and mitigation because climate change affects all sectors – agriculture and forestry, energy, water management, and many others and thus demands an integrated approach. Furthermore, the Protocol addresses the conservation of soils in wetlands and moors in Article 9 and considers agriculture, pasture farming, and forestry in Article 12.

The Climate Action Plan 2.0 of the Alpine Convention also has a specific chapter for soil and calls for an Alpine-wide coordinated approach for solving soil related issues, highlighting in particular the value of carbon rich soils.

The EU Soil Strategy for 2030 that was released in November 2021 states that "targeted and continued sustainable soil management practices can significantly help in achieving climate neutrality by eliminating the anthropogenic emissions from organic soils and by increasing the carbon stocked in mineral soils." As for adaptation, it highlights the crucial role of soil in the water cycle: "A high water retention capacity in soils reduces the effects of floods and decreases the negative impact of droughts." The Strategy defines its vision: "By 2050, all EU soil ecosystems are in healthy condition and are thus more resilient, which will require very decisive changes in this decade." (European Commission, 2021a).

Starting points

Different institutions, networks, projects and working groups are dealing with soil related issues. Within the Alpine Convention, different Thematic Working Bodies are directly or indirectly addressing this issue, e.g., the WG Spatial Planning and Sustainable Development, PLANALP, the Alpine Climate Board, the WG Mountain Agriculture and Mountain Forestry. EUSALP Action Groups 6 and 7 are also working on soil related issues. At the level of the European Commission, different actions are underway such as preparation of a Soil Health Law that is being in elaboration with the help of the Soil Expert Group. The Joint Research Centre (JRC) is carrying out different projects, such as the Soil Data Centre or the newly established EU Soil Observatory.

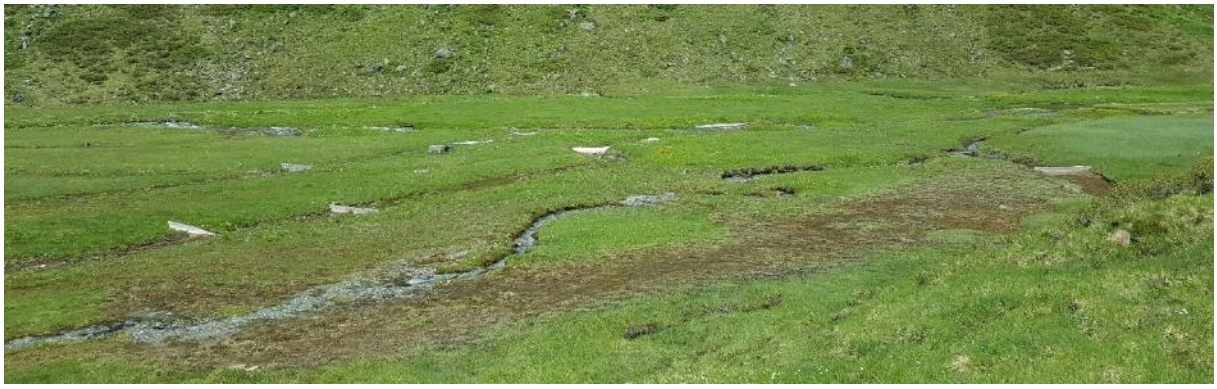
Other relevant publications that emphasise the importance of soils and soil fertility for climate mitigation and adaptation are:

- Climate Action Plan 2.0 of Alpine Convention,
- EU Soil Strategy for 2030 and
- the upcoming EU Soil Health Law.

3.2 Actions

Short-term actions (until 2024)	**Outputs/Indicators**
Promoting education and training as well as information for the public regarding the importance of soil and soil fertility for climate mitigation and adaptation (Soil Conservation Protocol, Article 22).	Workshops, trainings
Start an Alpine-wide awareness raising and communication campaign and focus on the message “Soil protection is climate protection and vice versa” (IP_SP1_2a).	Preparation or campaign started
Coaching of spatial planners and decision-makers through fostering communication about the importance of spatial planning as a tool for the protection of soil and soil fertility, and the necessity to consider data on soil and soil fertility and functions in spatial planning (IP_SP2_2b).	Workshops or trainings
Collecting information/examples about national, regional, and local activities which also support EU policies.	Reports or promotions which can also support relevant EU policies, strategies, and plans
Medium-term actions (until 2030)	**Outputs/Indicators**
Collecting the statistical data on soil and soil fertility in relation to climate mitigation and adaptation in the Alpine region and their review and comparison.	Soil dataset
Establishing a methodology and relevant targets and indicators of soil and soil fertility assessment in relation to climate mitigation and adaptation (EU Soil Strategy for 2030).	Report
Planning of further long-term measures for the protection, restoration, and enhancement of soil and soil fertility in the sense of climate-resilience, mitigation, and adaptation.	Report

Long-term actions (until 2050)	Outputs/Indicators
A hot-spot analysis of fertile soils and soils that have a high impact on climate mitigation and adaptation. This data collection on the quality of Alpine soils shall be updated regularly to become a monitoring system on Alpine soils (IP_S3_1).	Hot-spot analysis and dataset
Safeguarding, enhancing and preserving the functions and ecosystem services of soil, both qualitatively and quantitatively. The restoration of impaired soils shall be promoted (Soil Conservation Protocol, Art. 1 (2)).	Report
Establishing Alpine-wide initiatives to protect or rehabilitate soil and soil fertility in the sense of climate-resilience, mitigation, and adaptation (IP_S3).	Alpine-wide initiatives
Supporting relevant strategies, policies, and plans of the Contracting Parties of the Alpine Convention with examples at the respective national, regional, and local levels.	Technical support of relevant strategies, policies, and plans



4. CONSERVATION OF SOILS OF HIGH NATURAL VALUE, SUCH AS SOILS WITH HIGH ORGANIC CONTENT, WETLANDS, AND MOORS

Chapter authors: Frank Glante (German Environmental Agency), Bernd Schilling (Bavarian State Agency for the Environment), Jochen Daschner (Bavarian State Ministry for the Environment and Consumer Protection).

4.1 Background

Moors, wetlands, and soils with a high organic content store more carbon than any other ecosystem on earth. This means that the protection of these soils is especially relevant for climate protection because they are true all-rounders. They are excellent water reservoirs and can delay runoff during flooding events; they are home to a great diversity of species and are habitats for endangered animals and plants.

Significance of the issue in the Alpine region

In the past, cultivation with resulting drainage of wetlands and moors in the Alpine region to produce food and feed was socially desired. However, drained wetlands and moors currently contribute significantly to greenhouse gas emissions in the Alpine region. When draining moors and wetlands, carbon dioxide (CO_2) is released. A particularly high release of greenhouse gases (GHG) is to be expected, especially from peatland used for agricultural purposes. This is accompanied by the release of nutrients, the reduction in water retention in the area, and the susceptibility of the soil to (wind) erosion. With the increasing importance of combating climate change, climate protection by protecting and restoring moors and wetlands, with the accompanying reduction of greenhouse gas emissions, is becoming ever more urgent.

Initial situation, including targets

The guiding principle for the conservation of wetlands and moors in the perimeter of the Alpine Convention is laid down in Article 9 of the Soil Conservation Protocol of the Alpine Convention:

(1) The Contracting Parties undertake to preserve high moors and lowland moors. To achieve this objective, the use of peat shall be discontinued completely in the medium term.

(2) Drainage schemes in wetlands and moors shall be limited to the upkeep of existing networks unless there are sound reasons for exceptions. Remedial measures shall be promoted to minimise the environmental impact of existing drainage systems.

(3) On principle, moor soils shall not be utilised or, when used for agricultural purposes, shall be managed so that their characteristic features remain intact.

Starting points

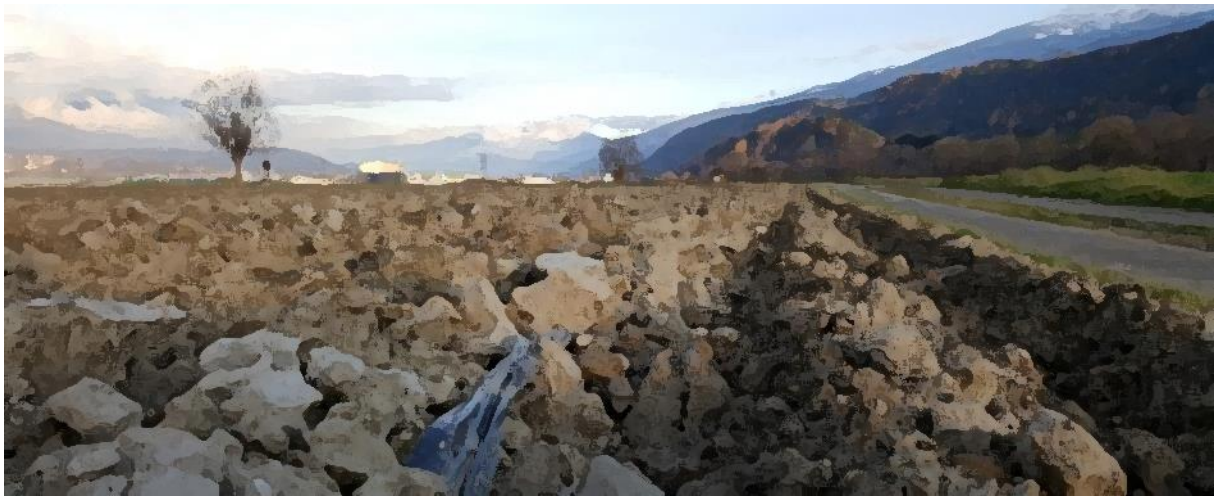
In most of the member states of the Alpine Convention, the currently intact wetlands and moors and their condition have been recorded and renaturation projects have started in some areas. However, an Alpine-wide overview of soils with high organic carbon content does currently not exist.

In several Alpine countries, strategies or legal requirements regarding moors are being developed or are already in force. In the German federal state of Bavaria for example, the "peatland master plan" aims to intensify peatland protection. As part of the plan, raised bogs will be restored in the state forest, and the renaturation activities of the nature conservation administration for rewetting bogs will be tripled by 2050. Moors should be protected from a further reduction of the groundwater level.

4.2 Actions

Short-term actions (until 2024)	**Outputs/Indicators**
Common definition of "wetlands" and "moors".	Common definitions
Review and comparison of the available data on wetlands and moors for the Alpine Convention perimeter (IP_S1_1a).	Research of existing data
Support (already existing) initiatives for substitution of peat products.	Exchange and cooperation
Medium-term actions (until 2030)	**Outputs/Indicators**
Harmonisation of the databases and representation in peatland and wetland types including recording and evaluation of soil functions (IP_S1_1a).	Projects for collecting maps on moorland distribution
Protection of designated near-natural wetlands and moors on the basis of environmental laws (IP_S1_3).	Protection measures improved

In each member state, implementation of pilot projects for the renaturation of moors and wetlands degraded through agricultural and forestry use to soils with intact soil function and carbon storage through renaturation as close to nature as possible or extensive use of bog soils with high (close to nature) water levels (IP_S1_3b).	Pilot projects implemented
Exchange about best practice examples of planning long-term measures for the renaturation of wetlands and moors.	Exchange on the planned long-term measures that were put in place or implementation in progress
Further raise public awareness of the need to protect soils in wetlands and moors.	Conferences for presentation of the results of long-term actions
Long-term actions (until 2050)	**Outputs/Indicators**
Increased renaturation of moors and wetlands with the aim of reducing climate-relevant emissions.	Restored peatlands and wetlands
Halting peat extraction and significant reduction in the use of peat products in landscaping.	No peat extraction happening in the Alpine area, use of peat products in landscaping is significantly reduced compared to 2022



5. AVOIDING DEGRADATION AND FOSTERING RESTORATION OF SOILS

Chapter authors: Marco Di Leginio (Italian Institute for Environmental Protection and Research), Michele Freppaz (University of Torino, President Alpine Soil Partnership), Evelyne Navillod (Region Aosta Valley), Silvia Stanchi (University of Torino).

5.1 Background

Soil degradation is a widespread and diverse threat to soil health and functioning. However, it is not monitored exhaustively, and often remains hidden. It has been estimated that about 60% to 70% of soils in the EU are not healthy, and thus suffer from some form of degradation. Land and soil continue to be subject to severe erosion, compaction, organic matter decline, pollution, loss of biodiversity, salinisation and sealing. This damage is often the result of unsustainable land use and management, over-exploitation, and emissions of pollutants (European Commission, 2021a). Soils can be kept healthy in managed ecosystems through the application of sustainable management, i.e., a set of practices that is able to maintain the soil in, or restore it to, a healthy condition yielding multiple benefits, including for water and air (European Commission, 2021a). On the principles to be followed, there are international reference documents such as the Voluntary Guidelines for Sustainable Soil Management (FAO, 2017) and the EU Biodiversity Strategy for 2030 (European Commission, 2020), whose main objective is to restore degraded ecosystems, in particular those with the highest potential to capture and store carbon.

Significance of the issue in the Alpine region

In mountain landscapes the surface of fertile soil is limited and increasingly under pressure because of competing land uses and climate change. As a result, mountain soils increasingly face problems such as erosion, organic matter decline, nutrient mining, loss of biodiversity, as well as soil and water contamination which, in turn, affect and reduce productivity and the provision of goods and services. The soil implementation pathway 3 of the Climate Action Plan

2.0 supports measures to preserve and enhance Alpine soil quality. In fact, among other functions, soils can contribute to climate regulation through carbon sequestration. The FAO has recently recognised mountain soils as hotspots of organic carbon content (FAO and ITPS, 2021). In this context, the protection of Alpine soils, carbon content and soil biodiversity, with particular attention to wetlands and peatlands, is linked to the identification of specific recommendations, including mountain agricultural practices.

Initial situation, including targets

Land degradation neutrality is promoted by Target 15.3 of the UN Sustainable Development Goals, which, by 2030, strives to combat desertification and restore degraded land and soil. SDG 2 (zero hunger) connects soils, food production, and healthy living. Land and soils are also bound to goals that address poverty reduction (SDG 1), health and well-being through reduced pollution (SDG 3), access to clean water and sanitation (SDG 6), the environmental impact of urban sprawl (SDG 11), and climate change (SDG 13) (European Environment Agency, 2019). Soil is a key element in the future agricultural policy (Farm to Fork Strategy), environmental protection (Biodiversity Strategy), and in climate change adaptation and mitigation (European Climate Law). According to this vision, the recent EU Soil Strategy underlines the importance for maintaining soil ecosystems in healthy condition, following a list of objectives to be reached by the medium and long-term, including the prevention of soil pollution. The Soil Conservation Protocol of the Alpine Convention is an important tool for soil protection: in particular Articles 15, 16, and 17 highlight the importance of limiting the inputs of harmful substances, minimising the use of gritting salt, promoting fewer contaminating materials, and surveying suspicious landfills by checking their environmental conditions. The Protocol is already largely implemented in national legislation, even if many Member States are not completely aligned on the concepts of soil contamination or pollution (from point or diffuse sources): the procedures for defining thresholds or critical limits, risk assessments, and management are defined in different ways among EU countries.

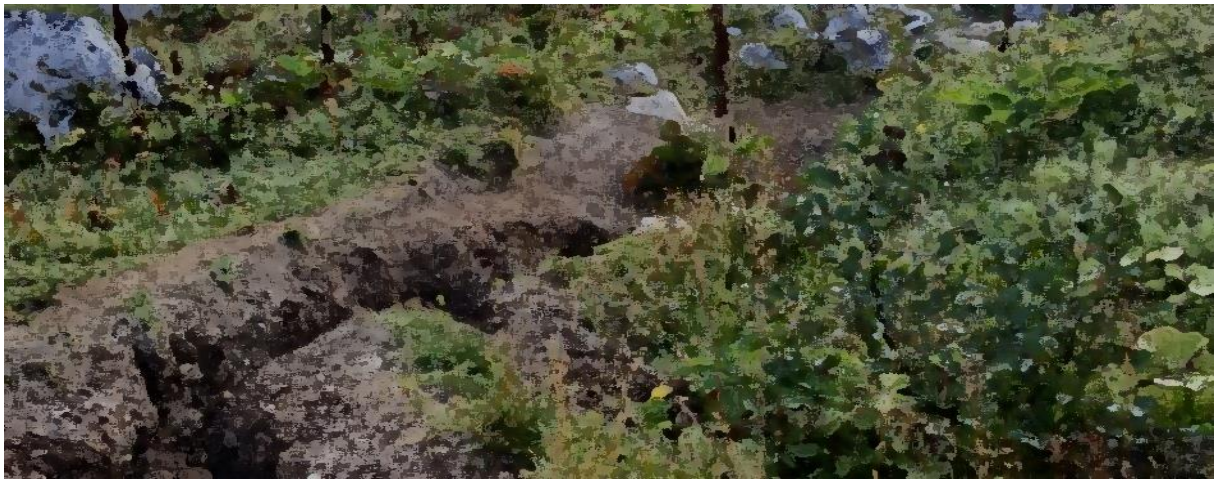
Starting points

- **Mission "A Soil Deal for Europe"**: establish a series of measurable goals to be achieved:
  - Reduce land degradation.
  - Conserve and increase soil organic carbon stocks.
  - Promote No net land take and increase the reuse of urban soils.
  - Reduce soil pollution and enhance restoration.
  - Prevent and mitigate soil erosion.
  - Reduce the EU global footprint on soils.
  - Improve soil literacy in society.
- **Links4Soils**: describes and demonstrates good soil management practices and soil ecosystem services in the Alps. It established the Alpine Soil Partnership.
- **Soil4Life**: established some Regional Observatories on Soil Consumption putting together the different competences usually present within Italian regional offices dealing with agriculture, environment, landscape, spatial planning, etc.

- **Landsupport**: developed a decision support system (S-DSS smart decision support system) that is open and freely accessible via a web platform and is capable of integrating territorial and environmental data and models of analysis and evaluation.
- **Relevant networks**: European Soil Observatory (EUSO)/European Soil Data Center (ESDAC - Lucas Soil Survey), Global Soil Partnership, European Soil Partnership (ESP), Alpine Soil Partnership (AlpSP), UNCCD (United Nations Convention to Combat Desertification).

5.2 Actions

Short-term actions (until 2024)	**Outputs/Indicators**
Promotion of the importance of soil and soil ecosystem services with annual training activities and public information.	Events (to be held in national languages) and/or posts on social media/websites
Promotion of safe and sustainable use of fertilising and plant protection products.	Events (to be held in national languages) and/or posts on social media/websites
Exchange experiences about existing soil testing systems in the Alpine countries especially by considering specificities occurring in the Alpine region in view of the EU 'Test Your Soil For Free' initiative (EU Soil Strategy 2030).	Experiences exchanged
Medium-term actions (until 2030)	**Outputs/Indicators**
Restoration of degraded and carbon-rich areas, including soils (EU Soil Strategy 2030) (IP_S1_3b)).	Surface restored (ha)
Assessment of the regular reporting on land degradation from all parties of the Convention (UNCCD, 2018).	Reports submitted by Alpine countries
Long-term actions (until 2050)	**Outputs/Indicators**
Soil pollution in the Alpine area must be reduced.	Soil pollution in the Alpine area is reduced
Significantly degraded lands should be restored.	Degraded lands in the Alpine area are restored
Achievement of the No net land take in the EU target of the Seventh Environment Action Programme (7th EAP).	Contribute to the application and implementation of this target on the national and regional level



6. AVOIDING AND MITIGATING SOIL EROSION AND RELATED HAZARDS

Chapter authors: Frédéric Berger (French National research institute of science and technology for environment and agriculture, Grenoble regional center), Benjamin Einhorn (Director of the Alpine Natural Hazards Cluster, France).

6.1 Background

Climate change is responsible for the increase in climate-related disasters. The European Environment Agency states that the EU regions experienced substantial economic losses (1980-2020: € 460 billion) and fatalities (1980-2020: 89,525) from climate-related hazards. These extreme events are often the results of compound events (not necessarily extreme ones). Compound events are a combination of multiple climate-related hazards, land uses, ecosystems management and social components that contribute to social and environmental risks. This innovative concept integrates small to large-scale events in all their dimensions (natural, human, and social) to fully assess climate change induced risks to support adaptation actions and policies.

In this context, soils play a key role by being both, a) a source of risks (erosion, gullying, landslides, etc.) when degraded and/or without an efficient protective vegetation cover, and b) a support for natural risk prevention and mitigation actions based on Nature-Based Solutions (NBS). NBS are defined by the IUCN as "*actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits*" (IUCN, 2022).

Land artificialisation, the frequency of climatic disturbances (droughts, storms, etc.), climate change (changes in rainfall patterns, global warming, etc.) and phytosanitary problems (diseases, insects, invasive species, etc.) are all constraints that weaken soils and their ecosystem services. Our quality of life and well-being are thus intimately linked to healthy soils and sources of biodiversity, which support a vast array of ecosystem services. It is therefore a

fundamental and global issue to preserve soils, the foundation of our well-being and of a resilient and sustainable society.

Significance of the issue in the Alpine region

Mountain regions are the areas where climate change and its impacts are most rapid and significant, such as melting of permafrost, reduced snow conditions, increased risk of forest fires, changes in the spatial distribution of forest species.

The geomorphology and the relief of the Alpine region condition its urbanisation and its economic development. They are also the main factors of gravity hazards (erosion, landslides, rockfalls, etc.) which constrain the development and functioning of mountain territories. The main drivers of these natural hazards are the steepness of slopes, the materials that can be mobilised and the “engine” of propagation (water and/or gravity).

As natural hazards and climate-related disasters do not stop at national borders, an Alpine-wide harmonised framework is needed to face this challenge. To be effective for both risk reduction and climate change adaptation services, Alpine soils need to be protected and resilient to climate change. This requires action plans and not only reaction plans.

Initial situation, including targets

The Alpine Convention Soil Conservation Protocol is an important tool for soil protection and natural hazard prevention. In particular, its Articles 11, 12, and 13 highlight the importance of limiting soil erosion and compaction using engineering and adequate land uses (farming, forestry). The Protocol identifies solutions based on ecosystems services that are now integrated in the concept of Nature-Based Solutions.

The Climate Action Plan 2.0 and the Alpine Climate Target System 2050 focus on the added value of Alpine-wide cooperation on climate change mitigation and adaptation. As natural hazards are a result of compound events, their prevention requires a real, integrated, and adaptive management, and as such it is transversal to at least 6 of the 10 pathways identified in the Climate Action Plan 2.0, namely:

- IP_S2: Defining Alpine-wide guidelines for minimised land take and sealing,
- IP_S3: Supporting measures to preserve and enhance Alpine soil quality,
- IP_NH1: Implementation of an Alpine-wide risk management plan, focusing on cross-border risks,
- IP_NH2: Implementation of an Alpine-wide monitoring of permafrost and geomorphological processes related to permafrost warming,
- IP_W2: Tools and methods for drought management in the Alps,
- IP_W3: Implementing of an Alpine-wide flood risk management, based on nature-based solutions,
- IP_SP1: Alpine-wide concept “Spatial planning for climate action”,
- IP_Fo1: Promoting the full use of the potential of Alpine protective mountain forests,
- IP_Fo4: Promote an Alpine-wide integrated sustainable forest management approach,
- IP_Agr2: Moving to organic and climate-friendly methods in Alpine farming.

In addition, NBS are an efficient way to develop sustainable risk mitigation and prevention strategies (European Environmental Agency, 2021). The EU's 2030 biodiversity strategy, a key pillar of the European Green Deal, also includes a nature restoration plan that should be effective for limiting soil erosion. NBS are also highlighted in the new EU strategy on adaptation to climate change, adopted by the European Commission on 24 February 2021 (European Commission 2021c). It states that:

"*Climate change will have impacts at all levels of society and across all sectors of the economy, so adaptation actions must also be systemic. The Commission will continue to actively mainstream climate resilience considerations in all relevant policy fields. It will support the further development and implementation of adaptation strategies and plans at all levels of governance with three cross-cutting priorities:*

- *integrating adaptation into macro-fiscal policy*
- *nature-based solutions for adaptation*
- *local adaptation action."*

In all these documents and schemes, common keywords are used which define the main foreseen target actions:

- Data harmonisation
- Harmonised monitoring
- Knowledge and database sharing
- Hazard potentialities mapping
- Improvement of remote sensing technics and modelling for large-scale mapping
- Limiting soil-related hazards
- If adapted, promoting Nature-Based Solutions
- Developing integrative and adaptive risk management and prevention strategies
- Raising awareness about soil preservation and risk prevention
- Mainstreaming European, national, regional, and local project results

Starting points

- **GreenRisks4Alps:** gravitational risks modelling toolbox, protective forest economical evaluation.
- **Links4Soils:** soil management practices and soil ecosystem services in the Alps, the creation of the Alpine Soil Partnership.
- **RockTheAlps:** first harmonised Alpine model for rockfall risk mapping, a new concept for quick and large-scale rockfall risk assessment and protective forest mapping, forest management guidelines.
- **Art Up Web:** a methodology for the characterisation and analysis of the resilience of territories based on the analysis of the resilience of road networks to snow avalanches, rockfalls, and landslide risks.
- **EUSALP:** mainly Action Groups 6 and 8.
- **Alpine Convention:** Soil Protection and PLANALP working groups.
- **LUCAS**: soil survey.

- **EFFI:** European Forest Fire Information System – supports the services in charge of the protection of forests against fires in the EU and neighbour countries and provides the European Commission services and the European Parliament with updated and reliable information on wildland fires in Europe.
- **COPERNICUS:** databases and satellite images.
- **European Soil Observatory/European Soil Data Centre**: databases.
- **European Climate Assessment & Dataset project**.

6.2 Actions

Short-term actions (until 2024)	**Outputs/Indicators**
Identification of available and usable data sources.	Research of existing data Report on data sources
Reflection on the implementation of a participatory science action for the inventory/survey of events.	Drafting of the specifications of future applications
+Medium-term actions (until 2030)	**Outputs/Indicators**
Development of a common concept of natural hazard modelling and use to develop open-source models.	Report on the concept Developed models
Creation of a harmonized database for the calibration of propagation models.	Harmonised database
Long-term actions (until 2050)	**Outputs/Indicators**
Production of harmonised natural hazard maps for the entire Alpine region taking into account climate change impacts according to IPCC scenarios.	Several thematic maps
Maintenance and updating of databases, models, and maps.	Updated models, databases and maps Reports are available
Support of the Alpine Climate Action Plan.	Reports are available
Setting up training sessions for stakeholders: summer universities, massive open online courses, etc.	Events and sets of training materials
Support of spatial planning initiatives dedicated to NBS and natural risks integrative/adaptive management.	Report on each initiative

7. ALPINE-WIDE CONCEPT OF DATA COMPARABILITY AND MONITORING

Chapter authors: Arwyn Jones (European Union, JRC), Thomas Peham (Government of Tyrol), Andrea Spanischberger (Austrian Federal Ministry for Agriculture and Forestry, Regions and Water Management), Christian Steiner (Lower Austria, Authority of Land Reform, Department for Rural Development).

7.1 Background

In Europe, various actors (e.g., European Commission, national and regional authorities, universities) are carrying out soil sampling campaigns and analyses, all according to differing standards, resulting in non-harmonised data. In addition, data accessibility differs significantly. Both these issues hamper the assessment of soils (e.g., soil quality, sequestration potential, contamination, biodiversity).

Significance of the issue in the Alpine region

In the Alpine region, several uses (e.g., agriculture, forest, industry, infrastructure, tourism) concur strongly in the very limited permanent settlement areas. In addition to direct emissions, soil pollution occurs as a result of different emission streams. Finally, a large area, especially in the Alpine zone, is underrepresented in monitoring schemes and soil surveys.

Initial situation, including targets

- Soil Conservation Protocol Article 20 and 21, Climate Action Plan 2.0 implementation pathways (IP_S1, IP_S2 and IP_S3).
- EUSALP AG6 “Declaration Sustainable Land Use and Soil Protection – Joining Forces for Nature, People and the Economy”.
- European Green Deal with special focus on the EU Soil, Farm to Fork and Biodiversity Strategies, and the Zero Pollution Action Plan.

Starting points

- European Soil Observatory (EUSO)/European Soil Data Centre,
- National data centres (e.g., BORIS in Austria (Austrian Environmental Agency Austria 2022),
- Project Links4Soils,
- Long-term monitoring sites.

7.2 Actions

Short-term actions (until 2024)	**Outputs/Indicators**
Specific instructions for the LUCAS 2022 sampling on Alpine sites.	Instructions are distributed
Workshop on sampling Alpine sites during the LUCAS coordinators seminar 2022.	Input during workshop was held
Medium-term actions (until 2030)	**Outputs/Indicators**
Develop an Alpine-wide soil classification system (IP_S1_1aa).	The soil classification system is available OR adaptations are done to existing classification systems (e.g., WRB) Respective trainings to soil classification are offered
Evaluating the synergies and comparability potential of LUCAS, national, and regional soil monitoring programmes.	Report is available
Long-term actions (until 2050)	**Outputs/Indicators**
Further support the Alpine Convention Climate Action Plan 2.0 implementation steps.	Engagement in respective working groups
Develop, apply, and spread easily understandable deductions of the existing data to improve the understanding and sustainable management of soils.	Soil awareness activities Farmers consultancy activities

8. IMPROVING SOIL LITERACY AND AWARENESS IN THE ALPINE REGION

Chapter authors: Elena Havlicek (Swiss Federal Office for the Environment), Silvia Stanchi (University of Torino), Michele Freppaz (University of Torino, President Alpine Soil Partnership), Evelyne Navillod (Region Aosta Valley).

8.1 Background

Binding soil protection legislation, whether at national, regional or international level has so far proven to be insufficient for an effective and widespread implementation of soil protection measures. Moreover, voluntary soil protection measures are not sufficient to achieve sustainable soil management. In many cases, a lack of awareness has been identified as one of the underlying causes of unsustainable soil management practices, of the general lack of investment and of the political reluctance to adopt measures that preserve and enhance soil conditions. During the last EUROSOIL congress in 2021, the “Connecting People and Soil” initiative identified key topics related to soil awareness. Stakeholders operating in different sectors with impact on soils have voiced their needs regarding improved soil literacy for all and the definition of a common language. It appears that the main barriers to scaling up practices that allow the preservation of soil capital are the low level of soil knowledge, the limited common understanding between the different stakeholders and, insufficient sharing of appropriate data between the scientific, policy, and field implementation levels.

Contrary to other vital resources, soils are biologically active: they are not only a milieu for living organisms but are built up by these organisms. Despite its essential role, soil biodiversity remains invisible and is therefore difficult to understand and protect. Moreover, the physical, chemical and biological properties of soils interact with each other in a complex way, giving soils their diversity of functions. This complexity often generates incomprehension in the broad audience. The rationale based on soil functions as the contribution of soils to major societal

issues such as climate change, water management, biodiversity losses, nutrient flows, food security, and land preservation, has proven to be effective and should be further developed. Moreover, good narratives and proposals to engage people on an emotional level help to involve the general audience.

Significance of the issue in the Alpine region

Similar to other regions, soil is the basis of Alpine ecosystems. In the Alpine region, soils and soil functions are particularly vulnerable to threats, especially due to climatic conditions at elevated and high altitudes. On the one hand, the formation time of soils is much longer and after a disturbance soils and their functions cannot be quickly regenerated and restored. On the other hand, climate change is occurring more rapidly in mountain areas and although its effects on soils are not yet fully assessed, negative changes are to be expected.

Initial situation, including targets

Members of the FAO established the Global Soil Partnership in December 2012. For fulfilling its mandate, the GSP addresses five pillars of action – among them pillar 2 “Encourage investment, technical cooperation, policy, education, awareness and extension in soil”. These activities are reflected in the regional and sub-regional soil partnerships, such as the European Soil Partnership (ESP) or the Alpine Soil Partnership (AlpSP). The AlpSP was established during the EU Alpine Space project Links4Soils, focused on raising awareness of soils in the Alpine region, reviewing the existing regional and national soil data, transferring knowledge and best management practices to policymakers, decision-makers, and other stakeholders. The AlpSP establishes a link between existing Alpine and soil networks and is particularly committed to the implementation of the Soil Conservation Protocol of the Alpine Convention. The activities of the AlpSP secretariat, formulated in five pillars based on the ESP, include the following targets:

- Coordination and Alpine-wide networking of soil stakeholders by actively supporting the members of the Alpine Soil Partnership as well as the exchange with other soil protection actors in the form of annual meetings and webinars and the development of identity-creating symbols.
- Promotion and communication of sustainable soil management by building up knowledge of relevant actions to be taken by local and regional decision makers.
- Raising awareness and innovative soil communication through digital media.

The Soil Conservation Protocol directly addresses communication and awareness raising in its article 22, which seeks to promote the education as well as the information of the public. Active cooperation with the AlpSP coordination unit and members as well with the other relevant partners will help to meet the objectives of the Protocol.

Starting points

Partners: Alpine Soil Partnership, Global and European Soil Partnerships

Publications & activities specific for the Alpine region	
Book on Alpine Soil Ecosystem Services (long & short versions)	https://alpinesoils.eu/wp-content/uploads/2019/11/2019-1025_SoilEcosystemServicesInTheAlps-WEB.pdf
Soil Ecosystem Services logos	https://alpinesoils.eu/desrciption-of-link4soils-ses-logos
Earthworms Book & Identification sheets	https://alpinesoils.eu/portfolio/links4soils-earthworms-booklet-and-identification-sheets/
Soil etiquette	https://alpinesoils.eu/soil-etiquette/
Digital soil check	https://alpinesoils.eu/soilcheck/
Videos: Soil in the Alps (in EN/ FR/ GER/ IT/ SL)	https://www.youtube.com/channel/UCZ_OUdjiHspNob1sk6DVdEQ/videos
Alpine SOILutions congress	https://alpinesoils.eu/the-alpine-soilutions-congress/
Summer school in Pokliuck for high school students from the Alpine region	https://alpinesoils.eu/summer-school/
Publications & links (not specific for the Alpine area)	
Towers et al. (2010): Soil awareness and education – developing a pan European approach	https://www.iuss.org/19th%20WCSS/Symposium/pdf/2106.pdf
International Decade of Soils 2015-2024	https://www.iuss.org/international-decade-of-soils/
Soil4life: Toolkit for raising awareness	https://soil4life.eu/wp/wp-content/uploads/2020/03/Raising-Awareness-final-with-links.pdf
Dazzi & Lo Papa (2021): A new definition of soil to promote soil awareness, sustainability, security and governance	https://www.sciencedirect.com/science/article/pii/S2095633921000708
GSP webpage, dedicated to the WSD (Awareness raising | Global Soil Partnership | Food and Agriculture Organization of the United Nations	https://www.fao.org/global-soil-partnership/en/

8.2 Actions

Short-term actions (until 2024)	**Outputs/Indicators**
Identification of soil protection and management relevant projects in the Alpine region.	List of relevant projects
Annual mailing to communicate on current findings and promote projects on sustainable soil management.	Annual mailing and newsletter to be prepared in collaboration with the AlpSP secretariat
Organisation of a meeting with relevant stakeholders in order to define priorities for Alpine soils (communication, management practices, etc.).	Publication of a report on the results of the meeting, jointly by the WG Soil Protection and the AlpSP secretariat
World Soil Day (WSD): organisation and/or promotion of the WSD in the Alpine region and include the Alpine events on the GSP webpage, dedicated to the WSD.	Events held in the Alpine region Events on the GSP WSD webpage
Medium-term actions (until 2030)	**Outputs/Indicators**
Making the information acquired in the short-term action permanent (identification of soil protection and management relevant projects in the Alpine region) by publishing the relevant information on the website www.alpinesoils.eu.	Evolving information and exchange platform
Identification and adaptation of at least two points of the Voluntary Guidelines on Sustainable Soil Management (VGSSM published by the GSP) that are relevant for the Alpine region.	Online publication of sustainable soil management practices specific to the Alpine region on the relevant websites (e.g., www.alpinesoils.eu)
Long-term actions (until 2050)	**Outputs/Indicators**
Adaptation and concretisation of the Voluntary Guidelines on Sustainable Soil Management, to the Alpine context.	Publication in all Alpine Convention languages of a booklet/document linked to the GSP VGSSM

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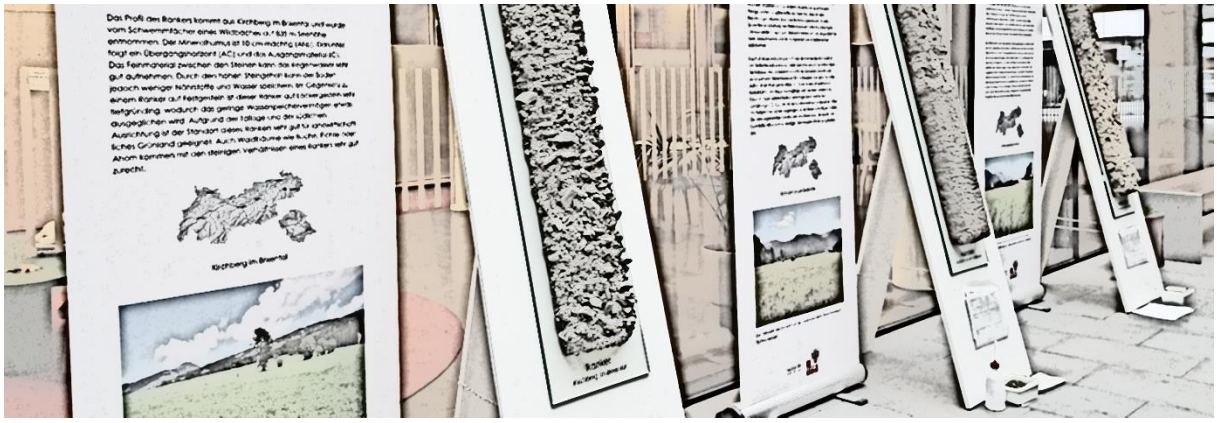

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