

Transnational Strategy for Climate Proof Spatial Planning

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Climate Change Adaptation by Spatial Planning in the Alpine Space – WP 7

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1. Background and motivation

Main goal and target group of the Transnational Strategy for Climate Proof Spatial Planning

Adaptation to climate change should become a prioritised field of action of spatial planning. The Transnational Planning Strategy (TPS) offers transferable approaches and options for action to adapt to climate change. They may be implemented in the various spatial planning systems used in the Alpine countries. As a catalyst, this strategy is mainly aimed at policymakers, decision makers and political actors in spatial planning in the Alpine Space to identify options, provide orientation and promote action towards climate proof and resilient spatial development. It is hoped that the guidelines and actions that are proposed in the TPS will serve as a support to policy makers and officers working in the field of regional and local spatial planning.

The necessity of a Transnational Strategy

Due to many similarities in natural and socio-economic characteristics, the entire Alpine Space is affected by similar types of climate change impacts and resulting impact chains. However, the magnitude and severity of the effects of climate change will vary on a relatively small spatial scale from region to region across the Alpine arc, depending strongly on location and context-specific variations in the determinants and degrees of vulnerability. Differences in regional exposure to changes in climatic stimuli (e.g. varying changes in precipitation patterns due to different terrain features), sensitivity of natural, economic and social systems as well as in adaptive capacities will cause a regional diversity in the effects of climate change. Without countermeasures, this is anticipated to lead to increasing disparity regarding growth potentials and economic development between and within regions, which threatens territorial cohesion in the Alpine Space.

The cross-border dimension of many consequences of climate change, e.g. regarding the catchment areas of rivers, as well as of many adaptive actions, e.g. both structural and non-structural flood protection measures, requires reinforced transnational cooperation.

The need for transnational coordination in climate change adaptation is sustained by the Territorial Agenda of the European Union 2020:

“The impacts of climate change vary considerably across Europe in terms of geographical regions with different types of impacts and different degrees of vulnerability. The increased risk of sea level rise, drought, desertification, floods and other natural hazards calls for territorially different responses. Regions have different opportunities to embed adaptation and mitigation into their strategies, decreasing greenhouse gas emissions and adjusting their socioeconomic systems to a low carbon economy. Climate change may also lead to new development opportunities, such as within agriculture, green economy and renewable energy production. The challenges of climate change draw attention to the territorial coordination of policies, especially climate, energy, water management, agriculture, housing, tourism and transport”
COPTA, 2011: para. 20).

Despite all similarities, the national states of the Alps have widely independent and so far hardly coordinated spatial planning systems as regards administrative traditions, policies, leg-

isolation, instruments and processes of spatial planning and regional development. While fully respecting national specificities, the TPS intends to make a contribution to the coordination of national planning strategies where this is considered beneficial to coping with climate change and balancing regional disparities. In addition, implementing the adaptation measures of the TPS has the potential to create positive economic effects, for example by reducing risks and relieving public budgets.

The importance of Alpine spatial planning in the adaptation to climate change

The impacts of climate change affect the Alpine Space more severely than most other regions in Europe. As regards spatial development, the availability of space suitable for permanent settlement activities in Alpine areas is limited, and additional land use demands for development in terms of housing, working, tourism, business, and transport are ever increasing. This ongoing trend is exacerbated by climate change, which is likely to cause an expansion of hazard zones as well as additional demand for land for protection measures. As a consequence, land for development is becoming a scarce resource in many Alpine regions. This threatens to confine future spatial and economic development potentials and to intensify spatial conflicts over land use. Thus, the requirements to future spatial development concepts in the Alpine Space are particularly high. Spatial planning is considered a consistent, effective and influential means to prevent and respond to the consequences of climate change on the territory – since it is based on instruments that already exist and operate on the territory.

In this context, the following definition of spatial planning is used:

„Spatial planning refers to the methods used largely by the public sector to influence the future distribution of activities in space. It is undertaken with the aim of producing a more rational organisation of activities in space, including the linkages between them.” (European Commission 1997). Spatial planning therefore covers activities of land use planning (regulation of suitable use of zones and sites), spatial development (regional, urban and municipal development) and spatial management (coordination and assignment of various spatial requirements to sectors such as agriculture and forestry, transportation, energy, etc.).

The Strategy within the CLISP project

The TPS is part of the European project CLISP (Climate Change Adaptation by Spatial Planning in the Alpine Space) funded by the Alpine Space Programme under the European Territorial Cooperation 2007-2013. CLISP is focused on the challenges of spatial planning in the face of climate change and shall contribute to climate change adaptation by providing knowledge and experience for climate proof spatial planning. CLISP is committed to positioning spatial planning as a key player for future sustainable development under the adversities of climate change. The goal of CLISP is to support and strengthen the local, regional, and national spatial planning institutions by providing the knowledge, tools and guidelines needed in order to assure that spatial development is prepared to cope with the future challenges of climate change impacts.

1.1 International, European and transnational context

Dealing with climate change is becoming an increasingly relevant principle of the political agenda at the European and international level. Among the outcomes of the 16th Conference of Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) in Cancun 2010, the Parties affirmed that adaptation must be addressed with the same level of priority as mitigation. In 2008, Germany passed an adaptation strategy, while the development of such strategies is ongoing in most other Alpine countries, including Austria, Switzerland and Slovenia. However, spatial planning has played a rather subordinate role in national adaptation strategies of European nations so far (see BMVBS 2010).

The Green Paper “Adapting to climate change in Europe – options for EU action” of the European Commission (EC, 2007) states that *“spatial planning is a cross-sectoral issue which makes it a suitable tool to define cost-effective adaptation measures.”*

Recognizing that infrastructure (buildings, transport, energy and water supply) and densely populated areas are specifically threatened by climate change impacts, the European Commission’s White Paper “Adapting to climate change: Towards a European framework for action” (EC, 2009) explicitly stresses the role of spatial planning in delivering adaptation: *“A more strategic and long-term approach to spatial planning will be necessary, both on land and on marine areas, including in transport, regional development, industry, tourism and energy policies.”*

The “Territorial Agenda of the EU 2020” (COPTA, 2011) regards the handling of the effects of climate change as one of the core challenges for territorial cohesion in the context of cohesion policy. Thus, the development of cross-border, integrated adaptation strategies (with special focus on spatial development) is defined as a highly relevant task, especially in the context of trans-European risk management. The principles of the European Spatial Development Perspective to achieve a balanced and sustainable development of the territory of the EU are to be integrated and developed further in adaptation strategies. The strategy at hand supports the cause of the Territorial Agenda.

Likewise, the “Action Plan on Climate Change in the Alps” by the Alpine Convention (Alpine Conference, 2009) and the preceding “Declaration of the Alpine Ministers” (Alpbach, 2006) on Climate Change portray spatial planning as a major field of action in the development of an integrated approach to adaptation. The Alpine Convention emphasizes the role of spatial planning to better control natural hazards and limit their consequences as well as ensuring sustainable development in terms of housing and economic activities. According to the Action Plan, the results of the CLISP project are to *“serve as a reference basis for the implementation of the proposed measures in terms of spatial planning”* (Alpine Conference, 2009).

1.2 Guiding principles

The options for action for the TPS have been developed on the background of the following general propositions and principles:

Sustainability

In the preparation of adaptation strategies, not only the aspects of climate change, but also various other social concerns related to the use of space should be considered. Any adaptation actions should be in line with, and support, sustainable spatial development, avoid negative impacts on the environment, society, or economy, and should not be detrimental to other sectors or limit their own capacity to carry out adaptation. The aim is spatial development that strives to balance different public and legitimate private interests in the use of space across sectors. Preference should be given to no-regret or low-regret options which are beneficial in all plausible climate futures, such as early warning systems and insurance against floods, as well as to the optimum use of multiple-benefit options that provide synergies with other goals such as mitigation or sustainability (ETC/ACC 2010). Adaptation needs to be coherent with sustainable spatial development, which is a declared goal of the EU and is a main concern of the “Alpine Convention”.

Precautionary and preventive principle

Spatial planning means to anticipate development options – to take precaution on sustainable land-use and regional development and to prevent spatial conflicts and risks. A core principle of spatial planning as well as of adaptation is to choose such development alternatives which have minimal impacts on the environment (climate, nature, etc.) and at the same time enable the fulfilment of development needs of society. „*The precautionary principle demands that the absence of full scientific certainty should not be used as an excuse to postpone adaptation when there is a potential of serious or irreversible harm*” (ETC/ACC 2010).

Adaptive management

Adaptation is not a final state, but a process that is iterative, ongoing and relies on learning as implementation proceeds. Adaptive management thus builds on monitoring spatial development, climate change impacts, and the implementation of adaptation measures, on regular evaluation of adaptation policies for their effectiveness and adequacy against monitoring results and new scientific information, and on revision of policies and instruments, if necessary. In some cases such an adaptive management approach has to go beyond improvements of existing socio-economic and planning systems and has to modify the system itself (e.g. termination of ski tourism in some regions) (ETC/ACC, 2010).

An adaptive management approach facilitates reduction of uncertainties and contributes to retaining flexibility. It ensures that spatial planning institutions and their instruments are fit for climate change not only today but also in the future, i.e. that they are *adapting* rather than adapted. The planning cycles of most spatial plans foresee regular revisions; these intervals should be suited (i.e. be short enough) to allow implementation of adaptive management in spatial planning.

Avoidance of maladaptation

Maladaptive actions may deliver short-term benefits, but increase vulnerability to climate change impacts in the medium- and long-term. Adaptive action should not limit future development scopes or put the aims of different sectors in opposition. It should rather seek and ex-

exploit potentials for synergies (e.g. measures for flood protection that also contribute to an ecological added value and to the recreation potential of the landscape). Therefore, options for adaptive action must be designed to integrate climate change mitigation and lead to sustainable use of resources (such as limiting the use of groundwater for irrigation in regions prone to water scarcity, space and energy-saving transport and settlement infrastructures, etc.). “Business as usual” (e.g. progressing urban sprawl and dispersed settlement development) often bears the risk of unwanted maladaptation effects and higher follow-up costs. In many cases, effective adaptation action would require consistent implementation of existing spatial planning objectives that aim at sustainable spatial development (e.g. space and resource-saving settlement and other infrastructures).

Consensus and cooperation

As cross-cutting policy fields, both spatial planning and climate adaptation require intense and effective coordination and cooperation between sectors and governance levels. By way of participation and negotiation processes the broadest achievable consensus has to be found between the different actors (planners and decision-makers, those affected by planning) and on different levels. Agreements on adaptation should enjoy majority support, reinforce personal responsibility and accountability of all actors and avoid any one-sided allocation of burdens in implementing adaptive action. A joint course of action in developing and implementing adaptation strategies allows full use of potentials by pooling resources and sharing knowledge and experience. Enhancing cooperation and coordination between national states and with subsidiary regional and local spatial planning authorities as well as with sectoral stakeholders are basic principles of the TPS and should take place in all phases of the planning cycle, including data collection, impact prediction, evaluation, strategy building, planning, and implementation of planning measures.

Courage

Dealing with climate change and other issues of spatial development (such as land consumption, traffic load and urban sprawl) requires taking action that will appear unpopular in the short term, but yield long-term benefits. This will require the courageous enforcement of existing instruments in addition to the employment of new methods and actions. Spatial planning needs more assertive power in order to uphold the legitimate interests of a community wherever they conflict with individual interests.

Effectiveness and efficiency

The primary focus of this strategy is to make full use of all possibilities to improve existing instruments as well as their implementation within current planning systems. This will require reducing current deficits in implementation and meeting new challenges, such as adaptation to climate change, with a pro-active – not re-active – attitude. Climate adaptation may be seen as a driver for better coordination of spatial planning authorities on different planning levels as well as with and between other sectors; it can also act as an opener for new opportunities (while recognizing the priority of coping with climate change and of sustainability). If implemented properly, climate change adaptive and mitigative spatial planning has strong potential to be more effective in relation to spent money and resources and thus more efficient, i.e. economically productive and innovative. In adaptation, as in other policy fields, aiming at effectiveness and efficiency may also be described as doing the right thing (effectiveness) in the right way (efficiency), rather than continuing to do the wrong thing in a better way (ASP, 2010).

2. Guidance for action

The guidance for action is the core element of the strategy at hand. It is designed to be used by decision-makers and executives in spatial planning as an orientation and decision-supporting tool for the development of suitable adaptation strategies and actions in response to climate change. The actions and measures presented should be regarded as general recommendations that need to be adjusted to the relevant national challenges and planning systems.

The guidance for action is based on the findings of the *Alpine Space Programme Project CLISP – Climate Change Adaptation by Spatial Planning in the Alpine Space* (see www.clisp.eu). In addition, findings from other projects and studies on climate change have also been integrated (see Annex).

Reducing *vulnerability* and increasing *resilience* by developing robust and flexible spatial structures are the main objectives pursued by way of the adaptation strategy. The recommendations of the action plan are based on the guiding principles and propositions set forth in chapter 1.2

Spatially relevant impacts of climate change in the Alpine Space

An increasing average temperature, changing precipitation patterns and stronger weather extremes and variability will lead to an array of effects in the Alpine Space. Within CLISP, climate change impact assessments based on climate scenarios were used to identify the most important consequences for the Alpine Space.

- Direct and indirect damage to buildings and infrastructures as a consequence of more frequent and more severe extreme weather events
- Increasing risks due to natural hazards such as landslides, mudflows, avalanches, rockfalls
- Changes in runoff regimes and flooding areas of rivers and higher flood risks – possible expansion of flood hazard zones and more frequent floods in existing hazard zones
- Increasing water scarcity by a change in water availability: higher probability of dry periods and droughts primarily in summer; threats to reliability of drinking water supply quantity; intensification of conflicts over water use
- Possible threats to drinking water quality due to higher water temperatures and heavy precipitation events
- Increasing heat stress caused by higher temperature extremes and heat waves
- Retreat of glaciers and perma-frost soil thawing: higher risk of rockfalls, mudflows, landslides and glacial lake outbreaks; higher sediment load in Alpine rivers
- Rising snow lines as well as less snow reliability, especially in lower areas and the south of the Alpine Space
- Rising timber lines; impairment of the forest functions, especially the protective function, due to multiple climate stress on forest ecosystems; increasing risk of forest fires
- Changes to ecosystems and ecosystem services, including decreasing habitat suitability for many species, changes to species distribution and migration patterns, accelerated biodiversity loss, spreading of pest species and vector-borne diseases
- Degrading effects on soil, such as more erosion, loss of organic matter and soil carbon.

The consequences of climate change result from a chain of events. The climate change impacts mentioned above will cause direct changes in natural systems and in the built environment, which in turn cause second-level, indirect changes and knock-on effects in economic and social systems. It is anticipated that all economic sectors and land use activities relevant to spatial development in the Alpine Space will be affected by climate change, including construction, water management, agriculture, forest management, tourism, energy, and human health and wellbeing. In many cases, impacts of climate change are exacerbated by other environmental change and socio-economic development trends (e.g., climate-induced water scarcity may be aggravated by rising water demand of society; soil sealing and other land use changes contribute to occurrence of river floods).

The manifold impacts of climate change on spatial development clearly show that there is a strong need for action by spatial planning and by spatially relevant sectors planning disciplines on all levels. Any successful implementation of adaptive action requires an integrative approach and cross-sectoral, interdisciplinary cooperation. Therefore this strategy pools space-related options for action and measures in trans-sectoral fields of action.

Fields of action for the development of climate proof spatial planning

The strategy defines *general fields of action* and *specific fields of action*. *General fields of action* include cross-cutting recommendations that need to be implemented across different topics, such as awareness-raising, knowledge transfer and further development of planning methods. The *specific fields of action* relate to the identified climate change impacts on sectors and systems important to spatial development. Clustered by themes, the specific fields of action pool measures and options for actions that are expected to yield the best adaptation success for the Alpine Space from the perspective of spatial planning.

Overview of fields of action

General fields of action

| | |
|-----|---|
| (1) | Enhancing planning systems and instruments |
| (2) | Cooperation across sectors, levels and borders |
| (3) | Building and transferring knowledge |
| (4) | Awareness-raising |

Specific fields of action

| | |
|-----|--|
| (5) | Resilient settlement systems and infrastructure |
| (6) | Natural hazards prevention |
| (7) | Integrated water resource management |
| (8) | Landscape development and ecosystem services |
| (9) | Reorientation of tourism |

Note: The numbering of fields of action, objectives and actions implies no prioritisation – it is merely meant to facilitate orientation and provides the opportunity to make cross-references between actions across different fields of action.

Structure of the Action Plan

Within each field of action, its general relevance in the context of climate change is briefly described, a set of objectives is defined, and a set of recommended measures and options for action related to the objectives is presented and described. The following figure gives an overview of the structure of the Action Plan.

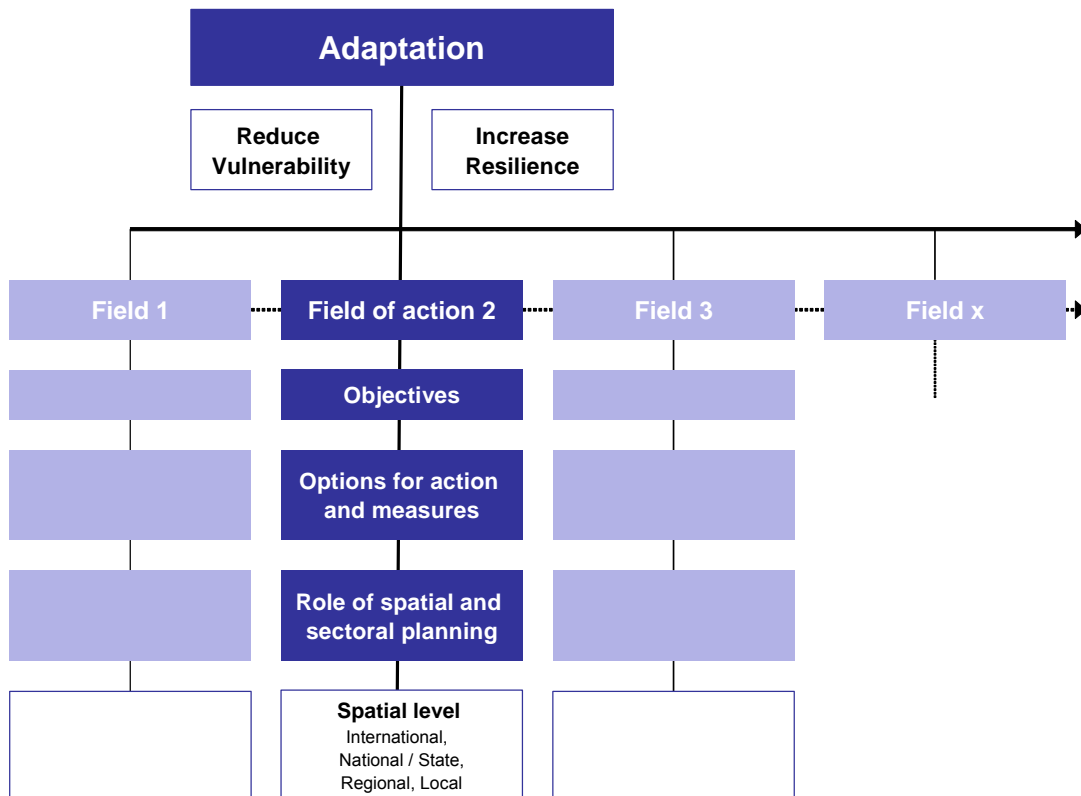


Figure: Structure of the Action Plan

Pointers on the roles of spatial planning, on spatially relevant sectoral planning and on the level of implementation

The differences in the existing sets of instruments as well as the differences in administrative and planning systems in the Alpine countries only allow exemplary allocations of specific instruments suitable for implementing the recommended measures and options for action. Both the identification of the bodies responsible for implementation as well as the assignment of suitable instruments must be customised to the national, regional and local levels. Therefore the possible roles and areas of activity of spatial planning as well as spatially relevant sectoral planning disciplines are only meant to provide orientation.

Possible roles and areas of activity of spatial planning (simplified overview)

Spatial planning can contribute to the planning and implementation of actions in various roles, either as trans-sectoral, comprehensive and cross-cutting planning domain or as spatially relevant sectoral planning.

The following descriptions of roles and tasks not only pertain to spatial planning, but can also be applied to spatially relevant sectoral planning disciplines in most cases

| Role | Tasks |
|-----------------------------|--|
| Lead | Steering of processes Implementation of actions by determining planning measures Coordinating and implementing measures of spatially relevant sectoral planning |
| Moderation | Moderating regional (climate change) governance processes Coordinating and balancing different requirements of sectoral planning Accompanying and supporting planning and/or implementation of actions |
| Cooperation, Input, Impulse | Partnership-oriented cooperation with spatially relevant sectoral planning bodies |

Many of the challenges mentioned can only be handled successfully, if different sectoral planning disciplines cooperate. Therefore, in addition to spatial planning, this action programme also addresses sectoral planning and sectoral policy fields of all spatially relevant or space-effective economic sectors. This includes planning in the following economic sectors: agriculture, forestry, water management, real-estate development and construction, energy, tourism, traffic and transport, as well as planning on natural hazard management, environmental protection and landscape planning as well as social and technical infrastructure planning. Sectoral planning bodies that can certainly play a role in planning and implementing action will be mentioned – however, the list will not be exhaustive.

As an additional pointer for possible roles and areas of activity of spatial and sectoral planning, the main levels of activity for each action will be mentioned. This refers to those spatial levels that should be the main focus of implementation activities. The spatial levels have been divided into the *transnational*, *national / state*, *regional* and *local* level. The *national / state* level corresponds to the highest-ranking spatial planning level in each of the Alpine countries Austria, Germany, Italy, Liechtenstein, Slovenia and Switzerland, which may be the national level and/or the provincial state level if it is in charge of legislation and execution of the spatial planning law - this depends on the respective planning system (*Land* in Austria, *Kanton* in Switzerland, *Regioni* and *Provincia Autonoma* in Italy). The *regional* level focuses on functional regions that cover at least several communities and sometimes are also administrative units (as provincial state sub-units, e.g. *Landkreis* in Germany).

See below for an exemplary table:

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-----------------------------|--|
| Lead | National / State | – |
| Moderation | Regional | Sector X |
| Cooperation, Input, Impulse | Local, Transnational | Sector Y |

In this example the spatial planning authorities on national / state level should take the lead in implementing the measure. The sector X and regional planning should moderate and coordinate different needs of actors. The spatial planning authorities on the transnational and local level together with sector Y should support the implementation by cooperating with other planning authorities (spatial planning and sectoral planning bodies) and / or by providing input impulses.

(1) Enhancing planning systems and instruments

In principle, the available instruments of spatial planning would allow meeting the numerous and varied challenges brought up by climate change. However, the expected, intertwined, in some cases mutually exacerbating climate-triggered effects require rethinking the concept of planning in the direction of more flexibility and dynamic within the existing, stable frame. This entails advancing the available set of instruments as well as developing entirely new methods to be applied within existing planning systems.

Objectives

- O1.1 Stable systems with flexible planning instruments**
- O1.2 Dynamic, process-oriented spatial planning instruments**
- O1.3 Improved implementation and advancement of available instruments**
- O1.4 Enhanced development, introduction and use of innovative methods and approaches**

Options for action, measures

M1.1 Making adaptation to climate change a legal objective and a priority field of action of spatial planning (O1.1-2)

Climate adaptation needs to be explicitly addressed in the legal framework of spatial planning. Incorporating climate adaptation as an objective in spatial planning laws is the first step towards making it a priority field of action for all levels, procedures and instruments of spatial planning. Legal anchoring of adaptation will legitimate and oblige regional and local planning levels to consider adaptation in their daily planning decisions. This would also ease the process of improving the implementation and enforcement of existing instruments and objectives of spatial planning, as most of them already work towards the goal of adaptation.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | National / State | – |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Regional, Local | All spatially relevant sectors |

M1.2 Advancing mission statements and long-term objectives (O1.1-2)

The challenges of climate change go beyond the usual timeframes employed in planning. The definition and implementation of guiding principles and objectives that exceed a horizon of 10-15 years and support the development of resilient structures has to be promoted. This is highly justified due to the long lifespan of the infrastructure.

Guiding principles aimed at resilient spatial development, however, should not only promote the principle of growth, but also occupy themselves with maintaining the status quo or even dealing with the challenge of shrinking processes and retreat. More than one desirable final states as well as options for reaching them should be foreseen. The instruments of spatial planning should open multiple options for development (to cope with uncertainties) but still be suited – in the way of a no-regret or low-regret strategy – to generate mostly advantages, despite the impacts of climate change.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|---------------------------------------|--|
| Lead | National / State | – |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Transnational, Regional, Local | All spatially relevant sectors |

M1.3 Promoting regional planning (O1.1, 1.3)

The regional level (supra-local, supra-municipal) is well-suited to effectively control the mechanisms of adaptation. On the one hand, it is on a small enough scale to make specific climate change related impacts tangible, on the other hand it is also wide enough (it includes several local municipalities) – to meet the challenges adequately by way of a collaborative approach. Many climate change impacts, e.g. on flood risk or on groundwater resources, affect more than one municipality and require an inter-municipal approach to adaptation that is coordinated on regional level. Accordingly, regional projects should receive special support, with funding mechanisms aiming particularly at this level.

For this purpose legal framework conditions will have to be adjusted wherever this has not yet been effected e.g. determinations on adaptation to climate change in regional plans applicable as binding basis for local planning. The local communities will have to be supported by the higher ranking levels in planning and implementing adaptive action, especially when it comes to enforce the legitimate interests of the public as opposed to individual interests. Support could be provided by offering basic support and data on a regional level, initiating interactive planning processes, providing advice on the local level but also by requiring compliance with supra-local regulations regarding the promotion of adaptation, supervised by regulatory authorities.

The existing instruments of regional planning would have to be developed further, regarding the integration of conditions and actions of climate adaptation. According to M1.1 they would have to be designed flexible enough to leave room for short-term readjustments despite long-term planning periods.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|---------------------------------------|--|
| Lead | National / State | – |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Transnational, Regional, Local | All spatially relevant sectors in particular water management |

M1.4 Establishing climate governance (O1.1-2, 1.4)

The complexity of adaptation as well as the multitude of actors on different levels requires a combination of different steering instruments. A process oriented *climate governance* should aim to flexibilise the administrative and planning system, in order to arrive at high quality decisions for possible actions, despite the multitude of actors and uncertainties. Therefore, methods of risk governance resp. risk management should be integrated, in order to cope with the uncertainties of climate change (see M3.3).

In this process where actors with different interests are involved, spatial planning could use its coordinating power and mediate between conflicting interests. The focus of these governance-efforts should be on the regional level. Decision-makers and actors of the other spatial levels, however, also have to be involved. Firstly, in order to obtain balanced decisions for implementation on a local level, and also in order to define coherent conditions on a supra-regional level (multilevel governance).

Informal, accompanying instruments should be developed further and used more intensively to support formal instruments. The aim is to increase acceptance and to find agreements on actions based on consensus wherever possible, even if such actions are unpopular, like e.g. interventions in the status quo of land use. Such informal instruments could include compensation schemes, methods of participation and awareness-raising, guidelines, manuals and assessment tools (see also M2.5).

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-----------------------------|---|
| Lead | National / State | – |
| Moderation | Regional | – |
| Cooperation, Input, Impulse | Transnational, Local | All spatially relevant sectors in particular environmental affairs |

M1.5 Installing climate proofing on all levels (O1.3-4)

Existing as well as future instruments should be assessed in terms of their suitability in dealing with climate change (climate proofing). The following questions could be considered: To what extent are the contents of the instruments appropriate to support adaptation? Do the designations correspond to the goal of sustainable development? How far do they go in supporting mitigation? Have residual risks been taken into account as well?

Spatially relevant strategies, programmes, plans and concepts from the national to the local levels can be subject to review of content and – if appropriate – adaptation. In addition, the associated implementation regulations as well as approval and revision procedures can be reviewed. Climate proofing can be implemented by and within spatial planning by integrating a climate fitness check or climate adaptation review as standard operating procedure in planning processes and administrative working routines, for example in set-up and approval procedures of plans, tendering procedures for basic studies, and in guidelines for application of instruments.

In the case of setting up new spatial plans or programmes, potential impacts of a changing climate on these plans and projects would have to be assessed over the course of a SEA (Strategic Environmental Assessment) in which criteria for climate proofing would have to be integrated. Even if there is no obligation to carry out a SEA or EIA, all instruments and larger projects should be put through a climate impact assessment. This assessment should be carried out within the framework of an appropriate monitoring system that employs essential climate relevant indicators. Corresponding to the status of developments, programmes and plans will have to be adapted continuously. As a reference for designing a climate proofing procedure within spatial planning authorities, the tool developed in the CLISP project can be used: *Assessing the Climate Change Fitness of Spatial Planning: A Guidance for Planners*.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|---------------------------------------|---|
| Lead | National / State | – |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Transnational, Regional, Local | Spatially relevant policies, programmes, plans and projects in all sectors |

M1.6 Applying innovative methods and instruments in planning (O1.4)

Flexible adaptation to the dynamic consequences of climate change requires both the consistent and effective application of existing instruments and further development of innovative methods. This is primarily about the advancement of existing instruments and accompaniment with informal instruments in order to reinforce the implementation of objectives and actions. These would include:

- methods of assessing suitability of land for development by applying vulnerability assessments, e.g. screening risk potentials,
- methods of land management, e.g. land-use correlating with climate developments, such as the so-called *temporary building right*,
- the promotion of compact, resilient and resource saving settlements per the principle of internal development before external development and
- the improvement of the existing built environment, e.g. unsealing, green roofs.

Of particular significance are methods for mobilising land designated for development in suitable locations as well as the development of compensation schemes for sharing burdens and benefits.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-----------------------------|--|
| Lead | National / State | – |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Transnational, Local | All spatially relevant sectors |

M1.7 Preparation of guidelines for climate adaptation on regional and local levels (O1.3-4)

Guidelines on planning and implementing adaptive action should be prepared by the supra-local spatial planning bodies in cooperation with representatives of the spatially relevant sectoral planning bodies and sectors for the regional and local levels. The guidelines shall serve as implementation support for decision-makers and actors in regions and local communities and – given that criteria for evaluation have been defined – for supervising authorities for reviewing climate suitability of local and regional planning. Regular updating of contents based on the latest knowledge or changed framework conditions should be ensured.

The guidelines could feature the following content (compare chapter 3 Implementation):

- *Background information*: Description of expected effects of climate change, existing uncertainties and residual risks, tailored to the specific region and based on regional climate scenarios.
- *Action guide for regions and local municipalities*.
Content: Supra-local rules on adaptation by spatial planning and other spatially relevant sectoral planning disciplines; specific strategic consideration for regions and municipalities; recommendations for actions based on existing adaptation strategies; catalogue of actions on regional and local levels naming suitable formal and informal instruments for implementation.

- *Information section:* Instructions on reviewing climate change fitness of existing local and regional planning instruments, methods and examples from other regions, basics and available data, list of relevant contacts and implementation partners, links to climate adaptation initiatives.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-----------------------------|--|
| Lead | National / State | – |
| Moderation | Regional | – |
| Cooperation, Input, Impulse | Transnational, Local | All spatially relevant sectors |

(2) Cooperation across sectors, levels and borders

Mission statements, objectives and instruments of spatial planning support sustainable development and adaptation to climate change in principle. However, the challenges posed by climate change can only be coped with by way of a cooperation of different sectoral planning disciplines. Therefore, apart from spatial planning, sectoral planning bodies and sectoral policies of all spatially relevant or spatially effective economic sectors have to be addressed as cooperating actors. This includes planning and supporting instruments in the following economic sectors: agriculture, forestry, water management, real-estate development and construction, energy, tourism, transport as well as natural hazard management, environmental protection, landscape development and social / technical infrastructure planning.

The successful implementation of adaptive action requires an integrative approach and inter-sectoral cooperation from transnational to local levels. The coordinating competence of spatial planning as an integrative cross-cutting matter should be used to its full potential.

Objectives

- O2.1: Transnational and cross boundary networking for joint activities**
- O2.2: Reinforcing existing and creating new cooperations**
- O2.3: Reinforcing the coordinative role of spatial planning**
- O2.4: Priority of public welfare and reinforcement of individual responsibility**

Options for action, measures

M2.1 Establishing transnational and national multi-level cooperation networks for joint activities (O2.1-3)

By establishing a transnational cooperation network in the Alpine space, synergies can be used, resources pooled and adaptation to the consequences of climate change can be promoted. Apart from the exchange of data, methods, experiences or planning intentions, bases for decision-making in politics can be prepared, and joint projects can be developed along the fields of action of this strategy. In principle, this applies to all fields of action, but it applies in particular to several *general fields of action* such as (3) *Building and transferring knowledge* and (4) *Awareness-raising* as well as cross-border planning and implementation of action on flood, water and erosion protection and the support of ecosystem services (see fields of action (6) (7) (8)). Tasks for the network can include hosting expert meetings, international conferences and the creation of transnational work groups on specific issues.

It could be the role of planning authorities on national and state levels to initiate and coordinate the network, involving actors from different spatial levels, spatially relevant sectors and sectoral planning bodies. Ongoing organisation and coordination can be distributed among the partner countries, e.g. with a periodic change of responsibilities. On a national level and on the level of states, inter-sectoral networking has to be reinforced, preferably as a cell in a transnational network.

Experiences and structures available from previous projects and existing networks should be used as bases (e.g. CLISP, ClimChAlp, PLANALP). The possibility of cooperation (to the point of integration) with existing transnational organisations and cooperation platforms in the Alpine Space has to be examined.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|--|--|
| Lead | Transnational | – |
| Moderation | Transnational | – |
| Cooperation, Input, Impulse | National / State, Regional, Local | All spatially relevant sectors in particular water management |

M2.2 Promotion of regional and intercommunal cooperation (O2.2)

The effects of climate change are not confined by administrative boundaries. Adaptation requires action across and beyond regional and community borders. This includes the exchange of methods and experiences as well as joint planning and implementation of specific action e.g. on protection from natural hazards, in securing and establishing retention areas or cold and fresh air corridors, in singling out and developing suitable locations for industrial areas, shopping centres, infrastructures or large leisure-time facilities.

The experiences and structures of existing cooperation, such as with communal infrastructure regarding social services and individual services, should be used and developed further.

An active cooperation policy requires cities and municipalities to ensure a fair balance between their interests and those of their surrounding communities, and to define cooperation offers. To this end, the large bandwidth of possible forms of cooperation should be used, ranging from informal cooperation, structures organised under civil law, and associations of local communities to institutionalised forms.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | National / State | – |
| Moderation | Regional | – |
| Cooperation, Input, Impulse | Local | All spatially relevant sectors |

M2.3 Incentives for developing and implementing strategies and action on adaptation (O2.3-4)

Supra-local bodies can specifically support the development and implementation of adaptive strategies and action on regional, inter-community and local levels by providing incentives, impulses and financial support e.g. by way of:

- Support in communicating the advantages of adaptation, forward-looking action and the development of resilient structures
- Initiating and co-financing pilot and model projects
- Providing climate-relevant data and basic information (e.g. geo-information, vulnerability analyses), methods and guidelines
- Financial support in preparing adaptive strategies, especially by supporting cooperative approaches
- Non-bureaucratic expertise and consulting, e.g. within a pool of advisors

Moreover, existing funding and subsidy schemes have to be checked as to whether they actually yield positive adaptation effects or rather contain perverse incentives, and they have to be re-oriented according to the objectives of spatial planning and adaptation to climate change (e.g. exclusion of subsidised housing in hazard zones or remote locations).

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-----------------------------|--|
| Lead | National / State | – |
| Moderation | Regional | – |
| Cooperation, Input, Impulse | Transnational, Local | All spatially relevant sectors |

M2.4 Installing climate protection and adaptation officers (O2.2-4)

Wherever this is not yet the case, adaptation officers could be appointed on national, state and possibly also on lower-ranking levels to ensure inter-sectoral coordination of adaptation tasks and to provide input for the implementation of adaptive action. Already existing bodies dealing with climate protection could be extended by the agendas of adaptation. Additional tasks would include networking with spatial planning authorities and other spatially relevant sectoral planning bodies, as well as the organisation of knowledge exchange.

These officers for climate adaptation could take the ownership for climate governance processes as recommended in M1.3 and form the core cell of a transnational network as suggested in M2.1.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|---------------------------------------|--|
| Lead | National / State | – |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Transnational, Regional, Local | All spatially relevant sectors |

(3) Building and transferring knowledge

Knowledge on the possible effects of climate change is the pre-condition for any acceptance of adaptation strategies and implementation of actions.

The production and transfer of knowledge on the effects of climate change, on basics and data, new findings and developments as well as suitable options and methods for adaptation should be given particular attention. The exchange between spatially effective sectors and sectoral planning bodies should be reinforced. This would be a field of activity for the transnational and national networks suggested in action field (2) *Cooperation for improved implementation*.

Decision-makers in politics and administration as well as technical experts should realise where objectives of adaptation meet with their areas of responsibility. In this way, they will be able to link them with specific projects and action within their direct areas of responsibility and daily work.

Preparation, networking and accessibility of knowledge are also very basic prerequisites for any well-founded and serious public relations work. The objectives and actions mentioned here are therefore closely related with action field (4) *Awareness-raising*.

Objectives

- O3.1: Extending the knowledge on impacts of climate change as well as on suitable options for action for adaptation**
 - O3.2: Establishing a knowledge network on climate change**
 - O3.3: Mediating and transferring climate change and spatially relevant knowledge and facilitating access to information**
 - O3.4: Visualisation of spatially relevant climate change impacts**
 - O3.5: Developing suitable strategies and building capacities for coping with uncertainties in active and transparent ways**
-

Options for action, measures

M3.1 Transferring, visualising and documenting expert knowledge (O3.1-4)

In order to deepen the knowledge basis on connections between climate change and space, simulation models should be used to better combine climate and spatial data e.g. degree of built-up and sealed areas, demographic and socio-economic data.

One special challenge is the transfer of expert knowledge. It often requires an intermediate step of “translation” in consideration of uncertainties and socio-economic, legal and political framework conditions in order to get to specific action. While experts on climate change will have to take on the task of providing spatially relevant information and data on climate change to spatial and sectoral planning, spatial planning as a cross-cutting domain could then play the role of an editor-in-chief, interpreting and “translating” the scientific data, as well as additional data provided by spatially relevant sectoral planning. It could also contribute data and knowledge itself, e.g. through ongoing spatial monitoring.

Risks, trends, effects of climate change and successes of adaptation would have to be visualised in clearly understandable depictions (charts, simulations and scenarios) and communicated to decision-makers as the basis of public relations work. The cartographic marking of vulnerable areas and of planning measures for adaptation (such as retention areas for flood prevention) in plans and concepts of spatial planning should be pursued. Useful contents and determinations could be the result of spatial vulnerability analyses, foreseeable changes to hazard zones, residual risk areas.

Experiences and lessons learned in implementing action and applying tools should be documented on all spatial levels and exchanged on inter-sectoral and international levels.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | Transnational | – |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Regional, Local | All spatially relevant sectors |

M3.2 Creation of an information pool on adaptation to climate change in the Alpine space (O3.1-5)

In order to connect actors and transfer knowledge, the transnational network (see M2.1) could establish and operate a transnational internet platform. This umbrella platform could fulfil the role of an adaptation clearing house and be linked with European, national and regional web-based resources. Adaptation officers on national and state levels (compare M2.4) are called upon to contribute content periodically. This platform would also allow the organisation and content related support of meetings and conferences.

The platform could offer the following services and content (this list of possible content is not exhaustive):

- State-of-the-art knowledge on climate change impacts and adaptation in the Alpine Space
- News on climate change, spatial planning, spatial research
- Information and communication on objectives and current state of planning as well as implementation of adaptation strategies
- Open list of adaptive action with practical evaluations regarding efficiency, sustainability and acceptance
- Provision of tools and aids such as guidelines, checklists, e.g. *Assessing the Climate Change Fitness of Spatial Planning: A Guidance for Planners* as produced within CLISP or an adaptation information kit for public relations work and for disseminators
- Documentation of positive and negative examples of climate change adaptation
- Possibility to exchange data such as maps, basic planning data or climate models
- Simulations on climate change in the Alpine space, preferably in visualised forms
- Contact persons / contact points
- Links to other relevant websites and resources on climate change and spatial planning
- Interactive communication offers, e.g. comments, blog, space for free content, ...

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | Transnational | – |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Regional, Local | All climate relevant and spatially relevant sectors |

M3.3 Working with uncertainties (O3.3, 3.5)

Coping with uncertainties with regard to climate change is a particular challenge for planners. A continuous discourse involving all actors could help and identify diverging utilisation requirements to space as well as different perceptions of uncertainties and could then assess the risks caused by such uncertainties. The above-mentioned visualisation of effects of climate change and risks could be a good basis for this dialogue (see M3.1).

The objective of the discourse should be a consensus on long-term goals, on clarifying value and distribution issues (balance of cost and benefit) and the development of approaches and

methods on dealing with uncertainties. This discourse on risk governance is necessary on all levels. However, introduction on a regional level should enjoy priority given the regionally different effects of climate change.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|---|--|
| Lead | Regional | – |
| Moderation | Regional | – |
| Cooperation, Input, Impulse | Transnational, National / State, Local | Climate research, Natural hazard management |

M3.4 Providing work aids (O.3.3-5)

In order to build and enhance professional capacities in implementing adaptive action on regional and local planning levels, supra-local spatial planning and various sectoral planning bodies should provide specific work aids and implementation guidelines. These aids are to facilitate implementation. A “one-stop-shop” at the offices established by the authorities or contact persons responsible for climate protection and/or adaptation (compare *M2.4*), possibly supported by web-based services, could serve as a hub for providing these aids, answering questions, and offering advice and training. This institution should be closely linked with the above-mentioned information pool (see *M3.2*) and should practice a mutual exchange of experiences and findings.

Possible aids would be e.g.: planning guidelines and decision-support tools on adaptation for regional and local planning authorities and planners, a good-practice database, GIS analyses,...

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|--|--|
| Lead | Transnational | – |
| Moderation | Transnational | – |
| Cooperation, Input, Impulse | National / State, Regional, Local | Climate research, Natural hazard management |

(4) Awareness-raising

The consequences of climate change are often only felt in the long run. They are difficult to conceive and communicate on a local level. Moreover, there are still uncertainties about the magnitude and distribution of impacts and actual cause-effect relationships. This is also reflected in controversial coverage of climate change issues by the media. The general lack of problem awareness, existing uncertainties, and the lack of basic data in forms that are usable by planners lead to the fact that spatially relevant aspects of climate change are as of yet rarely taken into consideration in planning processes and decisions. One important task would therefore be to elaborate communication strategies contributing to higher awareness for the space-related effects of climate change and supporting the preparedness to take adaptive action. It should also be highlighted that coping with these challenges requires an integrative perspective as well as partnership-based cooperations between spatial planning and spatially relevant sectoral planning.

The objectives and actions mentioned here are closely coupled with the target-group-specific measures on knowledge generation and transfer as described in action field (3) *Building and transferring knowledge*. The communication approach suggested focuses on activating disseminators that can act as “change agents”, i.e. groups or individuals who can contribute to the broad acceptance of adaptation in spatial planning and raise support for action. For the realisation of communication objectives, the entire range of tools, methods and media of public relations work and communication is available. Only a few examples can be cited here.

Objectives

- O4.1: Communicating the urgency, importance and benefits of anticipatory adaptation to climate change**
- O4.2: Highlighting potentials and possible roles of spatial planning in developing and implementing adaptation strategies**
- O4.3: Activating and supporting key actors for the implementation of adaptive action**
- O4.4: Increasing individual responsibility in coping with risks**

Options for action, measures

M4.1 Developing a communication strategy to promote the implementation of adaptive action (O4.1-2)

The main objective of a communication strategy would be the promotion of adaptation and the support of adaptive action. Efforts could focus on: the communication of spatial effects of climate change, benefits and opportunities of adaptation, the dissemination of possible objectives and actions, synergies, and the need for a partnership-based cooperation between spatial planning and sectoral planning of spatially effective sectors.

On a transnational level – e.g. as the task of a transnational network – a basic communication strategy could be elaborated that would then have to be refined into national and state level communication concepts regarding messages and actions on awareness-raising, as well as project-related communication on a regional and local level. Those concepts would have to be specifically tailored to the respective target groups of key actors and disseminators in the different states, regions or municipalities.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|--|--|
| Lead | Transnational, National / State | – |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Transnational, National / State | All spatially relevant sectors |

M4.2 Motivating key actors on different action levels to act as disseminators (O4.1-4)

One action of a transnational communication strategy as well as of communication concepts on national and state levels could be to motivate spatially effective actors to act as disseminators and “change agents”. The main objective would be to promote integration of climate adaptation into daily planning and project work.

This would primarily aim at activating and informing key policy makers and experts on all spatial action levels – from the transnational to the local level. To this end, methods and activating communication instruments adequate for the relevant spatial level should be employed. It would include decision-makers in politics and responsible technical experts in the administration of all spatially effective sectors and spatially relevant sectoral planning as well as interest groups. Further target groups may also include representatives from the educational sector, e.g. deans of study, and directors from environmentally and spatially related fields.

On regional and local levels, in addition to local mayors and political representatives, representatives of cooperations, associations, NGOs, environmental protection organisations or housing cooperatives could be activated as disseminators. Technical experts and occupational groups active in spatial design, construction or consulting, such as energy farmers, spatial planners or architects should also be targeted.

Comprehensive information, well-prepared material and concrete examples are prerequisites allowing the above-mentioned disseminators to be effective (see also action field (3) *Building and transferring knowledge*).

Spatial planning authorities can contribute valuable impulses. It would be the task of administrative units already responsible for climate change agendas in public institutions and interest groups to directly address these actors.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-----------------------------|--|
| Lead | National / State | – |
| Moderation | Regional | – |
| Cooperation, Input, Impulse | Transnational, Local | All climate relevant and spatially relevant sectors |

(5) Resilient settlement systems and infrastructure

Settlement systems and infrastructures are increasingly under stress and at risk due to extreme weather events such as heat waves, heavy rainfalls, and storms as well as natural hazards triggered by meteorological extremes. The progressing consumption of land for settlement and infrastructure indirectly exacerbates the negative effects of climate change. Spatial planning is called upon to orientate the development of settlements in consistent ways towards the aim of increasing the resilience and robustness of settlement structures and at the same time reducing vulnerability and risk. In many cases, this means more effective implementation of the established objectives and principles of sustainable spatial development.

Objectives

- O5.1: Protecting the health of humans from heat stress and natural hazards**
- O5.2: Resilient, energy-saving and traffic-reducing settlement structures**
- O5.3: Sufficient amount and adequate structure of open, green and blue spaces within settlement areas**
- O5.4: Ensuring cold and fresh air supply for settlement areas**
- O5.5: Maintenance of development options for future generations**
- O5.6: Retreating from land-use with high damage potential in highly endangered areas**

Options for action, measures

M5.1 Developing and stabilising concentrated, mixed and well-landscaped, greened settlement structures (O5.1, 5.2, 5.5)

Developing a resilient structure requires a more effective implementation of established objectives and guiding principles of sustainable settlement development by way of consistent application of spatial planning instruments on all levels.

The goal is to develop compact, appropriately densified and concentrated settlement structures, which in many cases will require the moderate increase of settlement density. In-ward oriented settlement development also requires a balanced mix of land use functions (housing, working, service and supply facilities, recreation facilities, etc.) Concentrated, mixed-use building structures can be protected and adapted more efficiently due to their more compact dimensions. In addition, concentrated structures contribute to saving energy, reducing traffic and thus promote climate protection, thus tying in with the goals of post carbon planning. Settlement extensions, new settlements and densification of existing settlements should primarily be planned at locations that are well connected to the public transport system. Development density should be in accordance with the quality and density of available public transport ca-

pacities and should not exceed set target values. Close coordination between spatial development and public transport infrastructure is necessary in order to develop compact structures.

Any concentration of settlement structures must be balanced with increased provision of green, blue and open spaces within the settlement area, which are required for mitigating heat stress and ensuring urban quality of life (see *M5.4*).

In the legal framework and instruments of spatial planning, climate protection and adaptation should be set forth as essential criteria for the selection of locations, density and design of settlements. Existing potential for concentration should be realized fully, e.g. by determining a constructional minimum density on the local level and by increasing building density on already developed sites.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | Local | – |
| Moderation | Regional | – |
| Cooperation, Input, Impulse | National / State | Transportation, Landscape development |

M5.2 Regulating second homes and holiday residences (O5.2, 5.5)

Some regions or local communities have a high share of second homes and holiday residences (e.g. apartment complexes or extended holiday resorts). They take resources and space that is lost for other types of usage such as housing, business or free areas. They also cause high construction and maintenance costs for public infrastructure. They further reduce the space available for development which is already limited due small remaining space reserves. The negative effects of climate change are exacerbated indirectly.

The new construction of second homes and holiday residences should be strictly regulated and/or limited wherever they do not contribute to stabilising town centres or settlements e.g. by way of reactivating old buildings and filling settlement gaps inside towns.

In addition, strategies dealing with empty or barely used buildings could be developed with the owners, e.g. by way of multiple use, temporary use for cultural and social projects. Needs of the local public, ecological and environmental aspects (green areas and free zones) should be given priority over those of holiday residents.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | Local | – |
| Moderation | Regional | – |
| Cooperation, Input, Impulse | National / State | Tourism, Real-estate development |

M5.4 Developing and maintaining green and blue infrastructure (O5.1-3, 5.6)

The preservation, development and functional design of green, blue and open areas on various scales is a vital measure of spatial and urban planning to support climate adaptation. "Green" infrastructure includes large-scale green space corridors and free landscape areas that should be combined with "blue" infrastructure, i.e. water bodies, their littorals and surrounding areas, including flooding and retention areas. Spatial planning has major steering capacity for determining and securing regional "green zones" and "blue zones", which can act as multi-functional open spaces, supporting fresh air circulation and cooling. To keep these areas free from building activities, spatial planning should determine priority areas (multifunctional open areas, including bioclimatic functions). In addition, it is a vital task of urban planning to develop and maintain a functional network of small-scale green and blue infrastructure within settlement structures and linking them to green and free spaces in surrounding areas (see also action field (8) *Landscape development and ecosystem services*). Horizontal and vertical greening within the built environment may range from urban gardening and parks to the greening of inner courtyards, rooftops, building facades and roadside areas.

A sufficient amount of green areas and volumes, greening of buildings and waterbodies is an adaptation option with multiple benefits because it improves the micro-climate within settlements (higher humidity, cooling), provides recreation areas, enhances the quality of life and wellbeing of urban populations and contributes to the networking of habitats for animals and plants. Such a network requires the combination of isolated, linear and extensive elements. The re-use of brownfield sites (e.g. abandoned industrial and commercial areas, former mining areas) as green, free or water areas should be taken into consideration.

As a starting point, an inventory of existing green, free and water areas should be set up and the status quo ascertained. Based on this data, the desirable final state as well as implementation steps, such as closing gaps in the network, could be defined.

Establishing open areas of sufficient size and adequate functional structure could be supported e.g. by determining minimum dimensions of green areas (green area figure), green volumes or water areas in relation to sealed areas or building land.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|--------------------------------|--|
| Lead | Regional, Local | Urban design, city planning |
| Moderation | – | Landscape development |
| Cooperation, Input, Impulse | National / State, Local | Nature conservation |

M5.5 Promoting shading and accompanying protective action in heat-exposed locations (O5.1-3)

Heat stress has already become more frequent and will continue to increase, especially in urban areas (urban heat island effect). Therefore, it is necessary to identify particularly heat-exposed locations within settlements and to mitigate heat impacts. The network of green and blue spaces as suggested in *M5.4*, in particular the planting of large-crown trees (e.g. avenue trees) at suitable points within a settlement, contribute to reducing the heat impact by increasing humidity and providing shade.

In addition, planning and constructional measures can also contribute to shading. The building regulation plan and technical building codes should be adjusted and properly applied in order to facilitate climatically favourable orientation of buildings, facades and windows, and heat impacts should be considered in architectural design of buildings. Moreover, appropriately densified settlement structures enable the implementation of centralized cooling supply systems.

Heat-sensitive infrastructure such as health care facilities should be identified, and preventive action should be defined (e.g. determining shading zones for sensitive facilities such as old people's residences on a local level). Contingency plans should be elaborated in cooperation with authorities and health care facilities, which can be integrated in the relevant spatial development concepts.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | Local | – |
| Moderation | Regional | – |
| Cooperation, Input, Impulse | National / State | Health care system |

M5.6 Preserving cool and fresh air generating areas and ventilation corridors (O5.1-2)

Areas inside and outside of settlement structures that are particularly suitable for producing cold air and fresh air should be preserved and kept free, in particular to improve bioclimatic living conditions in urban areas and to reduce the increasing heat impact. This could be effected e.g. by assigning appropriate priority zones and outer boundaries for settlement development. Any development or usage detrimental to the generation of a cold and fresh air should be avoided in these zones.

Forests, particularly if they are close to settlements, generate cold and fresh air with a climate-balancing effect. Any assignment of such areas must be made with particular consideration of the requirements of landscaping and forestry (see M8.1-3). Relevant information on urban heat exposure, cool air production, wind situation, fresh air corridors, micro-climatic characteristics etc. should be gathered in cooperation between spatial planning and the relevant technical service offices as well as being taken into account in settlement planning.

Interconnections between air generation zones and their possible flow corridors have to be identified and either have to be kept free from constructive development, or constructions have to be designed in a way not to interrupt the air flow. This can be attained e.g. by orientating the main front of buildings towards the predominant wind direction. Possible storm risks as well as excessive wind loads and nozzle effects should be taken into account when assign-

ning corridors and keeping them free from development. Spatially effective green elements such as hedges and tree groups can be used as accompanying measures to reduce excessive wind loads.

Making use of synergies with other ecological requirements should be the goal, e.g. fresh air corridors can also act as ecological corridors for the migration of species (see also M8.2).

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|---|
| Lead | Regional | – |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Local | Nature conservation, Forestry, Landscape development, Climatology, Meteorology |

M5.2 Re-zoning of existing building land in hazard-prone areas (O 5.6)

For highly endangered settlement areas, re-zoning of existing building land should be considered. Retreating or relocating should be taken into account as the last option, if the efforts required for securing and maintenance are not justifiable. When selecting replacement locations, the aim should be to promote compact settlement structures (see M5.1) with respect to any residual risks e.g. by connecting them to existing settlement areas in non-hazardous areas.

As for settlements in residual risk areas, it should be evaluated whether relocating the settlement in case of any exacerbation of risks due to climate change would be more efficient for all parties involved compared to additional protection measures that would have to be taken. Relocations should primarily be implemented with the consensus of the parties affected. Any intervention with existing constructions requires the use of informal instruments such as agreements under civil law in order to come to a stable consensus.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|--------------------------------|--|
| Lead | Regional | – |
| Moderation | Regional | Natural hazard management |
| Cooperation, Input, Impulse | National / State, Local | – |

(6) Natural hazards prevention

The increasing likelihood of extreme weather events, thawing perma-frost soils and retreat of glaciers will cause an increase in frequency, magnitude and spatial impact of natural hazard events such as floods, avalanches, mudslides, landslides or rock fall in many places. Climate-triggered extreme events are highly spatially relevant, threaten human lives and material assets, frequently cause substantial damage and consequential costs, can significantly affect regional economic growth potentials and confine future development options. Both the change in frequency, severity and other characteristics of natural hazards, as well as the increasing need for defences against natural hazards will lead to higher land demands in the future. This causes a strong need for action by both spatial planning and natural hazard management. In the context of scarce space suitable for permanent settlement activities, high usage density and ongoing land demand for further settlement development in the Alpine Space, spatial planning is called upon to act as an important player to develop resilient settlement structures, keep hazard zones reliably unblocked and secure areas for adaptive action in the long-term. Better coordination of legal frameworks, instruments, protection strategies and practical enforcement in spatial planning and natural hazard management as well as other spatially relevant sectoral planning bodies are all of particular importance. The instruments and concerns of natural hazard management should increasingly be integrated into spatial planning.

Objectives

- O6.1: Integration of climate change risks in natural hazard protection policies and instruments**
- O6.2: Close cooperation between spatial planning and natural hazard management**
- O6.3: Recovering and securing areas for flooding and retention purposes as well as for structural protection measures and keeping them permanently free from development**
- O6.4: Improved risk management in high-risk zones**
- O6.5: Protection of critical infrastructure and prudent decisions about the locations for high-risk and sensitive developments**
- O6.6: Securing and reinforcing the protection function of forests**

Options for action, measures

M6.1 Strengthening the protection from natural hazards in spatial planning and integrating climate change risks into sectoral planning on natural hazards (O6.1-2)

Coping with climate change and consequently changed natural hazard potentials must turn into a priority field of action. Legal foundations and regulations of spatial planning and spatially relevant sectoral planning on the protection from natural hazards should include the influence

of climate change. This requires strengthening hazard protection concepts that explicitly consider climate change in the entire spatial planning system, including by incorporating climate change adaptation in the objectives and principles of spatial planning laws, by stipulating obligatory contents and measures related to hazard protection in regional and local spatial planning instruments, and by concretizing and enforcing stricter prohibitions and restrictions for land use zoning decisions in hazard zones on local level.

On the other hand, changes in hazard potentials caused by climate change should be better integrated in the sectoral planning instruments of natural hazard and flood risk management (e.g. in hazard zone maps), which are a vital planning base for spatial planning. Additional climate change risks could be considered in hazard zone mapping, for example, by adding safety margins to design events (e.g. addition of a “climate change factor” of 15% to the design event in Bavaria), by including recent extreme events and decadal flood variability in statistical calculations of design events, by more frequent updating of hazard zone maps, and by developing more advanced mapping methods that take into account climate scenarios.

Measures and action strategies of natural hazard management should by all means be increasingly incorporated in spatial planning.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | National / State | Natural hazard management |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Transnational | All relevant sector planning bodies |

M6.2 Promoting cross-border and inter-sectoral cooperations in natural hazard management (O6.1-2)

Developing strategies and actions in handling natural hazards often requires cross-border coordination on various spatial levels, because the effects of natural hazards do not stop at national borders. This particularly applies to flood risk management, which requires thinking on river basin scale and, thus, often trans-boundary coordination. Also, protection measures in upstream areas may have detrimental cross-border effects on flood risks in downstream areas. The installation of transnational and national networks consisting of the authorities and institutions responsible for natural hazard management as well as spatially relevant sectoral planning bodies should be useful tools to promote cooperation, coordination and the development of joint strategies (see also action field (2) *Cooperation for improved implementation*). One task of such networks could be the cross-border harmonisation and area-wide preparation of natural hazard zone maps. A shared systematic approach to assess and map hazards would allow an exchange of knowledge respectively experiences and pooling of resources. Comparable natural hazard maps would be an excellent basis for cross-border protection measures.

In addition, intensive coordination between spatial planning and water management would be required in the context of natural hazard management. The scientific benefit from such coordination and the output of the networks (such as tools, methods, basics) should be integrated directly into the local and supra-local planning work.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|---------------------------------------|--|
| Lead | – | Natural hazard management |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Transnational, Regional, Local | Water management |

M6.3 Securing areas for flooding and retention purposes as well as for other protection measures against torrential processes (O6.1, 6.3-4)

The recovery or preservation of river systems in a close to nature state is one key component of passive flood protection. Any renaturation of rivers should consider the natural dynamics of runoff areas and their possible changes caused by climate change. Therefore flooding and retention areas should be identified and defined by sectoral water protection and management planning bodies on a superior level, in consideration of the risks implied as a result of climate change. In a next step, spatial planning should designate such areas in spatial plans, particularly on the level of regional planning, and keep these areas free from incompatible usages. Any designation of these areas might require the introduction of new planning measures, such as “priority areas for flood prevention”. This passive flood protection must be completed by the designation of areas needed for active (structural) protection measures (such as areas for flood-control dams), which are to be kept free from other development. Apart from flood protection, any overall perspective should also integrate protective action against natural hazards such as mudslides, avalanches and rockfalls. All protective action should be evaluated according to the principle of economic appropriateness in comparing cost and benefit arguments. The harmonisation and coordination of hazard zone maps mentioned in *M6.2* would be a sound basis for any long-term cross-border securing of areas by spatial planning. Securing areas for flood protection often creates unequal situations for upstream and downstream local communities. Therefore inter-municipal strategies and measures for flood protection should be used and promoted more.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | National / State | – |
| Moderation | – | Natural hazard management |
| Cooperation, Input, Impulse | Local, Regional | Water management |

M6.4 Restricting building land allocation and construction activities in hazard zones and areas needed for protective measures (O6.3-5)

Areas at risk due to natural hazards or required for flood runoff, retention or protective measures should be kept free from building land allocation and new development projects (including transport infrastructure) compromising the protection from natural hazards. This requires integrating hazard zone maps and designated flood runoff areas into spatial planning laws in a transparent and legally binding manner and to specifically define their legal consequences for building land allocation and zoning decisions, e.g. bans or restrictions on allocating building

land. Hazard zones should be included in spatial plans and planning processes on the local level and should be taken into consideration in a binding form in land use planning and during constructing buildings and infrastructure. Future development should be diverted to non-hazard areas. Exceptions should be reviewed under the aspects of climate change. Only in case of justifiable, transparent grounds should allocation of building land be allowed. In many places the re-allocation of allocated yet undeveloped building land (allocation status) in hazard zones is already applied in practice and should be reinforced.

Apart from regular updating, legally binding hazard zone plans should include the additional risks caused by climate change. The visualisation of residual risks, i.e. the damage risks in case of any failure of technical protection measures or in case of hazard events exceeding the design event should contribute to raising the awareness of local planning authorities and land owners. Apart from the development of well-structured, resilient settlements, this also helps to raise awareness about risks and strengthen individual responsibility of land owners.

In the interest of public welfare, relocation of individual buildings or severely endangered settlement areas should be taken into account as last option, if they obstruct a cost-efficient, large-scale protection measure and cannot be protected with justifiable efforts. This might yield national economic advantages in the long-term. It would require the development of suitable compensation models (*see also M5.6*).

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | National / State | Natural hazard management |
| Moderation | Regional | – |
| Cooperation, Input, Impulse | Local | – |

M6.5 Identifying and protecting critical infrastructures and endangered building stock (O6.5)

The authorities responsible for natural hazard management should identify critical infrastructures (e.g. technical infrastructures such as streets, bridges or energy supply facilities and endangered building stock) in cooperation with spatial planning on the basis of risk or vulnerability analyses. Social developments with direct impact on vulnerability or damage potential such as the demographic change or an on-site increase in real estate value should be taken into account. The methods and tools on vulnerability analysis provided under the CLISP project could be used as supporting elements (*see www.clisp.eu*). The results of vulnerability analyses can work as foundation for risk-differentiated allocation planning, allowing the determination of categorised usage intensities in danger zones according to the relevant potential for damage. This should be used for prudent location decisions regarding land-use and development with high damage potential and for timely preventive action to protect endangered building stock and infrastructure.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | – | Natural hazard management |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Region, Local | – |

M6.6 Stabilising and improving the protection function of forests (O6.6)

The preservation of protective forests is of particular importance as a consequence of increased demand for protection of usages with high potential for damage from natural hazards. Climatic stress impairs the functions of the forest, especially the protective function.

Therefore the functionality of protective forests should be stabilised by way of forest maintenance and melioration measures, in particular in the sub-Alpine fringe zones of forests, and by avoiding damaging impact of adjacent usages. On the other hand, an extension of protection forests – especially in the subalpine timberline-area and in extensively used agricultural areas – should be considered if there is local demand for it, since settlements occupy more and more areas. However, these designations have to be accorded with demands on landscape appearance or those of sensitive forest edges with special biodiversity.

Forest areas particularly suitable to protect from natural hazards and erosion and forests that might have this function in the foreseeable future should be identified, marked, their stock protected, e.g. in regional plans by marking priority zones and protection zones, and their protective function should be secured by targeted forest management measures. This requires the close cooperation of spatial planning, forestry and natural hazard management. Requirements of other sectors or sectoral planning bodies such as water management and energy sector should be included in all considerations. The use of synergies should be made possible, e.g. an extension and enhanced functionality of protective forests will also lead to improved water retention.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|---|
| Lead | – | Forestry |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Regional, Local | Natural hazard management, Water management, Energy sector |

(7) Integrated water resource management

The projected temperature increases as well as the changes to precipitation patterns influence the entire water balance of ecosystems. Obviously, all stages of the water cycle are highly sensitive and directly influenced by climatic changes, and any impacts on the hydrological system have cascade effects on a wide variety of societal water usages. This affects water supply and water usages of a multitude of sectors relevant to spatial development. On the one hand, the risk of floods increases, while on the other hand some regions see a trend towards dry periods, especially during summer months, leading to an increased risk of droughts as well as water supply shortages. Therefore the sustainable usage and management of water resources is equally important as flood protection (see action field (6) *Natural Hazards Prevention*). To guarantee affordable infrastructure provision, compact settlement structures are a key factor (see action field (5) *Resilient Settlement Structures*). This requires the close cooperation of spatial planning and spatially relevant sectoral planning bodies, especially in the field of water management. The objective is to include considerations on surface and ground water systems in planning processes and to develop interdisciplinary, cross-border action.

Objectives

- O7.1: Securing fresh water, drinking water and service water supply**
- O7.2: Protecting groundwater resources and supporting groundwater regeneration**
- O7.3: Maintaining and improving water storage and infiltration capacities of soils**
- O7.4: Closer integration of water management and spatial planning instruments**
- O7.5: Improving cooperation between spatial planning, water management, agriculture and energy sector**

Options for action, measures

M7.1 Reinforcing the protection of groundwater resources and drinking water zones (O7.1-2)

In many regions of the Alpine Space, climate change will lead to more frequent dry periods and droughts. Decreasing precipitation amounts during summer and higher evaporation will contribute to reduced groundwater renewal rates, lowering groundwater levels and regional depletion of groundwater resources. In particular in regions and during times when reduced water availability coincides with rising water demands of society, including the demand of sectors such as agriculture, tourism, households, and industry, water supply shortages are foreseeable. Besides, higher water temperatures and more frequent heavy precipitation events may negatively affect water quality. Therefore, a foresighted approach should be taken to secure water reserves over the long-term. Groundwater resources and drinking water extraction zones should be designated as water protection zones in spatial plans and/or existing protec-

tion zones should be extended and effectuated on a regional level, including an anticipatory consideration of changes to the water balance and groundwater bodies induced by climate change. Constructional activities as well as land uses with potentially negative impacts on usable groundwater supply and water quality should either be prohibited or restricted in these protected zones.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|---|
| Lead | – | Water management |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Regional, Local | Agriculture, Resource management, Forestry |

M7.2 Integrating water management concepts and plans into instruments of spatial planning and vice versa (O7.1-2, 7.4-5)

Particularly in areas prone to water scarcity, the influence of current and future water-intensive land uses and developments on water demand has to be considered in water management concepts. In this, spatial planning can take on a moderating and coordinating function, making cooperation between spatial planning and water management and reciprocal coordination of their planning instruments essential. In some countries where appropriate instruments are not available yet, introduction of integrated water management concepts should be considered. Foreseeable changes induced by climate change (e.g. changes to seasonal water availability) as well as water demands of several sectors, such as agriculture and forestry, the energy sector, industry, tourism, and settlement development, that have great influence on water usage, should be taken into account. Areas with high water storage capacity (e.g. certain forest areas) or with an important role in the water-ecological system (in particular riverside forests and wet areas) must be integrated into the big picture. A contingency plan for dry periods (e.g. regional regulation of water consumption) can also be a component of integrative water management concepts. Measures for flooding and retention areas, water retention basins as well as the protection zones for groundwater and drinking water resources mentioned in *M7.1* should be part of integrated water resource planning. As part of mainstreaming climate adaptation in sector policies, such a concept should be prepared together with the water management plans as required by the European Water Framework and Floods Directives (European Commission 2000, 2007) and / or in parallel to water body development concepts. These concepts should be used as planning basis by regions and local communities in their spatial planning decisions and lead to a more restrictive examination and approval practice for water-intensive land-uses in areas susceptible to dry periods.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|---|
| Lead | – | Water management |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Regional, Local | Natural hazard management, Forestry, Energy sector |

M7.3 Reducing the growth rate and degree of soil sealing (O7.2-3)

Land use changes, particularly soil sealing, contribute considerably to changes in the hydrological system. Avoiding sealing of soils wherever possible leads to better infiltration of water, enhances groundwater renewal, relieves drainage and sewer systems, and reduces the risk of floods, especially flash floods. Another advantage is the lowering of heat impacts, especially within agglomerations. Therefore the new development of built-up and sealed areas should be reduced to a necessary minimum, e.g. by increasing building density, limiting new building land allocations, and promoting re-development of brownfield sites. This fully corresponds to the objectives of sustainable spatial development and economic use of land resources and thus offers multiple benefits to climate adaptation (see action field (5) *Resilient settlement systems and infrastructure*).

Large commercial and industrial areas respectively transport infrastructures should be implemented with as little sealing as possible. On local and site level, suitable regulations have to be put in place that restrict new sealing and reduce the degree of sealed surfaces within already developed areas. Various opportunities for unsealing sealed surfaces exist, e.g. by replacing impenetrable surface covers with layers that allow infiltration of water. On a supra-local level, appropriate provisions can be defined, e.g. by determining a maximum degree of sealing. In supra-local planning documents, areas can be designated as important to maintain regional infiltration capacity, e.g. areas with regional relevance for groundwater regeneration or water retention (see also *M7.1* and *M7.2*).

As measures for soil protection are also part of environmental protection and sustainable land use management, some synergies can be exploited in this regard. In a concerted course of action, measures on soil protection should be coordinated with spatial planning, forestry and water management.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | Local | – |
| Moderation | Regional | – |
| Cooperation, Input, Impulse | National / State | Water management, Nature conservation, Landscape development, Transportation, Agriculture, Forestry |

M7.4 Reducing soil compaction caused by winter sports(O7.2-3)

The water infiltration and storage capacity of soils is considerably reduced by soil compaction. Skiing slopes in particular can lead to a clearly noticeable compaction of the soil. Spatial planning can influence the locations and dimensions of skiing areas. Existing skiing tracks should be re-dimensioned under the aspect of the expected climatic changes.

When defining new possible locations for winter sports infrastructure, suitable drainage capacities must be a serious consideration in order to reduce the risk of floods or flash floods. Accompanying measures for the reduction of soil compaction should be defined for both planned and existing skiing slopes, e.g. soil-conserving construction and operation.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | Regional, Local | – |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Transnational | Water management, Agriculture, Tourism, |

M7.5 Promoting decentralised rainwater management (O7.3-4)

The suitable drainage and retention of rainwater as well as the infiltration capacity of the soil are of particular significance for the reduction of flash flood risks, to relief sewer systems and to secure water supply for the vegetation – especially in areas with high amounts of sealed soils degrees. Suitable corridors for rainwater drainage as well as areas for rainwater retention basins should be secured and kept free. Rainwater runoff corridors are particularly important to avoid flood damages in settlement areas, because due to growing rainfall intensities there is an increasing threat that urban sewer systems are overloaded. In addition, in view of heavier rainfall events the capacities of sewers within settlement areas should be adapted. Rainwater can also be stored for cooling and irrigation purposes, which would reduce the consumption of groundwater.

Sufficient vegetation on buildings and within settlements e.g. by greened areas and trees contribute to increased water saving capacity, relief the sewer systems and produce positive micro-climatic effects due to higher humidity and shading. Therefore the greening of the built environment must be reinforced (see also M5.4).

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-----------------------------------|--|
| Lead | Local, Regional | – |
| Moderation | National / State, Regional | – |
| Cooperation, Input, Impulse | National / State | Water management, Nature conservation |

M7.6 Coordinating water usage with the requirements of agriculture (O7.4-5)

The expected changes in water availability and the increasing probability of dry periods require appropriate adaptation of water usage for agricultural purposes. Especially in regions already under water stress and during drought periods in summer, increasing water consumption for artificial irrigation may cause additional conflicts over water use. Agriculture is increasingly confronted with the requirement of adaptive climate action. Examples would be water-saving irrigation technologies, agro-technical measures such as a reduced intensity of cultivation to save water reserves, earlier sowing times, choice of more drought-resistant crop species and varieties (e.g. early ripening sorts to avoid heat / dry periods), reducing sowing quantity per square-meter, adaptation of plant protection and fertilisation measures.

With production conditions becoming increasingly more difficult for agriculture, especially in crop and vegetable farming, the importance of securing agricultural priority zones with instruments of spatial planning is increasing.

A coordinated adaptation option would be the forward-looking regional and local determination of water retention basins for the irrigation of agricultural areas susceptible to dry weather. This measure should aim at the use of synergies (e.g. keeping water retention basins unblocked, which also protects from natural hazards) and could be integrated in the above-mentioned water management concepts (see *M7.2*).

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | – | Agriculture |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Regional, Local | Water management |

M7.7 Coordinating water usage with the requirements of the energy sector (O7.4-5)

In order to mitigate climate change, the demand for renewable forms of energy is increasing. On the one hand, changes to river runoff regimes as well as to water availability for high-alpine reservoirs will alter hydropower production capacities, with the hydropower potential decreasing during summer and spring in many regions. On the other hand, more distinct low water levels in summer and rising water temperatures will also limit the availability of water to cool energy supply plants. These seasonal bottlenecks in water availability may threaten future security of energy supply. Thus, there is a strong need for spatial planning to consider climate change-related energy issues more closely in development planning. A tangible contribution of spatial planning to adaptation of the hydro-energy sector could be to support water retention capacities of the landscape by making appropriate determination in the instruments of spatial planning, which would help levelling out the volume and level of water in rivers. When singling out locations for energy supply plants, especially water power plants, the future availability of water and aspects of water protection have to be taken into account.

According to the European Water Framework Directive (European Commission 2000), invasive action on water bodies should be reduced, and water resources should be used sustainably.

The disposal of heated cooling water from energy plants into surface water bodies should be reduced, since global warming already puts great pressure on the ecology of these water bodies. The requirements of the energy sector call for spatial coordination of water usage with other sectoral planning bodies and sectors, especially water management and agriculture (see *M7.6*) by spatial planning (see also *M8.6*).

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | – | Energy sector |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Regional, Local | Water management, Agriculture |

(8) Landscape development and ecosystem services

The sensitive Alpine ecosystems are under particular pressure due to a diversity of anthropogenic influences (e.g. land use change, land consumption, habitat fragmentation, habitat degradation). These existing pressures on ecosystems are exacerbated by impacts brought about by climate change. Up- and northward shifts of ecotones, invasions of alien species, and multiple climatic stresses on animal and plant communities threaten to increase species extinction rates and cause additional biodiversity loss. Moreover, changes to soils, water balances, and other impacts on natural systems adversely affect the life-sustaining ecosystem services that society and many economic sectors of spatial development rely upon. Agricultural production, water supply and retention, protection against natural hazards and erosion by forests, etc. are only some of the essential services Alpine ecosystems provide to society. Ecosystems as the essential basis of life must be strengthened in their ability to adapt by way of sustainable landscape development (landscaping, landscape conservation). Sustainably managing, conserving and restoring ecosystems so that they continue to provide the services that allow people to adapt to climate change is also known as ecosystem-based adaptation. This approach generates a range of social, economic and cultural benefits and helps to conserve biodiversity. A diverse, ecologically functioning landscape, including protection of close-to-nature areas, is the backbone of any resilient spatial structure. Spatial planning should make use of and support ecosystem-based adaptation.

Objectives

- O8.1: Supporting ecosystem-based adaptation**
- O8.2 Preservation and restoration of ecological landscape connectivity on various scales**
- O8.3: Securing sufficient space for nature**
- O8.3: Protection of riverside forests and wetlands**
- O8.4: Coordination with agriculture, forestry and the energy sector to preserve and restore resilient ecosystem services**
- O8.5: Stabilizing important functions of forest ecosystems**

Options for action, measures

M8.1 Preservation of large-scale, not fragmented green areas (O8.1-3)

Close to nature habitats of sufficient size and with a low degree of any human disturbance are crucial to species survival. Large, connected nature areas not yet severely affected by human disturbances and not fragmented by any settlement activities and infrastructure should be maintained as such. Due to their extension, these areas, offer retreat for endangered species and allow regeneration of populations that are under increasing climatic stress. They support autonomous adaptation processes in ecosystems and provide more leeway for other future adaptation options. They are therefore central pillars of any stable ecosystem (see also M5.4). If these green areas also qualify as multifunctional open spaces e.g. because they in-

clude cold and fresh air generation areas (see *M5.6*) as well as riverside forests and wetlands (also serving as carbon reservoir), they deserve special protection.

Even if such large un-dissected and undeveloped areas are not yet protected under nature conservation law, spatial planning should secure these areas by way of binding and long-term determinations that prevent any zoning of building land on a supra-local level (e.g. by suitable priority and protected areas in regional plans, that require obligatory compliance in local land use plans). In these areas, any further dissection by transport and other infrastructure has to be avoided, including by rigorous application of SEA and EIA for any development projects.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|---|
| Lead | National / State | – |
| Moderation | Regional | Nature conservation, Landscape development |
| Cooperation, Input, Impulse | Local | Nature conservation, Landscape development |

M8.2 Preserving and restoring large-scale ecological corridors (O8.1-3)

Habitat fragmentation is recognized as a main driver of biodiversity loss. It also prevents autonomous adaptation processes in ecosystems because migration of species according to shifting climatic conditions is massively hampered. Strengthening the ecological functions and resilience of ecosystems requires large-scale green and open areas to be networked on a regional, supra-regional, and often transnational scale. Spatial planning has a key role in securing the preservation of existing ecological corridors and in avoiding any further fragmentation. It can also support the restoration of such ecological infrastructure by facilitating re-connection of disrupted corridors (e.g. accompanying planning measures for faunal and greenway passages over roads and railway lines) and by helping to improve their functionality for migrating species via appropriate land use management. Spatial planning has to facilitate the preservation and restoration of sufficiently wide and ecologically functional corridors by determining priority or preservation areas in spatial planning instruments to keep these corridors free from any building activities in a binding and long-term way.

Similar to large-scale, not fragmented open areas (see *M8.1*), ecological corridors often act as multifunctional areas that can deliver many co-benefits, especially in an adaptation context. For example, rivers and their surrounding areas (3 to 7-times the width of rivers) would be suitable as veins of life that function as ecological corridors and at the same time deliver flood protection. Spatial planning will be responsible for designating ecological corridors in regional and supra-regional planning instruments, including their binding implementation on the local planning level.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|---|
| Lead | National / State | – |
| Moderation | – | Nature conservation, Landscape development |
| Cooperation, Input, Impulse | Regional, Local | Nature conservation, Landscape development |

M8.3 Implementation of a small-scale structured network of green, blue and open areas (O8.1-3)

Locally networked green and free areas as well as water bodies within agricultural and settlement areas are an ideal completion of large-scale, undivided green areas (see *M8.1*) as well as ecological corridors (see *M8.2*). On the one hand, these networks allow the preservation of biodiversity and offer small-scale backup areas for endangered species. On the other hand, these natural landscape elements improve the micro-climate (see *M5.4*), landscape aesthetics and the recreational quality of the landscape. Such a network should be secured by the appropriate use of spatial planning instruments on a local level, aiming for keeping these areas free from building activities.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-----------------------------------|--|
| Lead | Local | – |
| Moderation | – | Nature conservation |
| Cooperation, Input, Impulse | National / State, Regional | Nature conservation |

M8.4 Conversion of brownfields and abandoned housing areas to green, blue and open areas (O8.1-3)

Brownfield recycling, i.e. the re-development of previously used, but currently abandoned sites for settlement and industrial purposes, is a major strategy for reducing new land consumption. However, their conversion back to “greenfield” land is an option that should be considered more strongly in an adaptation context. Abandoned industrial and settlement areas (brownfield sites) should be re-used more often as green areas or water bodies, if possible, unless they are suitable for energy production, concentration of building structure, or other purposes in support of adaptation goals. These abandoned areas should be identified on the local level (e.g. land register of abandoned areas) and re-development options weighed against the benefits of restoring them as natural areas. Abandoned areas in particular can have an important compensatory function e.g. for densely developed areas. Their usage and design as green areas or water bodies should definitely be given priority wherever possible (see also action field (5) *Resilient settlement systems and infrastructure*). As an additional benefit, they offer public recreational space and could be integrated in the small-scale free space network as recommended in *M8.3*).

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | Local | – |
| Moderation | Regional | – |
| Cooperation, Input, Impulse | National / State | Nature conservation, Real-estate development, Energy sector |

M8.5 Support by agriculture in developing a resilient spatial structure (O8.4)

Depending on the situation of an agricultural area, it must be reviewed to what extent it is suitable for integration into an ecological network or corridor. In sensitive zones e.g. high nature value farmland within an ecological corridor (see M8.2), agricultural usages should be subject to spatial coordination with ecological requirements and demands of other sectoral planning disciplines (particularly water management, natural hazard management, energy sector). Such a multi-functional agriculture should be supported by accompanying measures (e.g. securing areas for protection from wind erosion, also used for the small-scale networking of ecological areas). In many cases, optimizing the multifunctionality of agricultural areas will mainly require adjusting agricultural practices and managing agricultural land in ways that also serve objectives of other sectors (cross-compliance), e.g. by preserving or re-introducing close to nature landscape elements. This requires on the one hand re-adjusting instruments and subsidies of agricultural policy so that they allocate incentives correspondingly. On the other hand, spatial planning should coordinate the different requirements and spatial development and ensure that areas needed for landscape development measures remain available as such. Agricultural areas suitable as green areas or forests can be reviewed and marked, if applicable (e.g. in land use plans).

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|---|
| Lead | – | Agriculture |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Local | Water management, Natural hazard management, Energy sector |

M8.6 Coordinating the requirements of ecosystems and free space with renewable energy production (O8.4)

The increasing demand for areas for renewable energies in the context of mitigation of climate change must not shift into compromising other goals of sustainable development and adaptation to climate change. This would be the case if, e.g., the location of energy production plants conflicted with fresh and cold air supply areas of an agglomeration, or if bioenergy crops were being farmed far away from the energy production plants, or if the production of energy crops caused disproportionate water consumption.

Therefore, priority areas for renewable energy production should be identified, their location, dimension and suitability evaluated as to possible adverse impacts on sustainability, spatial development and adaptation goals, and then designated in spatial plans on a regional level. Other adaptation priorities should be closely considered before taking any decisions on future land use. Any impairment of wetlands and riverside forests must be avoided (e.g. by leaving enough room for safety buffer zones). The trends in the energy sector require continuous adaptation (e.g. new forms of energy production with a high level of space consumption). Identifying, assessing and determining priority areas suitable for renewable energy production should become one of the main tasks of spatial planning. Competing or conflicting requirements can be coordinated by and between spatial planning and the energy sector, by adap-

ting existing approaches of energy planning into a spatial renewable energy concept on supra-local and regional levels.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|---|
| Lead | – | Energy sector |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Regional, Local | Nature conservation, landscape development |

M8.7 Securing and strengthening important forest functions (O8.4-5)

Forests fulfil many useful ecosystem services that make important contributions to climate change adaptation: protection from natural hazards, protection from erosion, supply of cold air, fresh air and drinking water, water retention, favourable regulation of bio-climatic conditions in areas susceptible to dry weather and heat stress. At the same time, forest ecosystems in the Alpine Space are increasingly under pressure from climatic stress. Securing the important functions provided by forests to the public requires reinforced cooperation by different sectors, e.g. via appropriate forest management, water management and landscaping determinations (for example by way of protected zones). In countries where specific planning instruments exist within the forest sector, these instruments should be better coordinated with spatial planning. For example, from the perspective of spatial planning it would be important that instruments of forest function planning not only consider existing built-up land, but also allocated, but not yet developed building land as well as future spatial development goals.

Areas suitable for reforestation - in order to secure the required forest ecosystem functions - must be marked as such (e.g. in land use plans or technical forestry planning) and have to be kept free from other usages as far as possible, by way of restrictions imposed by spatial planning. In sub-Alpine forest fringe zones (around the timber line) and intensively used agricultural areas, the protection performance of forests should be strengthened in particular (*see also M6.6*). These determinations, however, have to be adjusted to sensitive forest fringes where biodiversity is particularly rich as well as to other goals of landscape development. The requirements of energy production, water management and agriculture also have to be taken into account. Spatial planning could take a stronger coordination role in this regard in the future.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | – | Forestry |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Regional, Local | Energy sector, Agriculture, Natural hazard management, Water management |

(9) Reorientation of tourism

Tourism (especially winter tourism) is of high economic importance in many regions of the Alpine space. Due to reduced snow reliability especially at lower altitudes and in southern Alpine areas, thawing perma-frost soil, retreating glaciers, higher risks from natural hazard events, increasing heat exposure in summer – to just mention a few consequences of climate change – spatial adaptations of tourist infrastructure have become necessary. Apart from adverse effects, climate change might also create new opportunities, e.g. due to extended seasons for summer tourism and competitive advantages compared to other European summer tourism destinations. All this will require a reorientation of the tourism sector in the Alpine Space. Spatial planning and regional development are suitable tools in supporting the transformation process in tourism and to mediate between different spatial requirements.

Objectives

- O9.1: Adapting vulnerable tourist infrastructure to climate change impacts**
- O9.2: Coordination of spatial requirements of tourism with other spatial developments (especially settlement development)**
- O9.3: Diversification of offers in tourism**
- O9.4: Tourism offers adapted to natural conditions and sustainability requirements**

Options for action, measures

M9.1 Marking and adapting vulnerable tourist infrastructure (O9.1-3)

Tourist infrastructure may be vulnerable to climate change due to dependency on snow reliability, high water demand, or growing exposure to natural hazards. Tourist infrastructure with a high degree of vulnerability due to climate change should be identified and marked (e.g. in a spatial concept for tourism). The same applies to infrastructures exacerbating the effects of climate change (e.g. high water consumption, highly compacted soil on skiing slopes). Options for action for vulnerable tourist facilities that provide protective measures against natural hazards as well as options for alternative usages (e.g. as green areas) or shifts of usages (e.g. from snow-based winter offers to summer offers or snow-independent year-round offers) have to be taken into consideration. This should also include a review of the transport infrastructure required for tourism.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | – | Tourism |
| Moderation | National / State | – |
| Cooperation, Input, Impulse | Regional, Local | Natural hazard management, Transportation |

M9.2 Implementation of integrated spatial planning and tourism concepts (O9.1-3)

Concepts for tourism should aim at the diversification of offers for tourism and at exploiting opportunities created by climate change. The aim is a form of tourism adapted to future climatic conditions and adjusted to the natural conditions, with a careful development of available infrastructure. New infrastructural offers for winter and summer tourism should be primarily developed in the vicinity of already existing offers of the leisure-time and tourist industries. In case of a loss of significance of tourism as a consequence of climate change, especially at lower altitudes, or in case of demand for tourist facilities in other locations, forward-looking strategies for alternative usages of tourist infrastructure and/or areas have to be considered by with actors of spatial planning.

The objectives and criteria of spatial planning have to be integrated as content into concepts of tourism. Apart from the development of the above-mentioned strategies, the optimal determination of locations for tourist infrastructures and attractions can be jointly elaborated. The situation of traffic infrastructure and how tourist mobility is to be dealt with must also be taken into consideration. An ongoing close cooperation between spatial planning and tourism should be established.

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|--------------------------------|--|
| Lead | – | Tourism |
| Moderation | Regional | – |
| Cooperation, Input, Impulse | National / State, Local | Tourism |

M9.3 Developing strategies to deal with increasing pressure by tourism at higher altitudes (O9.1-2)

As a consequence of reduced snow reliability at lower altitudes and increasing heat exposure in agglomerations, the demand for tourist offers at higher altitudes will increase both in summer and winter. High-altitude ecosystems are, however, among the most ecologically sensitive in the Alps. Moreover, any communities located at higher altitudes have very little space suitable for settlement activities, which will be further reduced by the consumption of land by housing and other developments as well as for adaptive action due to climate change. Therefore a forward-looking area management has to be practised for foreseeable, additional demands of tourism e.g. by designating both protection and suitability zones for tourism. As a matter of principle, nature conservation should be given priority in high-Alpine locations, and zones suitable for touristic development should be restricted to locations where this is justifiable under the aspects of sustainability and ecology.

Decisions regarding locations for additional tourist infrastructure should be made after joint coordination efforts of the municipalities at an early stage and on high quality decision-making bases, e.g. expert reports on ecology, hydrology, landscape aesthetics. It must be obligatory to assess potential effects on nature and the environment as well as on the local and regional economic development, including any effects of additional transport infrastructure and traffic, by applying EIA and obtaining prior approval by nature conservation authorities .

Requirements of tourism have to be harmonised with the requirements of spatially relevant sectoral planning such as water management and forestry as well as various interest groups.

Forward-looking strategies for other or new focuses have to be developed for regions or communities at lower altitudes in case of a loss of viability and significance (especially regarding winter tourism).

| | Spatial planning | Sectoral planning and spatially relevant sectors |
|-----------------------------|-------------------------|--|
| Lead | National / State | – |
| Moderation | – | Tourism |
| Cooperation, Input, Impulse | Region, Local | Water management, Forestry, Nature protection |

3. Recommendations on the implementation of the Transnational Strategy for Climate Proof Planning

The present Transnational Planning Strategy (TPS) covers a range of possible actions for adaptation to climate change in the Alpine Space. The TPS highlights the necessity of adaptation as a future priority field of action of spatial planning and shows the possible roles for spatial planning in the adaptation process, whilst also addressing other planning sectors. The actions and measures presented in chapter 2 *Guidance for action* require implementation by the individual states and countries and will then have to be specified further on regional and local levels. This chapter includes suggestions on how to convey the content of the TPS as well as pointers on implementation and evaluation.

3.1 Communicating the TPS

The TPS supports the aims of European spatial development and climate change adaptation policies and should be communicated to the relevant EU institutions (e.g. European Commission and Committee of the Regions). Moreover the strategy contributes to achieving the aims of the Alpine Convention and the Action Plan on Climate Change under the Alpine Convention. The Parties to the Alpine Conference as well as the Permanent Secretariat of the Alpine Convention are invited to consider and implement the recommendations contained in the TPS. Existing networks within the EU and the Alpine space (e.g. PLANALP) should also be approached to spread the Strategy. Future projects within the ETC Alpine Space Programme are invited to further capitalise on its contents.

Communication on national and regional levels could be put into more concrete terms as follows:

- Translation of the TPS into the Alpine languages
- Further dissemination and transfer of the TPS and its concerns via the professional networks of all CLISP project partners and observers, including the stakeholders in the CLISP model regions and via further briefings of policy- and decision-makers
- Publication and placement of the TPS in the spatial planning offices as well as public offices of relevant sectoral institutions (including offices or individuals responsible for climate change issues)
- Presentation of the TPS in spatial planning authorities and agencies, relevant sectoral departments, regions and local communities as well as relevant representative organisations (e.g. chamber of commerce)
- Dissemination of the TPS and the CLISP project on various websites dealing with climate change and websites of relevant spatial planning offices including mutual linking
- Publications on the TPS and its concerns in professional journals, newsletters etc. dealing with the topics of climate change, spatial planning and regional development
- Public round table discussions based on the TPS

- Communication of the TPS and the results of the CLISP project to other ongoing projects and initiatives
- Organizing further conferences on the issue of climate change and spatial planning
- Integrating the TPS and its concerns in training and teaching activities, including in training for spatial planning professionals, university lectures, summer schools

Suitable sectoral bodies from the relevant nations and countries should be motivated and given advice on how to ensure a strategic dissemination of the TPS's content as well as the required networking with important stakeholders. In this regard, it would be particularly advisable to use the available networks of actors. The content communicated should be customised to the relevant spatial level and target group in order to find a common language.

Elements and experiences of risk communication from the CLISP project can be used on all levels:

- Adjustment of information and communication tools according to the spatial level (e.g. on a local level, local aspects have to be highlighted) and target groups (e.g. direct interviews or interactive involvement of experts, stakeholders and affected parties)
- Use and development of existing participation processes
- Transparency of horizontal and vertical communication (e.g. content, objectives, results)
- Open and flexible approach
- Adjusting to the requirements of the relevant target groups
- Awareness raising and knowledge transfer to local actors
- Talking frankly and openly about uncertainties resulting from climate change, also
- Where the public is involved
- Visualisation of effects of climate change as one basis of communication (e.g. on charts and maps)
- Simple depiction of available adaptation options
- Pointers on implementation on national, regional and local levels
- Strong political backing and involvement of regional stakeholders is indispensable

Process on comprehensive national and regional adaptation strategies

The driving forces behind the development of comprehensive national and regional adaptation strategies could be the spatial planning offices in cooperation with the service offices of the spatially relevant sectoral planning divisions. Adaptation in spatial planning should ideally be embedded in comprehensive, cross-cutting climate adaptation strategy and governance processes. Spatial planning should be incorporated as a strategic action field in national and regional adaptation strategies, with interfaces and coordination needs towards other sectors being explicitly addressed. Initiating a climate change governance process requires involving stakeholders and spatially relevant actors from all sectors as well as the public early in the process. Findings on climate change, action campaigns and implementation steps on adaptation should be jointly reflected, developed and integrated into the strategy process. The transnational exchange of experiences and results could yield additional added value.

Mainstreaming climate change adaptation in spatial planning and relevant sector policies

Most Alpine countries have national spatial development policy concepts. Since adaptation to climate change is a comparatively new policy field, many of them do not consider climate change explicitly yet. As part of mainstreaming climate change in sector policies, climate adaptation challenges and options for action as contained in the TPS should thus be integrated in updates of strategic spatial development concepts on national level. The same applies to strategic sector policy-making, such as in the fields of natural hazard management, water management, etc.

Possible implementation steps

As the first implementation step, spatial planning executives should assess the adaptation suitability of available instruments. The CLISP document “*Assessing the Climate Change Fitness of Spatial Planning: A Guidance for Planners*” (www.clisp.eu) gives guidance on organisation and design of a respective self-assessment process. On the basis of this evaluation, gaps in the adaptation performance of the given spatial planning system as well as options for enhancing planning instruments and procedures and options for taking concrete action will be identified.

As a next step, one or several work groups may be created by the spatial planning offices. These work groups should primarily consist of experts from spatial planning authorities and spatially relevant sectoral planning bodies as well as experts from offices dealing with climate change and adaptation. Further experts e.g. from climate research, public relations as well as representatives from various associations and organisations may be called in if required.

The work groups should examine options for action realisable on a short-term basis by using available instruments. Depending on the potential for implementation, an assessment of the priorities of objectives and actions should be made.

Furthermore, the possibilities of implementing TPS action in the medium and long term should be identified, specified and prioritised. For this purpose, cost-benefit considerations could be used as a tool to identify and assess the long-term economic effects. The follow-up impacts of actions, for example on ecological or social aspects, should also be taken into account when selecting options for action to implement. Actions on various spatial levels must be harmonised. Regarding further implementation, responsibilities, time frames, next work steps as well as criteria for evaluation and monitoring have to be determined.

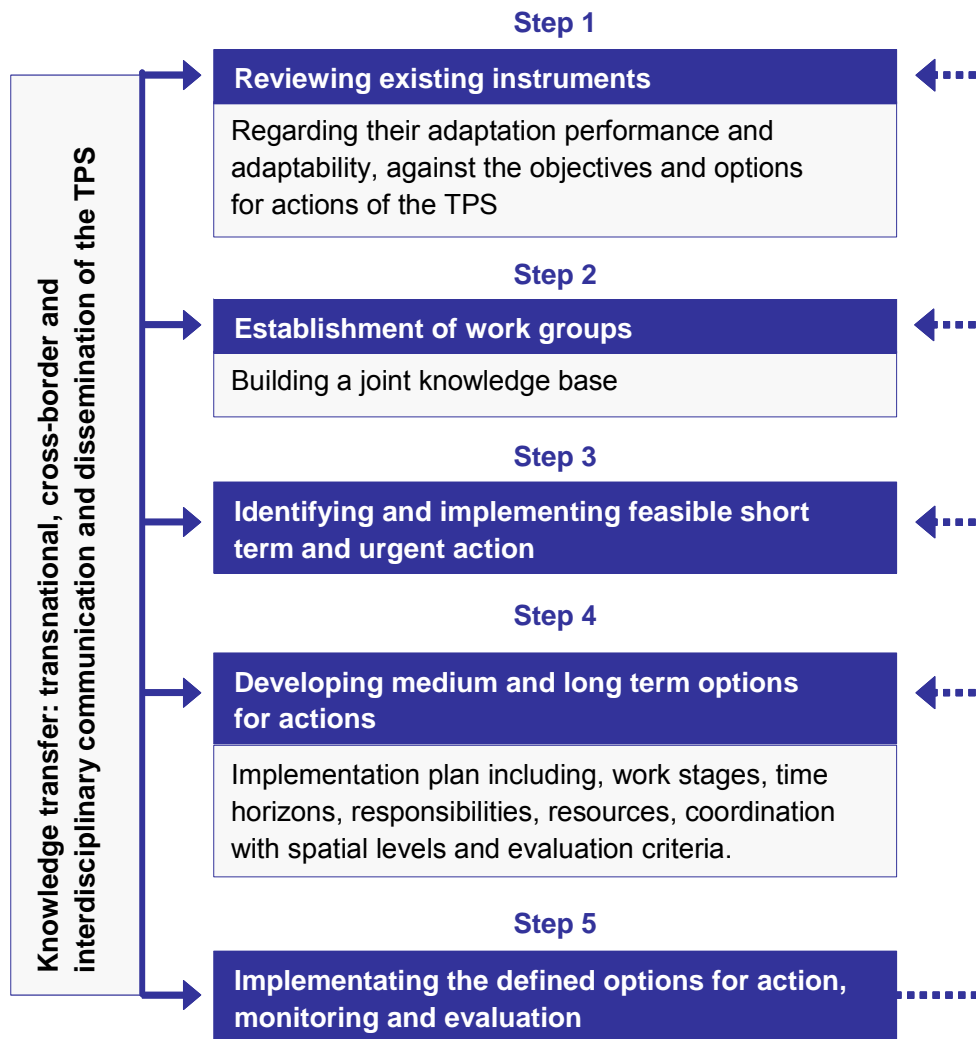


Figure: Scheme of possible steps of an implementation process

Coordination between spatial planning and spatially relevant sectoral planning bodies

An efficient and synchronised implementation of the TPS’ options for action requires the precise coordination of work steps and responsibilities between spatial planning and spatially relevant sectoral planning bodies.

The advantages of this course of action would be a continued exchange of knowledge between the actors, a pooling of resources, as well as increased effectiveness and efficiency in implementing adaptation measures in a cross-sectoral, concerted way.

The following figure shows a possible workflow and indicates the roles and required interactions between spatial and sectoral planning.

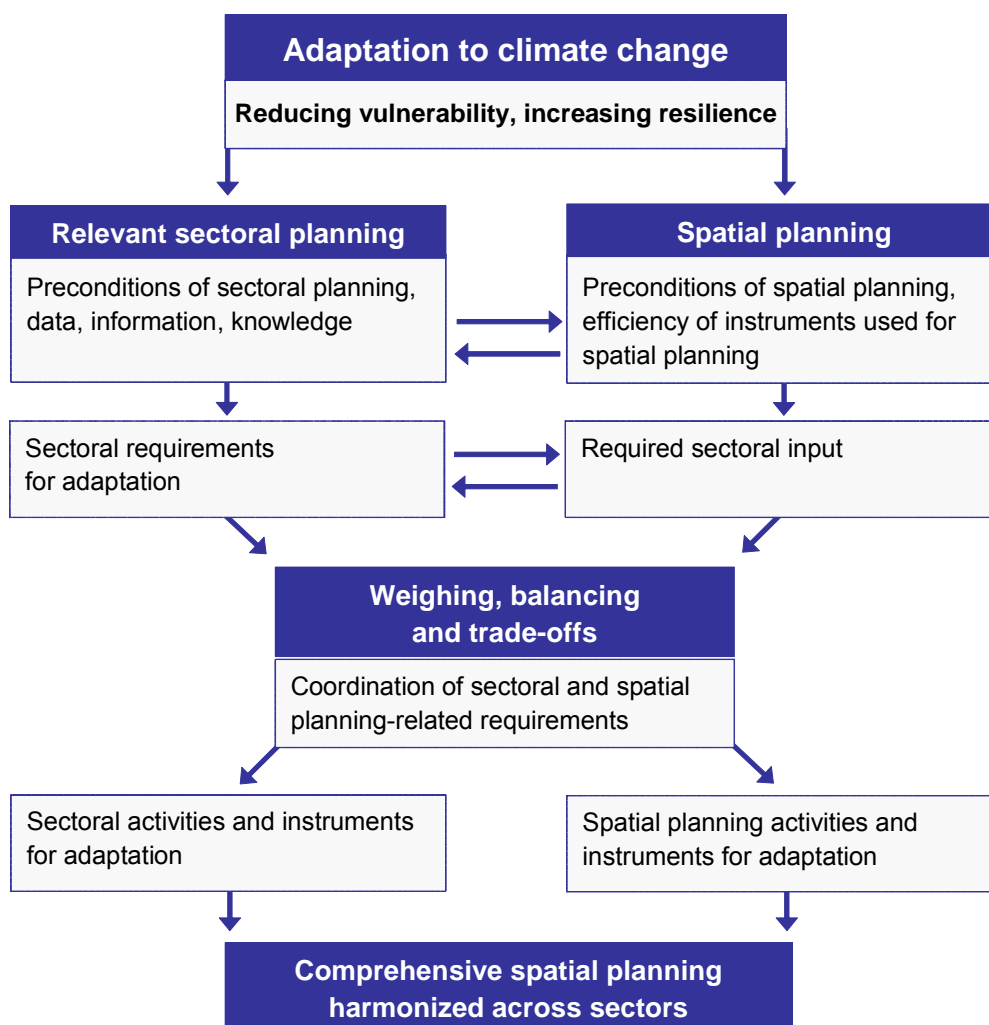


Figure: Scheme of a possible workflow indicating the roles of spatial planning and sectoral planning (based on Helmut Hiess)

Guidance for action plans for regions and municipalities

One of the possible tasks of the work groups mentioned above is the elaboration of a specific guidance for action tailored to and prepared alongside the respective regions and municipalities and prepared. This guidance could have the following contents:

- Legal basis and trans-local conditions e.g. land use planning act, land use allocation and development programmes
- Available instruments and recommendations for their possible applications e.g. municipal development plan, land-use plan, sectoral plans
- Support by informal instruments and methods e.g. guidelines, concepts
- Overview of available information on climate change as well as sources of further information e.g. climate research institutes
- Actors of implementation as well as the relevant contact persons e.g. responsible executives and information bureaus of the sectors

- Examples, good practices on methods, approaches, courses of action and effective implementation
- Recommendations on the communication of regionalised action strategies adjusted to the different target groups

3.2 Monitoring and evaluation

The work groups mentioned above should also deal with questions of monitoring and evaluation, as climate adaptation is an iterative process that has to be embedded in an adaptive management approach.

The ongoing monitoring of changes can partly be embedded in existing monitoring systems e.g. permanent space observation, environmental reports by the Alpine countries and regions. The work groups could determine indicators for monitoring such as severity and location of heat impact and size of heat-affected zones, changes of rain water drainage volumes. Changes may be documented and communicated by way of regular reporting. Monitoring results should then be directly linked to the revision of spatial plans and planning cycles; enabling a learning process regarding adaptation.

According to the concept of adaptive management (see chapter 1.2) a continued comparison between the status quo and the planned targets should be made. New knowledge and challenges as well as actual spatial development trends and observed climate change impacts on space require constant adaptation of objectives and actions –. This is of paramount importance in dealing with uncertainties in registering the effects of climate change and the impacts of other megatrends such as changing economic framework conditions.

Progress of implementation should be verified by way of regular evaluation. The work groups may determine criteria for this verification in advance. One example for a classification of such criteria is shown in the table below:

| Classification of objectives | Classification of actions |
|------------------------------|---------------------------|
| Particularly relevant | Implemented |
| Continues to be relevant | Being implemented |
| Less relevant | Implementation is pending |
| No longer relevant | No longer required |
| To be adjusted | To be adjusted |
| To be completed | To be completed |

Apart from verifying the actual progress in achieving the aims and in implementing actions, the follow-up impacts of individual actions from ecological, social and economic aspects (sustainability criteria such as degree of self sufficiency or distribution of workforce) should be assessed.

Another particularly relevant aspect is the regional-economic evaluation of adaptive action taken including their indirect climate protection effects:

- more sustainable supply of natural resources, including land, water and fresh air
- economic advantages of risk reduction
- relief effects for public budgets (especially due to cooperations between communities or better reconciliation of policies of the public sector on different levels)
- increasing income due to “green jobs”
- effects on land prices

The use of macro-economic analyses allows an assessment of the long-term economic effects of options for action such as the influence on changes of prices for land. Complementary cost-benefit analyses can be used for overall assessment and comparison of costs and advantages of adaptive action.

4. Annex

4.1 Guidance for action: Summary list of measures

(1) Enhancing planning systems and instruments

- M1.1 Making adaptation to climate change a legal objective and a priority field of action of spatial planning
- M1.2 Advancing mission statements and long-term objectives (O1.1-2)
- M1.3 Promoting regional planning (O1.1, 1.3)
- M1.4 Establishing climate governance (O1.1-2, 1.4)
- M1.5 Installing climate proofing on all levels (O1.3-4)
- M1.6 Applying innovative methods and instruments in planning (O1.4)
- M1.7 Preparation of guidelines for climate adaptation on regional and local levels (O1.3-4)

(2) Cooperation across sectors, levels and borders

- M2.1 Establishing transnational and national multi-level cooperation networks for joint activities (O2.1-3)
- M2.2 Promotion of regional and intercommunal cooperation (O2.2)
- M2.3 Incentives for developing and implementing strategies and action on adaptation (O2.3-4)
- M2.4 Installing climate protection and adaptation officers (O2.2-4)

(3) Building and transferring knowledge

- M3.1 Transferring, visualising and documenting expert knowledge (O3.1-4)
- M3.2 Creation of an information pool on adaptation to climate change in the Alpine space (O3.1-5)
- M3.3 Working with uncertainties (O3.3, 3.5)
- M3.4 Providing work aids (O.3.3-5)

(4) Awareness-raising

- M4.1 Developing a communication strategy to promote the implementation of adaptive action (O4.1-2)
- M4.2 Motivating key actors on different action levels to act as disseminators (O4.1-4)

(5) Resilient settlement systems and infrastructure

- M5.1 Developing and stabilising concentrated, mixed and well-landscaped, greened settlement structures (O5.1, 5.2, 5.5)
- M5.2 Regulating second homes and holiday residences (O5.2, 5.5)
- M5.4 Developing and maintaining green and blue infrastructure (O5.1-3, 5.6)
- M5.5 Promoting shading and accompanying protective action in heat-exposed locations (O5.1-3)
- M5.6 Preserving cool and fresh air generating areas and ventilation corridors (O5.1-2)
- M5.2 Re-zoning of existing building land in hazard-prone areas (O 5.6)

(6) Natural hazards prevention

- M6.1 Strengthening the protection from natural hazards in spatial planning and integrating climate change risks into sectoral planning on natural hazards (O6.1-2)
- M6.2 Promoting cross-border and inter-sectoral cooperations in natural hazard management (O6.1-2)
- M6.3 Securing areas for flooding and retention purposes as well as for other protection measures against torrential processes (O6.1, 6.3-4)
- M6.4 Restricting building land allocation and construction activities in hazard zones and areas needed for protective measures (O6.3-5)
- M6.5 Identifying and protecting critical infrastructures and endangered building stock (O6.5)
- M6.6 Stabilising and improving the protection function of forests (O6.6)

(7) Integrated water resource management

- M7.1 Reinforcing the protection of groundwater resources and drinking water zones (O7.1-2)
- M7.2 Integrating water management concepts and plans into instruments of spatial planning and vice versa (O7.1-2, 7.4-5)
- M7.3 Reducing the growth rate and degree of soil sealing (O7.2-3)
- M7.4 Reducing soil compaction caused by winter sports(O7.2-3)
- M7.5 Promoting decentralised rainwater management (O7.3-4)
- M7.6 Coordinating water usage with the requirements of agriculture (O7.4-5)
- M7.7 Coordinating water usage with the requirements of the energy sector (O7.4-5)

(8) Landscape development and ecosystem services

- M8.1 Preservation of large-scale, not fragmented green areas (O8.1-3)
- M8.2 Preserving and restoring large-scale ecological corridors (O8.1-3)
- M8.3 Implementation of a small-scale structured network of green, blue and open areas (O8.1-3)
- M8.4 Conversion of brownfields and abandoned housing areas to green, blue and open areas (O8.1-3)
- M8.5 Support by agriculture in developing a resilient spatial structure (O8.4)
- M8.6 Coordinating the requirements of ecosystems and free space with renewable energy production (O8.4)
- M8.7 Securing and strengthening important forest functions (O8.4-5)

(9) Reorientation of tourism

- M9.1 Marking and adapting vulnerable tourist infrastructure (O9.1-3)
- M9.2 Implementation of integrated spatial planning and tourism concepts (O9.1-3)
- M9.3 Developing strategies to deal with increasing pressure by tourism at higher altitudes (O9.1-2)

4.2 Practice Examples

The following practice examples all take climate change adaptation into account (directly or indirectly) and are in some way connected to spatial planning and/or spatially relevant sectoral planning. They can serve as a reference frame and starting point for possible implementations of adaption measures. The examples were chosen based on findings from the CLISP model regions and by external experts taking part in the Transnational Expert Network on Climate Change and Spatial Planning established under the CLISP project. The list is not intended to be exhaustive.

The table below allocates the example to fields of action and specific measures, as well as indicating alternatives as most examples apply to more than one field of action.

Examples - Overview:

| Field of action Example | Country / State | Action / Measure | Other possible fields of action |
|--|--------------------|------------------|---------------------------------|
| (1) Enhanced planning systems and instruments | | | |
| Towards robust planning and co-ordination of regional action on climate change | AT (Styria) | M1.2, M1.3 | 2, 3, 4 |
| Federal adaptation strategy | CH | M1.1-3 | 2, 3, 4 |
| (2) Cooperation for improved implementation | | | |
| Transnational natural hazards platform PLANALP | Transnational | M2.2 | 6 |
| (3) Create and transfer knowledge | | | |
| The river Tagliamento commission | IT (Tagliamento) | M3.1, M3.3 | 2, 4, 7 |
| Phenoclim – Chamonix Mont-Blanc | FR, CH, IT | M3.1 | 4 |
| Practical risk management based on hazard assessment in a 2005 disaster-region | AT (Styria) | M3.1, M3.3 | 1, 2, 4, 6 |
| (4) Awareness-raising | | | |
| Visualising high water marks | AT (Salzburg) | M4.2 | 3, 6 |
| (5) Resilient settlement systems and infrastructure | | | |
| Commandment to connect new building areas (Anbindungsgebot) | GER (Bavaria) | M5.1 | |
| Rooftop Gardens in Linz | AT (Upper Austria) | M5.4 | 8 |

| Field of action Example | Country / State | Action / Measure | Other possible fields of action |
|--|-----------------|------------------|---------------------------------|
| (6) Natural hazards prevention | | | |
| Working group “Natural Hazards Pinzgau” | AT (Salzburg) | M6.2, M6.3 | 2, 3, 4 |
| Program for a flood protected development of settlements | AT (Styria) | M6.2-4 | 2 |
| Integral flood protection in the Mangfall Valley (Rosenheim/Bavaria) | GER (Bavaria) | M6.2-4 | 2 |
| Hazard zone plan – South Tyrol | AT | M6.4-5 | 4 |
| Hazard zones – Liechtenstein | FL | M6.4-5 | 4 |
| Hazard zones – Canton Grisons | CH | M6.4-5 | 4 |
| (7) Integrated water resource management | | | |
| Kander.2050 – “läbigs Kanderwasser” | CH | M7.2 | 1, 2 |
| Wetland and peat land restoration in the Bavarian Alps | DE (Bavaria) | M7.1, M7.2 | 6, 8 |
| Sustainable development of the rivershed “Untere Salzach” | AT, DE | M7.2 | 2, 3, 6 |
| Orba river contract | IT | M7.1-3 | |
| Precipitation runoff model Alpenrhein | FL / AT | M7.5 | |
| (8) Landscape development and ecosystem services | | | |
| Suburban landscape development | CH | M8.1-4 | 2, 3, 5 |
| Forest development plan | AT | M8.7 | 6 |
| (9) Reorientated tourism | | | |
| Sectoral program for skiing infrastructure development | AT (Salzburg) | M9.1-3 | 7 |

(1) Enhanced planning systems and instruments

Towards robust planning and coordination of regional action on climate change (Austria)

Description:

Using the district Murau (Styria) as an example, the project develops a coordination process in which local stakeholders and experts create strategies for climate adaptation. Several workshops are held in the region, where regional stakeholders are invited to combine their ideas regarding a strategy for adaptation to climate change for Murau.

Aims:

The goal is to initiate a discussion among climate change experts and the local population on efficient, effective and flexible reactions to climate change impacts. Additionally, the aim is to derive a transferable model for regional discourses on climate change adaption from the work in Murau.

State of implementation:

The project is still ongoing, some conclusions (e.g. a regional institution is necessary in order to be able to reach relevant and competent participants, scientific input have to be of the highest quality and communicated with caution) have already been reached.

Relevance to spatial planning or spatial development:

The project activates regional stakeholders and promotes intersectoral coordination of regional development.

Relevance to climate change adaptation:

The project works towards an optimum method of compiling coordinated and regionally integrated portfolios, which are a necessity in climate change adaption.

References:

<http://www.cipra.org/competition-cc.alps/phspaeth>

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Federal adaptation strategy (Switzerland)

Description:

In 2009, the Swiss Federal Council assigned the Department of the Environment, Transport, Energy and Communications with the task of preparing - in cooperation with other affected departments - a joint strategy for adaptation to climate change.

The Federal Office for the Environment led the process, in which the participating Federal Offices worked in close cooperation to formulate goals and principles for adaptation, as well as nine sectoral sub-strategies for water management, forestry and agriculture, natural hazards, energy, biodiversity, tourism, health and spatial development. Furthermore, the points of intersection between sectors were analysed and the most relevant cross-sectoral challenges in adaptation to climate change were identified.

Aims:

The Federal adaptation strategy is meant to lay the foundation for coordinated action on adaptation to climate change on the federal level. It deals with in the cross-cutting matter of adaptation, and indicates how to handle the impacts of climate change in an integrative way (i.e. across sectors and departments), in order to exploit synergies and tackle conflicting goals. There will be action plans for the implementation of the strategy.

State of implementation:

The federal adaptation strategy will be approved by the Swiss Federal Council towards the end of 2011.

Relevance to spatial planning or spatial development:

The Federal Office for Spatial Development prepared a sub-strategy for the federal adaptation strategy, which points out the role of spatial planning as well as prioritised fields and options for federal action.

Relevance to climate change adaptation:

The strategy's main theme is adaptation to climate change.

Reference:

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(2) Cooperation for improved implementation

Transnational Natural Hazards Platform PLANALP

Description

After the devastating avalanches and floods of 1999, the Alpine Conference appointed a working group to develop common strategies and activity fields on the level of the parties to the Alpine Convention. As a result, PLANALP was established by the Ministers at the 8th Alpine Conference in 2004. The mandate of PLANALP covers both the formulation of strategic concepts on integrated risk management against natural hazards and the coordinated implementation of subsequent measures. The contracting parties to the Alpine Convention delegated high-level experts to PLANALP in order to ensure effective networking and coordination of activities in the Alps and exert influence on national strategies.

Aims

The main objectives of the PLANALP natural hazard platform are to discuss concepts for an integrated reduction of natural hazards, to identify “best practices”, to implement the subsequent measures and to intensify the cross-border exchange of experience.

State of implementation

PLANALP was set up in 2004 and is still active. At the XI Alpine Conference in March 2011 (in Brdo pri Kranju - Slovenia) the platform’s mandate was extended to the XII Alpine Conference in 2012.

Relevance to spatial planning or spatial development

One of the main working priorities of the PLANALP platform is also to provide concepts and recommendations for dealing with natural hazards, climate change and risk dialogue. In this context, recommendations of PLANALP address issues vital to spatial development.

Relevance to climate change adaptation

In general, the PLANALP platform is contributing to climate change adaptation by:

- awareness raising and providing information and recommendations
- strengthening risk dialogue in particular with the public;
- fostering cross-border exchanges, networking and coordination of activities in the Alps and among experts;
- collecting and promoting good practice examples in risk management,
- implementing the PLANALP-DB database, which lists best practice examples for risk management

References:

http://www.alpconv.org/NR/rdonlyres/CD60E30-2A54-4832-AC65-5968EDB1EED0/0/planalp_description.pdf

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(3) Create and transfer knowledge

The river TAGLIAMENTO: a unique Alpine river in Europe (Italy)

Description:

The flood plain along the river Tagliamento between the bridges of Pinzano and Dignano is a major environmental and natural beauty site. Any intervention in the area would jeopardise the ecosystem around the river and harm the landscape and its value as a recreational area. The project entails distributing this information to local authorities, institutions and the public at large, by organising workshops, excursions and seminars.

Aims:

The goal is to tone down the planned construction of retention basins and to do this it is necessary to create a base of information. This base should then be distributed to the population, to the administrators and allocating offices to signal that there are a number of alternatives to ensure the flood safety of the municipalities downstream.

State of implementation:

The project is still in its early phases; lectures and excursions will start in earnest in late 2011.

Relevance to spatial planning or spatial development:

Awareness and involvement of the population and relevant organisations in the spatially relevant topic of flood safety and environmental value.

Relevance to climate change adaptation:

The project's goal is to raise awareness of fluvial ecosystems and their relevance in preventing or responding to extraordinary flood events. Public support and knowledge can be crucial to successfully implementing adaptation measures.

References:

<http://www.alpenallianz.org/en/good-practice/676>

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Phénoclim – Chamonix Mont Blanc (France, Switzerland, Italy)

Description:

Phénoclim is a scientific and pedagogical program coordinated by the Centre de Recherches sur les Ecosystèmes d'Altitude, inviting the Alpine inhabitants to measure the climate change's impact on the vegetation through phenology monitoring. Phénoclim works with a network of observers from the Alpine massif (France, Switzerland, Italy) between 200 and 2200 m high. Private individuals, schools and protected areas take part on the project as well.

Aims:

The scientific goal of the Phénoclim program is the creation of a climate change participative observatory in the Alps and the creation, evaluation and the setting up of an integrated methodology for the analysis and the follow-up of the effects of climate change on the Alpine vegetation. The pedagogical goal is a long-term development of an awareness-program about climate change and biodiversity in order to change the behaviour of the inhabitants.

State of implementation:

The project started in 2004 and is set to continue until at least 2014; so far more than 6000 researchers and 200 institutions have participated in some way.

Relevance to spatial planning or spatial development:

The project supports knowledge transfer in the field of Alpine climate research and its impacts. The results can then be used as a base for planning activities.

Relevance to climate change adaptation:

The project aids in creating a knowledge base on climate change and its impacts on vegetation, laying the necessary groundwork for the development of effective adaption strategies.

References:

<http://www.cipra.org/competition-cc.alps/gwladys>

Contact information:

Centre de Recherches sur les Ecosystèmes d'Altitude

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<http://www.creamontblanc.org/crea/>

Practical risk management based on hazard assessment in a 2005 disaster-region in Styria (Austria)

Description:

In 2005 the 2 communities Gasen and Haslau in Styria / Austria were affected by a severe landslide event where more than 1000 shallow landslides occurred and one person was killed. After the first immediate protection measures the question was how to further develop the land use planning of the community. The solution was to revise the existing hazard zone map that was established in 1997. The new map was based on analysing data from the landslides and onsite investigation and was finalised in 2008. This map then served as a base to further analyse the possible impacts of climate change on geological hazards in the region, using different models and parameter sets. The results of this analysis were presented to the local authorities. In discussing the possible impact of climate change to the frequency and/or quantity of landslides, necessary changes in land use planning regarding short, mid and long term problems have to be agreed on. To also reach children and initiate awareness of hazards, risks and adaptation a special workshop was held using special tools and information material.

Aims:

All activities in the pilot region aimed to identify potential hazard zones and communicate possible dangers and risks. This is done in order to create an awareness of potential dangers and develop strategies and recommendations for sustainable land use that also take into account climate change.

State of implementation:

Final results from the model regions were presented in the summer of 2011.

Relevance to spatial planning or spatial development:

The project supports the adaptation of land use planning to consider hazard zones, by providing geological hazard assessment and mapping to a rural community.

Relevance to climate change adaptation:

This is an example on hazard zone mapping adapted to possible consequences of climate change as well as a project that focused on risk communication, especially to children. By improving the efficiency of risk management and raising awareness, the implementation of adaptive actions can be supported.

References:

http://www.adaptalp.org/index.php?option=com_content&view=article&id=55:wp7-pilot-actions-a-synthesis&catid=35:project-partners&Itemid=75

Contact information:

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(4) Awareness-raising

Visualising high water marks in Altenmarkt (Salzburg, Austria)

Description:

Approximately 40 years ago, a complex set of water management measures was implemented in the municipality of Altenmarkt. Their main aim was the drainage of the valley, in order to achieve a higher agricultural productivity. However, over the course of a recent revision of the hazard zone plan, it was determined that most of the settlement areas in Altenmarkt would be flooded in the case of a 20-year flood event (i.e. a flood that is predicted to occur once in 20 years).

This led to massive restrictions for future zoning or construction and subsequently to an emotional public debate. Some locals dismissed the plans as “scare tactics”. Obviously, it was necessary to raise the public awareness, in order to gain acceptance for the planned measures. In order to display the level of possible floods, large pegs were put up in highly-frequented locations in the municipality. On these pegs, the levels of 30 and 100-year floods were marked, which led to a raised acceptance for the planned, new flood retention measures.

Aims:

The main aim of the project was to raise the public’s awareness to the extent of possible floods and thus gain acceptance for necessary counter measures.

State of implementation:

The acceptance for new flood prevention measures could be raised by putting up the pegs; construction of the planned measures is set to happen in 2012/2013.

Relevance to spatial planning or spatial development:

The prevention of zoning or construction within hazard zones is one of the key instruments available to spatial planners in adaptation to climate change.

Relevance to climate change adaptation:

Raising public awareness of natural hazards and other impacts of climate change is a key step towards being able to implement the measures necessary for successful adaptation.

References:

http://www.regpi.at/stuff//NewsletterMai10/CLISP_Protokoll_WS1_Modellregion_13_04_2010.pdf (page 4)

Contact information:

Marktgemeinde Altenmarkt im Pongau

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(5) Resilient settlement systems and infrastructure

Commandment to connect new building areas (Anbindungsgebot) (Bavaria, Germany)

Description

The commandment proscribes that new building areas have to be connected to already existing built-up areas.

Aims

Its goal is the development of compact settlement structures.

State of implementation

This instrument has been part of the Bavarian “Landesentwicklungsprogramm” and was recently adapted with the update of the LEP in 2003.

Relevance to spatial planning or spatial development

Due to being included in the LEP, the commandment represents a legal basis for spatial planning in Bavaria, and thus has to be observed by all public actors, especially in the preparation of land use plans.

Relevance to climate change adaptation

Protection from natural hazards is easier for compact settlement structures than for dispersed settlements. Thus, the commandment can be one of many steps towards a resilient settlement structure which is a necessity in climate change adaption.

References

<http://www.landesentwicklung.bayern.de/instrumente/landesentwicklungs-programm.html>

Contact

Landesentwicklung Bayern

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<http://www.landesentwicklung.bayern.de/>

Rooftop gardens in Linz (Upper Austria)

Description:

In the City of Linz, the building plan has regulated green rooftops since 1985. From 1989 until 1999 subsidies were granted up to 30 % of the cost. After 1999 the subsidies have been reduced to 5 % of the cost.

Aims:

Enhance the quality of life by promoting rooftop gardens, which improves the city's overall microclimate.

State of implementation:

Since 1985 80 % of all new buildings with a roof pitch up to 20 degree have been planted (500.000 m²).

Relevance to spatial planning or spatial development:

A spatial planning instrument – the building plan – determines where green rooftops should be introduced.

Relevance to climate change adaptation:

Green rooftops deliver a relevant contribution to climate change adaptation with regard to heat waves as well as heavy rain events: The temperature on a green covered roof is 30 to 60 degrees below the temperature on normal roofs, the sewage flow is reduced and the sewage system disburdened because 40 to 90 % of the precipitation is retained and evaporated.

References:

<http://www.ma22-herbsttagung.at/followgruendach.htm>

<http://www.dachgaertnerverband.de/kommunen/gruendachinfos/list.php?c=Ausland>

Contact information:

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(6) Natural hazards prevention

Working group “Natural Hazards Pinzgau” (Austria)

Description:

This project comprises an interdisciplinary Working Group on the regional level (Bezirkshauptmannschaft) for the prevention of and protection against Alpine natural hazards. Participants of the Working Group are experts (geology, water...) of the administrative agencies from Pinzgau and Land Salzburg, representatives of the Government department of mountain torrent and avalanche control, representatives of hunters, forest management, the alpine police as well as representatives of NGO's e.g. the mountain rescue service.

Aims:

Main goals of the group are:

- Collection and interpretation of data to assess the vulnerability of areas
- Coordination of actions for protection against natural hazards
- Emergency management in case of natural disasters

State of implementation:

The working group meets regularly since 2002.

Relevance to spatial planning or spatial development:

Results of the group about the vulnerability of special areas are important basic information for spatial planners. The protection and the assessment of the vulnerability of settlement areas is one important challenge of the group. The group is integrated in the regional administration (leader of the group is the head of regional government). This circumstance guarantees the effectiveness of the tool.

Relevance to climate change adaptation:

As there might be an increase of natural hazards because of climate change the coordination of experts, data and actions is becoming more and more important. A very important topic for the group is vulnerability assessment and climate change adaption. The work of the group is important basic information for climate proof planning in the alpine space.

References:

-

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Programme for a flood protected development of settlements (Styria, Austria)

Description

The programme makes hazard zone plans legally binding for land use plans. It provides a standardized link between these two different planning logics and helps to avoid to zone new building land in hazard zones.

Aims

The programme aims to minimize the hazard and danger potential of flood events and avalanches by preventing or at least minimizing development in natural hazard zones.

State of implementation

The programme has been issued by the Styrian government in 2005 and is currently being implemented. According to the allocation of competences between federal and provincial governments in Austria, hazard zone planning lies in the responsibility of the central federal government. Up to now, increased risk potential due to climate change is not considered explicitly in the hazard zone plans, which limits the potential of the Styrian programme in terms of adaptation.

Relevance to spatial planning or spatial development

The programme is legally binding for all measures with territorial impact of the government, the communities and all corporations under public law, especially for land use plans. E.g. no building permits are allowed to be issued within areas flooded with a 100-year return probability. These HQ 100 areas and red natural hazard danger zones are directly legally binding for land use planning.

Relevance to climate change adaptation

The increasing risk of floods and natural hazards makes fast, standardized procedures a necessity. This programme allows for quick adaption to growing risk potentials: new hazard zones will be legally binding for new land use plans immediately.

References

http://www.raumplanung.steiermark.at/cms/dokumente/10107064_2863310/42322d97/hochwasserprogramm_englisch.pdf

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<http://www.raumplanung.steiermark.at/>

Integral flood protection in the Mangfall Valley (Germany)

Description:

42 000 inhabitants live in the inundation area of the River Mangfall in the lower Mangfall Valley. The flood protection infrastructure is dimensioned for a 30-year flood (HQ 30). The potential damage given a HQ 100 event is one billion euros and hence the highest by far in Bavaria. Envisioned measures include

- the construction of a retention basin with a capacity that exceeds the HQ100 volume and hence includes a climate change risk premium (plus 15% of HQ 100 on technical protection measures),
- supplementary measures by means of flood control measures at lake Tegernsee,
- retention in all upstream areas,
- decentral retention in the entire catchment area,
- relocation of dykes back to the alignment line,
- supplementary ecological measures (reactivation of old river arms, renaturation etc.)

The measures also include the introduction of the Flood Forum Mangfall Valley, target-project-specific community meetings and the Blue Riband initiative. 120 high water marks were set up throughout the settlement area with a view to achieving lasting risk awareness.

Aims:

In view of the increasing risk caused by climate change, a comprehensive flood protection concept has been drawn up for the valley region.

State of implementation:

The implementation of the measures mentioned above is well under way; however, the time-frame for the complete construction of all measures is the year 2020.

Relevance to spatial planning or spatial development:

An important prerequisite for successful implementation of the measures was awareness-raising and involvement of the population as well as of the downstream and upstream municipalities in the planning process.

Relevance to climate change adaptation:

Putting effective flood control measures in place is a key adaptation measure, considering the increasing number and severity of flood events.

References:

<http://www.cipra.org/competition-cc.alps/WWARO>

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Hazard zone plan (South Tyrol, Italy)

Description:

The Hazard Zone Plan is a sectoral spatial planning instrument at the local level. Municipalities are obliged to prepare this plan, in which they have to demarcate red, blue and yellow zones which signify different levels of endangerment and restrictions to development.

Aims:

The HZP aims to protect lives, settlement and economic areas, evaluate and protect infrastructure facilities and reduce vulnerability.

State of implementation:

The implementation of the HZP was agreed on in 2008. Since it has come into force, only one municipality ratified and implemented its hazard zone plan. The HZP of two other municipalities are already in the phase of being approved. The other 113 municipalities are currently at different stages of implementation.

Relevance to spatial planning or spatial development:

Municipalities have to take into account the results and zones of their Hazard Zone Plans when preparing land use plan. In red zones for example, all development is prohibited.

Relevance to climate change adaptation:

Though the HZP's primary focus is on vulnerability, issues of CC adaptation are always indirectly considered. The simulations for deriving the specific risk to delineate hazard zones are calculated for periods lasting 100 to 300 years into the future. For these simulations, precipitation data of the last three decades are integrated – including the latest impacts of CC. Thus, the HZP is already an effective adaptation approach that considers the impact of CC.

References:

<http://www.provincia.bz.it/raumordnung/raumplanung/gefahrenzonenplanung.asp>

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<http://www.provinz.bz.it/raumordnung/>

Hazard zones (Liechtenstein)

Description:

Hazard zones are designated in the structure plan [Landesrichtplan] and the municipalities have to respect these areas in their land use plans [Nutzungsplanungen]. The authorities enforce protection from natural hazards as far as possible by spatial planning measures. The lead lies with the municipalities and the Office for Forestry, Nature and Landscape [Amt für Wald, Natur und Landschaft].

Aims:

The designation of hazard zones allows to proactively keep those areas free which might be threatened by natural hazards (gradations red, blue, yellow, purple and green). With respect to increasing pressure from settlements and leisure activities it will be increasingly important to implement a proper planning of hazard zones and to enforce that such areas are kept free.

State of implementation:

Liechtenstein's latest structure plan [Landesrichtplan], in which the hazard zones are designated, was approved in March 2011.

Relevance to spatial planning or spatial development:

With respect to rising pressure from settlements and leisure activities it will be increasingly important to continue the marking of hazard zones to support spatial planning in enforcing that such areas are kept free.

Relevance to climate change adaptation:

In order to create resilient, well adapted settlement structures for the future, the designation of threatened areas that have to be kept free from development is a definite necessity.

References:

<http://www.llv.li/amtstellen/llv-slp-landesrichtplan/llv-slp-downloads.htm>

<http://www.llv.li/pdf-llv-slp-gesamtkarte.pdf>

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<http://www.llv.li/amtstellen/llv-slp-home.htm>

Hazard zones (Canton Grisons, Switzerland)

Description:

Hazard zone maps are prepared by cantonal authorities, and mark areas threatened by a high risk of natural hazards such as avalanches, floods, mudslides or rock falls. There are two types of hazard zones: In red zones, no development at all is permitted, whereas in blue zones, construction can take place if the planned buildings fulfill certain conditions. The hazard zones are also included in the land use plans by the municipalities. They enable authorities to enforce protection from natural hazards as far as possible by spatial planning measures.

Aims:

The designation of hazard zones aims to proactively keep areas free which might be threatened by natural hazards.

State of implementation:

The first hazard zone maps were prepared in 1975 and dealt mainly with the risk of avalanches. In the meantime, they have been updated continuously and now also include risks of flood, mudslides and rock falls.

Relevance to spatial planning or spatial development:

With respect to rising pressure from settlements and leisure activities it will be increasingly important to continue the marking of hazard zones to support spatial planning in enforcing that such areas are kept free.

Relevance to climate change adaptation:

In order to create resilient, well adapted settlement structures for the future, the designation of threatened areas that have to be kept free from development is a definite necessity.

References:

http://www.gr.ch/DE/institutionen/verwaltung/bvfd/awn/dienstleistungen/3_1_naturgefahren/Seiten/3_1_3_3_gefahrenzonen.aspx

Contact Information:

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<http://www.gr.ch/DE/institutionen/verwaltung/bvfd/awn/ueberuns/Seiten/default.aspx>

(7) Integrated water resource management

Kander.2050-"Iäbiges Kanderwasser" (Switzerland)

Description:

During the first phase of the project, a river management scheme for the river Kander was prepared, which will act as a framework for future water management, flood protection and upgrading projects or measures. According to the principle of sustainability, the fields society-economy-nature were integrated in equal parts. The interests of the public will be integrated into the management scheme via guiding principles compiled in public participation sessions. In the second part of the project, the appointed measures will be implemented until 2050.

Aims:

The objectives of the project are to attain a good ecological condition of the river, alongside acceptable protection from floods as well as high living quality and the creation of added value.

State of implementation:

The first phase (the preparation of the river management scheme) is completed; current steps are the evaluation of measures for swift realisation, as well as the preparation of a structure plan for the Kander, which will be binding to public authorities.

Relevance to spatial planning or spatial development:

Flood protection and river management are highly spatially relevant topics, which rely on instruments of spatial planning for implementation in many cases.

Relevance to climate change adaptation:

Adaptation to climate change is supported by the strategic goals of the project: attractive, close-to-nature landscapes, high water quality, sufficient expansion space for the water body and sustainable protection from floods, sufficient water levels, sustainable use of resources and the creation of an attractive living environment.

References:

<http://www.cipra.org/competition-cc.alps/Kander2050>

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willy.mueller@vol.be.ch

<http://www.vol.be.ch/site/home/lanat.htm>

Wetland and peat land restoration in the Bavarian Alps (Germany)

Description:

For decades the Bund Naturschutz in Bayern e.V. (BN) has been working on a mainly volunteer basis to improve the hydrology of degraded peat bogs. Activities include the purchase or lease of land, termination of inappropriate management methods, and above all impounding works. Peat growth resumes in the rewetted areas.

Aims:

The main objectives of the projects are to sustain the habitat for typical wetland species and to improve the function of the peat bog as a CO₂ sink (mitigation) and as water storage (adaptation).

State of implementation:

The activities described above have been carried out, mostly by volunteers, on 23 peat bogs from Algäu to Traunstein. Approximately 120 ha of peat bogs have been restored, with management measures now in process on a further 150 - 200 ha.

Relevance to spatial planning or spatial development:

While not touching the matter of spatial planning as such, the project is closely linked to spatially relevant sectors such as nature conservation, water management and agriculture.

Relevance to climate change adaptation:

Peat bogs can function both as CO₂ sinks and as water storage units, and their conservation is crucial to mitigation and adaptation alike.

References:

<http://www.cipra.org/en/cc.alps/competition/wetland-restoration-in-the-bavarian-alps>

Contact information:

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Sustainable development of the rivershed 'Untere Salzach' (Austria)

Description:

The morphological restoration of the river “Untere Salzach” (which is also the border between Bavaria and Austria) is a challenge to modern hydraulic engineering. The restoration should prevent further riverbed erosion and lowering, secure flood protection along the Salzach and improve the ecological status of the river system and the alluvial forest. The project will be carried out according to the principle of finding a new and sustainable balance for the river, in the most economic way possible.

Aims:

The Salzach – a typical Alpine river – featured a dynamically changing river basing with many branches. In order to make the river more navigable and to more clearly define the national border, the Salzach was straightened and constricted in the 19th and 20th century. Furthermore, the passage of sediment was interrupted by upstream dams. All this led to a substantial lowering of the riverbed and subsequently to lower groundwater levels, which in turn cut off the alluvial forest, resulting in negative impacts on its ecosystem. Additional lowering of the riverbed is to be expected, which could then endanger the existing infrastructure as well as the health and life of residents. The increasing likelihood for heavy rainfalls due to climate change could exacerbate the process. The restoration aims to prevent further lowering of the riverbed, to secure flood protection, to improve the ecological status of the river system as well as finding a natural, more resilient balance for said system.

State of implementation:

With the planning work mostly concluded, the construction phase for the most relevant measures has been underway since 2009.

Relevance to spatial planning or spatial development:

The project deals with sustainable river management as well as innovative water management, both of which are highly spatially relevant matters, in a transnational context.

Relevance to climate change adaptation:

The protection from natural hazards, sustainable water management and conservation of nature –all of which are aims of this project –are highly relevant towards creating a more resilient environment.

References:

<http://www.cipra.org/competition-cc.alps/Staton>

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Orba river contract (Italy)

Description:

The Contract of Orba River is based on cooperation and negotiation and is set up as a voluntary agreement between Region, Local authorities and other private or public subjects. It has to define objectives, strategies of participation, actions to be activated, and competences for giving shared solutions to problems connected with the water system.

Aims:

The objective of the Contract is to pursue the protection and the development of water resources and connected environments as well as improving protection from flood risks. Examples for actions taken could be to increase better water uses, water saving, water and waste water reusing and water resources monitoring.

State of implementation:

The instrument has been implemented only recently, and is still highly dependent on funding.

Relevance to spatial planning or spatial development:

Contracts of river (and lake) do not constitute an additional level of planning per se but represent an additional method for sustainable water management.

Relevance to climate change adaptation:

Main adaptation strategies are related to better water governance, with the aim to preserve, the quality and quantity of water resources against the decrease of water disposability and increase of water use, both of which are related to climate change impacts.

Thus, the Contract of Orba river, which deals with these threats by increasing water regulation capacity and decreasing water losses, can be seen as a good practice example for climate change adaption.

References:

<http://www.contrattidifiume.alessandria.it/CF%20in%20prov%20di%20AL.htm>

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Provincia di Alessandria

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<http://www.provincia.alessandria.it>

Precipitation runoff model Alpenrhein (Liechtenstein)

Description:

The precipitation runoff model combines records on precipitation and subsequent runoff with meteorological forecasts and to execute a sensitivity analysis based on a simulation model (e.g. to simulate the possible impact on runoffs due to an increase of precipitations by 10%).

Aims:

The goal is to provide reliable runoff forecasts and scenarios for the Alpenrhein region.

State of implementation:

The Office for Civil Protection started the installation of a precipitation runoff model together with the Land Vorarlberg and the Swiss Federal Office for the Environment (BAFU) in 2010.

Relevance to spatial planning or spatial development:

Such a model supports the identification of action fields related to spatial planning (such as retention areas, borders of building zones, etc.). It is expected that simulation models will provide valuable insight into for spatial planning problems and will therefore play an important role in the future.

Relevance to climate change adaptation:

The model is not restricted to Liechtenstein but includes the surrounding areas of Switzerland and Austria to take into account the real interconnections and consequences. It allows the simulation of possible scenarios of climate change and their consequences (what-if analysis) and is thus a valuable input for future adaption strategies and actions.

References:

-

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(8) Landscape development and ecosystem services

Suburban landscape development – promoting knowledge transfer and cooperation (Switzerland)

Description:

Diverse green and open areas, multi-functional, inviting streetscapes and public spaces as well as inter-connected agricultural and forest land are an important compensation for the built-up and often intensively used settlement areas and provide much needed relief for the local population. In this project, existing knowledge and experiences from the various federal policy areas on the field of suburban landscape development, will be collected and processed. The transfer of this knowledge will happen in 2010 - 2011 over the course of four seminars on various topics. Important results will be summarised in a closing session, and subsequently distilled into a guideline for planning representatives and other interested actors.

Aims:

The main aim of the project will be to promote knowledge transfer and cooperation in the policy field of suburban landscape planning. It will provide opportunities to discuss important scientific and practical problems, placing an emphasis on using existing knowledge, and recognizing synergies between the different policy fields and sectors. The goal is to identify new approaches and points of intersection and develop an integrated strategy for action.

State of implementation:

The project will be concluded in mid-2012.

Relevance to spatial planning or spatial development:

Although open spaces in agglomerations are numerous and provide important and diverse functions, they are often treated as “remainders” in planning. However, an attractive network of open spaces is crucial for the quality of life of residents and employees, and plays an important role in local climate and biodiversity as well as in agriculture and forestry. A transfer of knowledge on suburban landscape development provides an ideal platform to discuss the future of such agglomeration parks and the role of spatial planning in their development.

Relevance to climate change adaptation:

The Federal Office for Spatial Development has developed a Federal Adaptation Strategy, which determined that landscape development is a priority field in adaptation of agglomerations and cities. This project shows how a dialogue on suburban landscape development can be established on the regional level.

References:

<http://www.are.admin.ch/themen/agglomeration/04191/index.html?lang=de>

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Tel. 031 322 52 66

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Bundesamt für Wohnungswesen BWO

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Forest development plan (Austria)

Description:

The Austrian Forest Development Plan is an instrument of forest planning that covers the entire territory of Austria and is composed of sub-plans, which are prepared by regional forest authorities and then submitted to the Federal Minister for Agriculture, Forestry, Environment and Water Management.

The Forest Development Plan contains:

- a description of the actual state of forest functions (production, protection, welfare and recreation)
- an assessment of the fulfilment of functions by comparing the actual state of the forest with the planned target.
- definition of necessary measures and their degree of urgency

Aims:

The instrument's goal is to provide a basis for forest planning and thus enable forest policy decisions which advance sustainable forest management and permanently secure all forest functions.

State of implementation:

Forest Development Plans are set up for the entire Austrian territory on district level. The Plans guide management activities of the competent forest authority and are incorporated in spatial plans.

Relevance to spatial planning or spatial development:

Forest functions according to the Forest Development Plan are incorporated and considered in spatial plans on municipality level.

Relevance to climate change adaption:

Due to climate change, the importance of the forest's protective functions is increasing, which makes prudent forest management all the more necessary.

This also is reflected in the development of a new subsidy instrument for the conservation, renovation and promotion of these forests – the "Protection by Forest Initiative".

References:

Further information on the Austrian Forest Development Plan can be found under <http://www.forstnet.at/article/archive/5806>

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HABIT-CHANGE - Adaptive management of climate-induced changes of habitat diversity in protected areas

Description:

The project "Adaptive Management of Climate-induced Changes of Habitat Diversity in Protected Areas" (HABIT-CHANGE) is implemented within the INTERREG IV B CENTRAL EUROPE programme. The acronym of the project not only stands for the expected habitat changes caused by climate change but also for the necessary adaptation of our own habits in close connection to this. Investigation regions of HABIT-CHANGE cover protected areas from all over Central and Eastern Europe with a focus on wetlands, forests, grasslands and alpine areas. The habitat types of these regions and their composition seem to be very vulnerable regarding climate change.

Aims:

Main aims of the project are to evaluate, enhance and adapt existing management and conservation strategies in protected areas to pro-actively respond on likely influences of climate change as a threat to habitat integrity and diversity.

State of implementation:

The project is still in progress (2010-2013). Climate change adapted management plans (CAMPS) will be implemented in protected areas in Central Europe.

Relevance to spatial planning or spatial development:

Impacts on habitat diversity are made spatial explicit through mapping and modelling. Climate change adapted management plans (CAMPS) will be basic information for regional development in the investigation areas. Stakeholder involvement is targeted to raise awareness of land users and decision makers on local, regional and EU-level.

Relevance to climate change adaption:

The project's will evaluate, enhance and adapt existing management and conservation strategies in protected sites to pro-actively respond on likely influences of CC as a threat to habitat integrity and diversity. Furthermore, a monitoring concept is being developed to detect changes caused either by human activity or climate change effects. This will be a very valuable information and tool especially for the administrations of nature protected areas. Recommendations for CC adapted guidelines regarding protected areas are developed on national and EU-level.

References:

Further information on HABIT-CHANGE can be found under <http://www.habit-change.eu>.

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Sectoral Program for Skiing Infrastructure Development (Salzburg, Austria)

Description:

The program establishes goals, measures and location criteria for skiing infrastructure. A co-ordinated evaluation procedure is ensured by the working group „Schianlagen“ in which all relevant departments are represented.

Aims:

The goal is to bring economical interests in accordance with ecological requirements and landscape protection. The development and construction of skiing infrastructure should happen in an environmentally compatible way and preserve the countryside as much as possible.

State of implementation:

The sectoral programme was declared legally binding in 2008.

Relevance to spatial planning or spatial development:

Projects are analysed by the working group and a representative of the affected municipality as to their compliance with the programme's criteria and are then approved directly by this group. The land use plan is then adapted after the project's realization.

Relevance to climate change adaption:

The criteria inscribed in the sectoral program require developers to preserve the ecological and protective functions of Alpine environments (e.g. by providing replacement retention/flooding areas). These functions reduce vulnerability and are therefore crucial to climate change adaption.

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http://www.salzburg.gv.at/themen/bw/raumplanung/rp1_landesplanung.htm

4.3 Glossary

Adaptation

Adaptation is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Adaptation comprises initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned (IPCC 2007).

Climate change

A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. Climate system – the totality of the atmosphere, hydrosphere, biosphere and geosphere and their interactions. (Commission of the European Communities (ed.) 2007)

Climate proofing

“‘Proofing’ essentially involves assessing policies early on in the formulation process, to identify any obvious spillover effects on cognate sectors. ... new policies in climate and *non*climate sectors will need to be designed in ways which facilitate rather than hinder adaptive decisions – a process which could be termed ‘climate proofing’ ” (Jordan and Urwin 2008).

Climate proofing comprises methods, instruments and procedures that guarantee that plans, programmes and strategies and related investments are made resilient and adaptable to the present and future impacts of climate change and that moreover contribute to the objectives of climate change mitigation (Birkmann/Fleischhauer 2009). Climate proofing thus denotes the systematic examination and consideration of climate adaptation issues and the development of risk reduction strategies against climatic changes (Birkmann et al. 2011).

Ecosystem services

Ecological processes or functions having monetary or non-monetary value to individuals or society at large. There are (i) supporting services such as productivity or biodiversity maintenance, (ii) provisioning services such as food, fibre, or fish, (iii) regulating services such as climate regulation or carbon sequestration, and (iv) cultural services such as tourism or spiritual and aesthetic appreciation. (IPCC, 2007)

Governance

The actions, processes, traditions and institutions by which authority is exercised and decisions are taken and implemented. “Governance is the process by which stakeholders articulate their interests, their input is absorbed, decisions are taken and implemented, and decision makers are held accountable” (Furlong and Bakker, 2008). Government, on the other hand, is the institutional design and structure that operationalizes governance principles (Plumptre and Graham, 1999).

Hazard

A property, an event or a situation with the potential to cause harm. A hazard can be a chemical, biological or physical agent, or a threatening event, or characteristics of a system that represent the potential for an accident. A hazard is a source of risk that does not mean risk per se and that does not necessarily produce risk. It produces risk only if an exposure pathway exists and if exposure creates the possibility of adverse consequences (Royal Society, 1992; Brookes, 2001; Kolluru, 1996; DEFRA, 2000).

Resilience

The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change. (IPCC, 2007)

Risk

An uncertain consequence of an event or an activity with respect to something that humans value. Such consequences can be positive or negative, depending on the values that people associate with them (Renn, 2005).

Risk communication

Interactive process of exchange of information and opinion among individuals, groups and institutions. It involves multiple messages about the nature of risk and other messages, not strictly about risk, that express concerns, opinions or reactions to risk messages or to legal and institutional arrangements for risk management (Renn, 2008 after: US National Research Council, 1989).

Risk management

The creation and evaluation of options for initiating or changing human activities or (natural and artificial) structures with the objective of increasing the net benefit to human society and preventing harm to humans and what they value; and the implementation of chosen options and the monitoring of their effectiveness (Renn, 2005).

Spatial Planning

Spatial planning [Raumordnung, Raumplanung] refers to the various actions taken within a particular territory at various scales with the purpose of affecting or influencing the spatial development of the community, of industry and commerce, and of the natural, built and social environment. Spatial planning activities are carried out at different administrative or governmental levels. Spatial planning is the cover term which embraces different tiers of supra-sectoral planning, e.g. federal spatial planning; state spatial planning, which includes regional planning; and local/urban land-use planning. Taken together, these different planning tiers constitute a coherent spatial planning system. The supra-sectoral and co-ordinating remit which is a central aspect of the planning system means that spatial planning has to be seen as legally, organisationally and materially distinct from spatially relevant sectoral planning (cf. CEMAT 2007, COMMIN 2007).

Stakeholder

A person or an organisation that has a legitimate interest in a project or entity, or would be affected by a particular action or policy (IPCC, 2007; WG II).

Uncertainty

Uncertainty is inherent to the concept of risk. Risk involves thinking in potentialities. It implies that neither what exactly will happen nor when it will happen, nor what and how severe the effects exactly will be is known. If the outcome of something is certain, we do not speak of risk (Crawford-Brown, 1999). That is why risk is expressed using properties like probability, frequency, and variability. In probabilistic terms, risk is a probability distribution within a range of different possible outcomes. Above all, uncertainty over the future is the main reason why risk assessment is needed.

A state of knowledge in which (although the factors influencing the issues are identified) the likelihood of any adverse effect, or the effects themselves, cannot be precisely described (Renn, 2008).

Vulnerability

The degree to which a community, population, species ecosystem, region, or agricultural system is susceptible to, or unable to cope with, the adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity and its adaptive capacity. (Commission of the European Communities (ed.) 2007).

For further references of this definitions see the CLISP Glossary (www.clisp.eu)

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4.5 CLISP project outputs referred to

General outputs

CLISP Glossary

Workpackage 4 “Vulnerability Assessment”

WP4 Synthesis Report and WP4 chapters of Model Region Reports, including in particular:

CLISP Climate Change Scenarios for the Alps

CLISP Adaptive Capacity Indicator System

CLISP Climate Change Impact Chains

Manual for the climate change impact assessment in CLISP model regions

Vulnerability assessment results of CLISP model regions

Workpackage 5 “Climate Change Fitness of Spatial Planning”

Assessing the climate change fitness of spatial planning: A guidance for planners

CLISP Climate Change Fitness Assessment Criteria

CLISP Climate Change Fitness Check List

WP5 Synthesis report (including Good Practice Examples of Climate Proof Planning)

WP5 chapters on Model Region Reports

Workpackage 6 “Risk Communication & Governance”

Guidance for Risk Governance in Spatial Planning

WP6 Synthesis Report

WP6 chapters on Model Region Reports

For downloading the outputs and more details, see the webpage: www.clisp.eu