StartClim2018

Synergies and Trade-offs in the Implementation in Austria of Climate Change Adaptation and the Sustainable Development Goals

Final Report

Project Leader
Institute of Meteorology and Climatology
Department of Water - Atmosphere – Environment
BOKU - University of Natural Resources and Life Sciences, Vienna
Assoc. Prof. Dr. Herbert Formayer

Contracting Parties
Austrian Federal Ministry for Sustainability and Tourism
Austrian Federal Ministry of Education, Science and Research
Austrian Federal Ministry of Labour, Social Affairs, Health and Consumer Protection
Federal State of Upper Austria
Federal Environment Agency

Administrative Coordination
Federal Environment Agency

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Project Leader
Institute of Meteorology and Climatology
Department of Water - Atmosphere - Environment
BOKU - University of Natural Resources and Life Sciences, Vienna
Gregor Mendel Straße 33, 1190 Vienna
URL: http://www.startclim.at/
http://www.wau.boku.ac.at/met.html

Editors
Herbert Formayer, Nikolaus Becsi
Institute of Meteorology
Department of Water - Atmosphere - Environment
BOKU - University of Natural Resources and Life Sciences, Vienna

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Contributions to StartClim2018

StartClim2018.A: Evaluation of interactions between climate policy measures and the targets of the sustainable development goals (CliPo_Interlink)
Universität Innsbruck, Institut für Geographie: Prof. Dr. Johann Stötter
BOKU, Zentrum für globalen Wandel und Nachhaltigkeit: Dipl.-Ing. Benedikt Becsi, Mag. Martin Schlatzer, Damaris Fitz
Umweltbundesamt GmbH, Abteilung für Nachhaltige Entwicklung: Dr. Therese Stickler BOKU, Centre for Development Research: Dipl.-Ing. Dr. Andreas Melcher

StartClim2018.B: CCCS – Climate Change Conflict Solutions: Tackling conflicts of climate change adaptation and mitigation
BOKU, Institut für Landschaftsentwicklung, Erholungs- und Naturschutzplanung: DI Dr. Alexandra Jiricka-Pürrer Büro für Umweltplanung Hamburg: Ass. Dr. Thomas Wachter

StartClim2018.C: SnowAlb – Effects of artificial snow on the energy balance in the Saalbach-Hinterglemm ski area
BOKU, Institut für Meteorologie und Klimatologie: Ao.Univ.Prof. Philipp Weihs, Mag. Johannes Laimighofer MSc ZAMG, Abteilung Klimaforschung: Mag. Dr. Marc Olefs

StartClim2018.D: Business for Climate (B4C) – Business strategies for climate change mitigation and adaptation
Umweltbundesamt GmbH: Dr. Johanna Vogel, Konstantin Geiger, BSc, MSc

StartClim2018.E: Analysis of a strategy for awareness raising in flood risk management – Evaluation of an innovative educational concept as a basis for civil protection
BOKU, Institut für Wasserbau, Hydraulik und Fließgewässerforschung: Univ.Prof. Dipl.-Ing. Dr. Helmut Habersack, Dipl.-Ing. Markus Eder, Dipl.-Ing. Sabrina Scheuer

Scientific Lead and Coordination

Institute of Meteorology and Climatology
Department of Water - Atmosphere - Environment
BOKU - University of Natural Resources and Life Sciences, Vienna
Assoc. Prof. Dr. Herbert Formayer, Nikolaus Becsi

Scientific Board

Dr. Jill Jäger, Independent Scholar
Prof. Dr. Hartmut Graßl, Max Planck Institute for Meteorology, University of Hamburg
Dr. Roland Hohmann, Federal Office for the Environment FOEN, Switzerland
Prof. Dr. Helga Kromp-Kolb, University of Natural Resources and Life Sciences

Coordinating Group

Austrian Federal Ministry for Sustainability and Tourism
Austrian Federal Ministry of Education, Science and Research
Austrian Federal Ministry of Labour, Social Affairs, Health and Consumer Protection
Federal State of Upper Austria
Federal Environment Agency

Administrative Project Coordination

Umweltbundesamt
Maria Balas
Eva Margelik

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Abstract

StartClim has been studying adaptation to climate change since 2008. The projects in StartClim2018 addressed various research questions in connection with the Sustainable Development Goals, conflicts in climate change adaptation, climate change and the economy, and disaster management and education.

Recent studies show that numerous interactions exist between the targets of the UN Sustainable Development Goals (SDGs), because some targets are synergistic, while others exhibit trade-offs. The CliPo_Interlink project investigated these interlinkages by pursuing two aims: evaluating the interactions between climate policy measures (SDG13) and other SDG targets and then discussing the method used to identify these interactions and giving recommendations on the lessons learnt. A seven-point scale developed by Nilsson et al. (2016) to classify SDG interactions from +3 (indivisible) to -3 (cancelling) was used. Synergies and trade-offs between six selected climate policy measures and forty-four SDG targets from five SDGs were evaluated in an expert workshop. The results were broken down into an evaluation of the interactions, and the feedback from the structured methodological discussions conducted at the workshop. Some 54% of the interactions were evaluated as positive (synergistic), 3% as negative (trade-off), and 34% as neutral, meaning that the two aims did not influence one another. No strong trade-offs (-3, cancelling) were identified, and 9% of interactions were indivisible (+3). Also, 7% of the possible interactions were evaluated multiple times, indicating that impacts occurring outside Austria (spill-over effects) were considered in those cases. The application of the seven-point scale by Nilsson et al. (2016) to examine interlinkages between climate policy measures and SDG targets was discussed in the workshops. The discussions resulted in a number of recommendations: It is important to consider that the scale measures the strength and direction of the interaction, not the effectiveness of a measure to reach a target. The evaluations should be carried out by multiple experts to ensure that the assessment is not merely subjective, and a group discussion of the reasons behind the evaluation could further help objectify the results. Furthermore, clear system boundaries should be defined to make the results of the evaluation comparable. The project outcomes will be integrated in the SDG options report to the Austrian federal government prepared through a cooperation between many Austrian universities within the framework of the UniNEtZ (Universities and the sustainable development goals) project.

The aim of the CCCS research project was to provide an overview of the main problem areas arising from (increased) competition between existing land uses (sectoral and cross-sectoral) as a result of climate change and the necessary climate change adaptation measures in Austria. The national adaptation strategies of Austria, Germany, Switzerland and the Austrian provinces, were used to analyse potential utilisation conflicts. Furthermore, five expert interviews were conducted for different sectors. The analysis yielded a four-stage methodological approach for systematically identifying, minimising or avoiding potential conflicts as a result of adaptation measures in Austria's provinces. The study formulated key questions for each of the steps. The first three steps serve to identify climate change-related conflicts that could occur or become exacerbated in a specific area, and to allow the key actors to categorise their significance. They form the basis for the fourth step, in which appropriate solutions to these looming or intensifying conflicts can be found. Overall, the analysis showed that adaptation strategies should increasingly consider conflicts that cannot be managed solely by the existing regulatory or planning tools and that require new, complementary approaches. Within this StartClim project, four basic principles – communication, cooperation, little or no conflict, and consistency – were proposed for conflict resolution. The provinces' adaptation strategies contained a number of examples linking to the principles of the "4Ks", which were presented in overview.

Winter tourism is still of great importance for the Austrian economy, but the profits are dependent on climatological parameters such as snow security. One approach to reducing

the vulnerability of winter tourism due to climate is artificial snow. Artificial snow can lead to a higher snow security in ski areas and additionally increase the reflection of the incoming solar radiation (albedo). A study conducted by Joanneum Research concluded that the one of the positive effects of the additional reflectance of solar radiation as a result of artificial snow is that it compensates for the negative effects of the energy required to make artificial snow. This study reviewed this hypothesis using a more complex radiation model for the ski area of Saalbach-Hinterglemm and compared the final results with the Joanneum Research study. The 3-D radiative transfer model in this study used a digital elevation model (DEM) with a resolution of 10x10m. It also used land-use data to estimate the albedo for each pixel in the study area and snow data from the SNOWGRID model, which were interpolated in a 10x10m raster by residual kriging. The study concluded that under real snow conditions for the month of April, the simplistic model diverged by around 600% from the complex approach in this study. Furthermore, consideration of trees (canyon effect) in the complex model led to an additional reduction of the radiative forcing of 16% to 48%. This means that multiple reflections, shading and the inclusion of the “canyon effect” in a complex 3-D model have a major impact on the radiation budget and therefore raise doubts about the results yielded by the Joanneum-Research study.

In view of Austria’s climate targets for 2030 and 2050, this study surveys and analyses national as well as international approaches that provide opportunities for business and are also compatible with climate change mitigation and adaptation. The focus is on those sectors where decarbonisation is still considered a challenge, such as energy-intensive industries, the buildings and the transport sectors. By means of a comprehensive literature review as well as guideline-based interviews with 13 experts from the business and research communities, the most important innovative business strategies are identified and analysed regarding their practical applicability in Austria. Examples include new technologies such as Power to Gas and hydrogen-based steelmaking; products like heat pumps or low-carbon cement; and new business models in recycling or in energy services. According to the interview partners, some of the investigated approaches are already interesting from an economic point of view for industry and consumers, for instance industrial waste heat utilisation or bio-refinery. Others are not yet technologically mature and require further research and development, economic incentives, new infrastructure development (for some approaches coordinated at the European level) or adjustments to the legal framework. Overall, the currently known decarbonisation strategies in industry, transport and buildings imply a significant rise in renewable electricity demand. On the one hand, this can be countered by increasing energy efficiency, for example via sector coupling, and by linking and coordinating electricity and hydrogen supply on a European level. On the other hand, changes in consumer behaviour regarding mobility or the climate compatibility of products are necessary to keep energy consumption low and reach the climate targets.

The potential increase in extreme weather events as a consequence of climatic changes confronts decision makers with new challenges. In order to cope with the future hazard potential, suitable and effective educational concepts for risk communication and public awareness-raising are needed. One project StartClim analysed and evaluated an awareness-raising strategy by the federal province of Styria and an educational measure (“Selbstschutz Hochwasser”) in flood risk management. A telephone survey with the participants in this information campaign was conducted and the results were evaluated. In addition, optimisation possibilities and suggestions for improvement were developed. The evaluation of the campaign and the strategy focused on the effect of the educational measures on self-protection. It showed that public awareness could be increased and that most participants were convinced of the effectiveness of self-protection measures. There is still a need for optimisation in terms of reaching the target group under the age of thirty-five and focusing on education measures. The results of the evaluation were discussed at a stakeholder workshop together with good practice examples. Ways of implementing the recommendations in existing educational measures were also decided. The impact of the such implementation was demonstrated through a re-evaluation of the adapted and ongoing

educational measure. Based on the findings, strategy recommendations (combination of different measures, target group-oriented design, use of contemporary media and formats) for an effective educational concept were developed.

1 The StartClim research programme

The StartClim climate research programme is a flexible instrument. Because of the short project duration and annual allocation of project topics, it can react quickly to topical aspects of climate and climate change. It is financed by a donor consortium currently consisting of nine institutions:

- Federal Ministry of Agriculture, Forestry, Environment and Water Management (since 2003)
- Federal Ministry of Health (2005, 2006, 2007)
- Federal Ministry of Science, Research and Economy (since 2003)
- Province of Upper Austria (since 2012)
- Austrian Federal Forests (since 2008)
- Oesterreichische Nationalbank (2003, 2004)
- Austrian Hail Insurance (2003, 2004, 2006, 2007, 2008)
- Federal Environment Agency (2003)
- Verbund AG (2004, 2007)

StartClim has been studying adaptation to climate change since 2008. Since StartClim2012, the programme's aim has been to deliver scientific contributions to the implementation of the Austrian National Adaptation Strategy.

The five StartClim2018 projects examined different aspects of relevance to climate change adaptation in Austria. The topics explored were:

- The interactions between climate policy measures and the Sustainable Development Goals targets
- Conflict solutions regarding climate change mitigation
- The effects of artificial snow
- Business strategies for climate change mitigation
- A strategy for awareness raising in flood risk management

The StartClim2018 report consists of an overview of the results in German and English along with separate documentation containing detailed descriptions of the individual projects by the respective project teams. All StartClim2018 reports and documents will be available for download on the StartClim website (www.startclim.at). Furthermore, a limited number of folders containing a short summary of the results will also be made available.

2 StartClim2018.A: Evaluation of interactions between climate policy measures and the targets of the Sustainable Development Goals (CliPo_Interlink)

In September 2015, the United Nations General Assembly adopted the United Nations Resolution “Transforming Our World: The 2030 Agenda for Sustainable Development”. The resolution includes seventeen SDGs (Sustainable Development Goals) and 169 targets. These ambitions are based on the eight Millennium Development Goals, which the UN has not yet completely achieved (UN 2015a). Recent studies (ICSU 2017, Nilsson et al., 2016) show that many different interactions have taken place in the attempt to meet the various SDG targets. Some targets are positively associated and others have conflicting goals.

The CliPo_Interlink project picked up project interlinkages and evaluated the interaction of climate policy measures (SDG 13) with other SDGs. The methods used were discussed and recommendations derived. A rating scheme allowed quantification and prioritisation of these interactions,.

In a first step, literature, in particular the summary for decision makers of the AAR14 (APCC 2014), the Austrian Special Report Health, Demography and Climate Change (APCC 2018), the Austrian Strategy for Adaptation to Climate Change (BMLFUW and Umweltbundesamt 2017) and the Austrian Climate and Energy Strategy (BMNT and BMVIT 2018), was screened for relevant climate policy measures and recommendations. These measures were categorised according to the aims of the SDG 13, and six specific and effective measures were selected:

- Taxation of animal products
- Thermal building renovation with conversion from oil to renewable energy
- Abolition of self-supply power tax
- Promotion of energy-optimised spatial structures including multimodality in rural areas
- Climate-specific health knowledge for health professionals in education and training
- Heat-related urban planning measures

Based on a pre-selection (ICSU 2017), five SDGs (2, 3, 7, 9, and 11) were chosen for interaction assessment because of their close association with SDG 13.

The 264 interactions between the six measures and the forty-four corresponding subgoals of the five selected SDGs were evaluated in an expert workshop. In the first part of the workshop, the Nilsson scale interaction assessment was used by experts to classify the interactions of SDGs. (Nilsson et al., 2016) The Nilsson scale allows a classification of the SDGs interaction between +3 (inseparable), 0 (no influence), and -3 (cancelling). The second part included a discussion about assessments and the method itself.

During the workshop, the nineteen participants looked at interactions between the six measures and forty-four subgoals of the selected SDGs (fig. 1). For some interactions, no clear value could be determined by the experts. If there was an interaction with two values (global and national perspective, four cases), the national assessment was used, and for direct and indirect assessments (nine cases), only the direct link between the measure and the SDG target was selected. Another reason for mentioning multiple values per interaction (nineteen cases in total) was the different target groups addressed by the measures or SDG targets. The rating 0 (“consistent”) was the most frequent (43%) (fig. 2). 54% of the evaluations identified synergies (+1 to +3), 9% of which were in the category “indivisible” (+3). Only 3% of the cases identified a conflict of interest, and none of the ratings fell into the class “cancelling” (-3).

2 ZERO HUNGER	2.1	2.2	2.3	2.4	2.5	2.a	2.b	2.c
M1	1	3	-1	3	2	2	2	-1
M2	1	2	0	0	1	0	2	0
M3	1	0	3	0	1	2	0	0
M4	1	2	1	3	0	3	0	2
M5	2	1	1	1	1	0	0	0
M6	1	0	0	0	0	1	0	0

3 GOOD HEALTH AND WELL-BEING	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	3.a	3.b	3.c	3.d
M1	1	0	1	2	0	0	0	0	2	0	0	0	1
M2	0	1	1	2	0	0	0	0	3	0	0	0	1
M3	0	0	1	1	0	0	0	0	2	0	0	0	0
M4	0	0	1	2	0	2	0	1	0	0	0	0	0
M5	1	0	0	2	0	1	0	3	1	0	0	1	2
M6	0	1	2	2	0	1	0	3	2	0	0	0	1

7 AFFORDABLE AND CLEAN ENERGY	7.1	7.2	7.3	7.a	7.b
M1	0	2	1	0	0
M2	0	3	2	1	0
M3	0	1	-1	1	0
M4	0	1	3	1	0
M5	0	0	0	1	0
M6	0	0	1	0	0

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	9.1	9.2	9.3	9.4	9.5	9.a	9.b	9.c
M1	1	-1	0	2	1	0	0	0
M2	2	0	0	2	3	2	0	1
M3	2	0	0	3	2	2	0	0
M4	1	0	0	1	2	3	0	2
M5	0	0	0	0	2	1	0	1
M6	2	0	0	2	2	3	0	1

11 SUSTAINABLE CITIES AND COMMUNITIES	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.a	11.b	11.c
M1	0	0	1	0	1	0	1	1	1	1
M2	-1	0	2	-1	1	3	2	3	3	2
M3	2	1	1	0	1	3	-1	2	3	1
M4	2	2	2	0	1	3	2	3	3	2
M5	1	0	1	1	2	1	1	0	1	1
M6	2	1	3	-2	2	2	3	2	3	2

Fig. 1: Assessments of the selected climate action measures with the targets of the SDGs 2, 3, 7, 9 and 11 identified by the workshop participants using the Nilsson scale (Nilsson et al. 2016)

The greatest synergies were achieved with the measure “Promotion of energy-optimized spatial structures”, followed by measures for thermal renovation and conversion of oil boilers to renewable energy and heat-related urban planning measures.

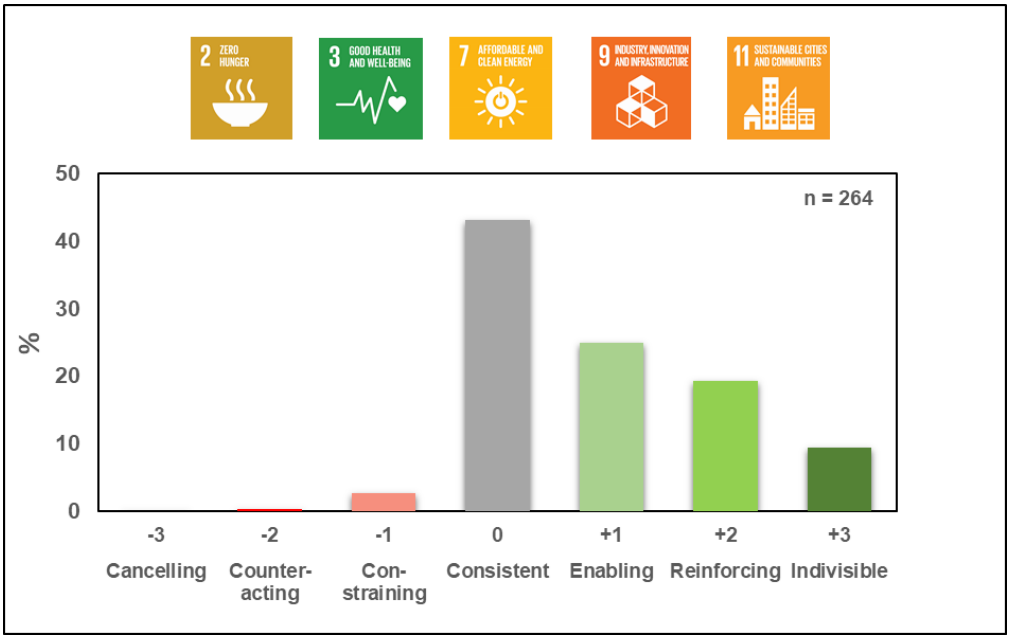

Fig. 2: Frequency evaluation of the rating scale of Nilsson et al. (2016). Most of the reviews identified synergistic interactions (+1 to +3 summarised) (own graph; SDGs images source: UN 2015b)

The discussion in the workshop focused on the methodology of the assessment itself, the measures, the practicability, and complementary optimising points in the context of the assessment on the basis of the Nilsson scale. The approach was found to be suitable in principle for evaluating the interactions. If the required technical expertise is available, this method can provide orientation or depict trends as to whether the measures considered are suitable for several SDG targets or whether there are conflicting goals. It should be emphasised that the levels of the scale indicate the strength and direction of interactions, not the effectiveness of a measure. A consideration of the target levels rather than the SDGs themselves were also thought to be useful.

The issue of subjectivity of the evaluations was also addressed, but it was found that it could be mitigated by discussing the evaluations. The more specific and detailed the action and the objective described, the easier the assessment of an interaction became. It was seen as critical that in the course of the evaluation, subjective values could be incorporated, for example, so as to avoid extreme reviews.

The results show that this method can be used in practice to evaluate selected measures. However, an understanding of the approach, an interdisciplinary approach and broad and diverse expertise by the participants with regard to the considered SDGs are required. Clearly defined system limits and possible concrete measures and targets simplify the evaluation. The measures used in the workshop were sometimes too general or vague (for example, “heat-related urban planning measures”). By contrast, the “abolition of personal income tax” made it easier to estimate the impact, because it was clear that it was about abolishing the mentioned tax.

From the results and the discussion of methodology and feasibility, some selected recommendations for the application of the Nilsson scale can be derived:

- Numbers only reflect something about the strength and direction of the interaction, nothing about the effectiveness of the measure
- Evaluations should be made by multiple experts if possible, and discussion on the reasoning may be helpful
- Clear system limits should be established to ensure comparability between the assessed measures

The results and recommendations of the Clipo_Interlink project are included in the SDG options report to the Austrian Federal Government, which is being created in a cooperation by several Austrian universities within the UniNEtZ (Universities and Sustainable Development Goals) project.

3 StartClim2018.B: CCCS – Climate Change Conflict Solutions Tackling conflicts of climate change adaptation and mitigation

Key documents such as the Austrian National Adaptation Strategy (BMFLUW 2017), the adaptation strategies of the individual provinces, and accompanying research reports recommend specific measures to increase the climate change resilience of different fields of activity. This can, however, also lead to conflicts in aims or utilisation with other sectors and fields of activity, e.g., an increased use of groundwater for farming leading to drought stress in conservation areas. The expansion of renewable energy has already led to numerous conflicts with other forms of land utilisation. Against this background, the Austrian NAS contains indications for each field of activity on whether measures could lead to negative consequences for other sectors. It is increasingly recognised internationally that climate change adaptation should also consider existing forms of land use, their interrelation, and overall regional planning aims (cf. BMU 2009, BMU 2011, BAFU 2014). For example, in its Switzerland-wide synthesis "climate-related risks and opportunities" (BAFU 2017, p.125), the Swiss Federal Office for the Environment lists different potentials for conflict development that could arise through adaptation (BAFU 2015). The German study "Germany's vulnerability to climate change" even goes as far as to issue some of its statements down to an individual district level (UBA 2015). Figure 3 summarises origins of conflicts.

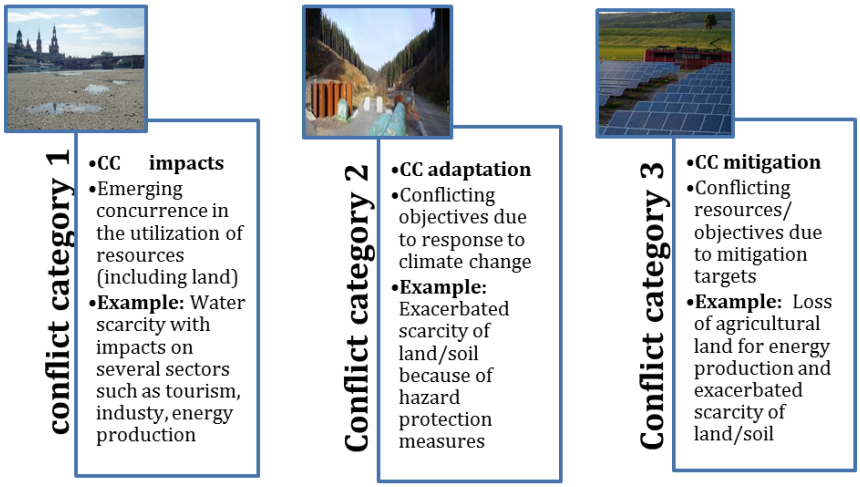

Fig. 3: Categories of conflicts with examples (photos commons)

The aim of the CCCS research project was to develop a methodological approach to identify spatial fields of conflict for individual Austrian provinces or regions, where sectoral or cross-sectoral conflicts could arise through climate change, climate change adaptation, or climate change-related usage competition, and to recommend possible solutions. Based on the analysis of literature and documents, an overview of the central areas of concern was compiled, and a course of action (step-by-step approach) was recommended for developing specific solutions in collaboration with actors from climate change adaptation, specialist planning and spatial planning. The process also incorporated tools from environmental (precautionary) planning and participatory conflict communication.

The national adaptation strategies of Austria, Germany, Switzerland and the Austrian provinces were used to analyse potential conflicts of usage. Furthermore, five expert interviews were conducted for different sectors. The specification of potential conflicts caused by climate change impacts, adaptation or climate protection varied greatly depending on the strategy examined, the spatial level, the time scale and the cross-sectoral consideration of climate change-related conflicts. Regarding the climate signals, potential sources of conflict were predominantly addressed in relation to "heavy rainfall" and "flooding/erosion", while the climate change impacts most often related to were "heat",

"aridity" and "low water levels". The evaluation of the interviews also showed that specific sources and sectors of potential conflict at regional and local levels cannot be addressed at all in the adaptation strategies because of their larger scope. Furthermore, the conflicts addressed could also affect additional sectors. In order to identify climate change-related conflicts for a province or region, it is therefore necessary to combine the analysis of published documents and studies (top down) with the knowledge of experts (bottom up), and to incorporate all planning levels.

The analysis of adaptation measures and the expert interviews yielded a sequence of four steps for systematically identifying, minimising or avoiding potential conflicts in aims and utilisation as a result of adaptation measures in Austria's provinces. The first three steps serve to identify climate change-related conflicts that could occur or become exacerbated in a province or region, and to allow the key actors to categorise their significance. They form the basis for the fourth step, which seeks to find appropriate solutions to these looming or intensifying conflicts. Because fields of conflict are specified over a number of levels, they can be identified proactively before they cause serious strains on the environment or impact other fields of activity and can only be reacted to with ad-hoc measures. The StartClim final report contains key questions for every step as well as notes on their implementation. Overall, the analysis showed that adaptation strategies must increasingly consider conflicts that cannot be managed solely by the existing regulatory tools or by spatial or environmental planning, and which therefore require new, complementary approaches.

The following principles – **four basic principles (4Ks) of conflict resolution** – are an important recommendation for all four of the steps:

First principle – communication: Cross-sectoral communication is essential in order to identify conflicts in aims or interest beyond an individual sector, or even within the different objective systems in the same sector. This is especially valid for the management of water resources. The project report provides an overview of relevant planning and programmes, as well as thematic examples.

Second principle – cooperation: In addition, exchange and cooperation between sectors can contribute to promoting synergies (e.g. multifunctional use of land) and creating benefits for multiple fields of activity ("multi-benefits" or "co-benefits", such as water conservation systems in one or multiple sectors which equally benefit other sectors/fields of activity with high/increasing water demand).

Third principle – considerate action: If synergies are not possible, deliberate "no- or low-regret" measures should be aimed for, which harbour no or only little conflict potential, such as cessation of draining in agricultural areas to benefit environmental objectives in wetland areas.

Fourth principle – consistency: Finally, the consistency of planned solutions with higher-level strategies and instruments needs to be examined so as to guarantee that the suggested measures can be integrated into the spatial target system. For example, renewable energy measures should be aligned with the protection and development aims of the affected sectors (e.g., regarding sufficient residual water flow).
The provinces' adaptation strategies contain a number of examples connected with the 4K principles, which are presented in the final report in overview

4 StartClim2018.C: SnowAlb – Effects of artificial snow on the energy balance in the skiing area Saalbach-Hinterglemm

Winter tourism is an important part of Austria's economy, accounting for about 5.2% of the country's GDP. Winter tourism in Austria is dominated by winter sports, which is vulnerable to climatic variability and therefore affected by climate change. Low-elevation ski areas in Austria will be particularly affected by variability in snow cover. The main regions involved are in the eastern part of the Austrian Alps. Some of the vulnerability due to snow security has been reduced in the recent years by artificial snow, with the result that skiing regions with high-quality snow-making machines and early investments in these properties have a better survival probability than others. Nevertheless, snow-making also contributes to carbon emission – on the one hand through the energy production itself, and on the other hand, by guaranteeing skiing tourism, an activity with high carbon emissions. However, the production of artificial snow in ski areas also has a positive effect. Because of the higher reflection of direct sunlight from snow (the reflection rate of the indirect solar radiation is defined as the albedo and is about 0.85 for snow, which means 90% of the radiation is reflected back into the atmosphere), a higher percentage of snow-covered area in ski areas produces an overall cooling effect, as the albedo of the area not covered by snow is between 0.2 and 0.3. A study by Joanneum Research in 2017 concluded that the effect of using artificial snow for ski slopes outweighs the carbon emissions from the snow-making machines. The study was performed using a simplistic radiation model, and the present study therefore aimed to show that a complex radiation model produces different results regarding radiation budget changes in ski areas as a result of artificial snow production for skiing slopes.

The present study used a complex 3D radiative transfer model to analyse the effect of artificial snow on the radiation budget of the ski area of Saalbach Hinterglemm (BOKU-Met approach). The results were compared with the simplistic radiation model in the Joanneum-Research study (JR study). The 3D radiation model used a digital elevation model (DEM) for Austria with a resolution of 10mx10m to calculate the aspect and ratio for the study area. Land use classification in the study area was based on the CORINE dataset, and each land use class was categorised in terms of its albedo value. One additional class was the Saalbach-Hinterglemm ski slopes. To simulate real conditions, snow data from the SNOWGRID model were used, a rasterised 1x1km file, which was interpolated by residual kriging to 10x10m for this study. To compare results for both approaches a snow albedo of 0.85 was assumed.

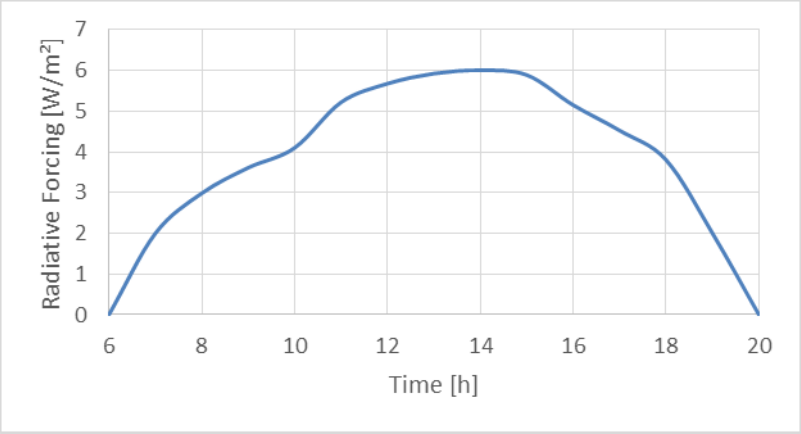

Fig. 4: Diurnal cycle of radiation forcing using the albedo difference between "real snow conditions" and "real snow conditions with artificial snow" in April

Assuming no natural snow cover in the whole area and all skiing slopes covered with artificial snow, simulations using the BOKU-Met approach showed that radiation forcing is highest in

April (33.05 W/m²). This effect is lower in January and December with a radiative forcing of 11.04 and 11.72 W/m².

In addition, if this approach includes a tree correction – which means that all land use classes considered as forests are increased by 10m – the radiative forcing is reduced by 46% in December, by 38% in January and by 16% in April. In a further step, real snow conditions were considered using mean snow probabilities for April. This led to a mean effect for a day in April of 2.32 W/m². Daily effects were highest at noon, mainly because of the radiation at the top of the atmosphere and diurnal changes in the albedo (albedo differences were lowest at one o'clock and highest in the evening). The JR study used different albedo values for snow cover and no snow cover. In order to reconstruct the results obtained in that study, the present study therefore used the maximum and minimum values, which produced albedo differences of 0.35 to 0.65 W/m². Results using the JR method for the "maximum albedo change" scenario assuming no natural snow cover in the study area amounted to 43.5 W/m² in April and 13.9 or 17.1 W/m² in December or January. Under real snow conditions the effect in April was about 14.7 W/m². Albedo reduction for the JR study resulted in a 46% change in radiative forcing.

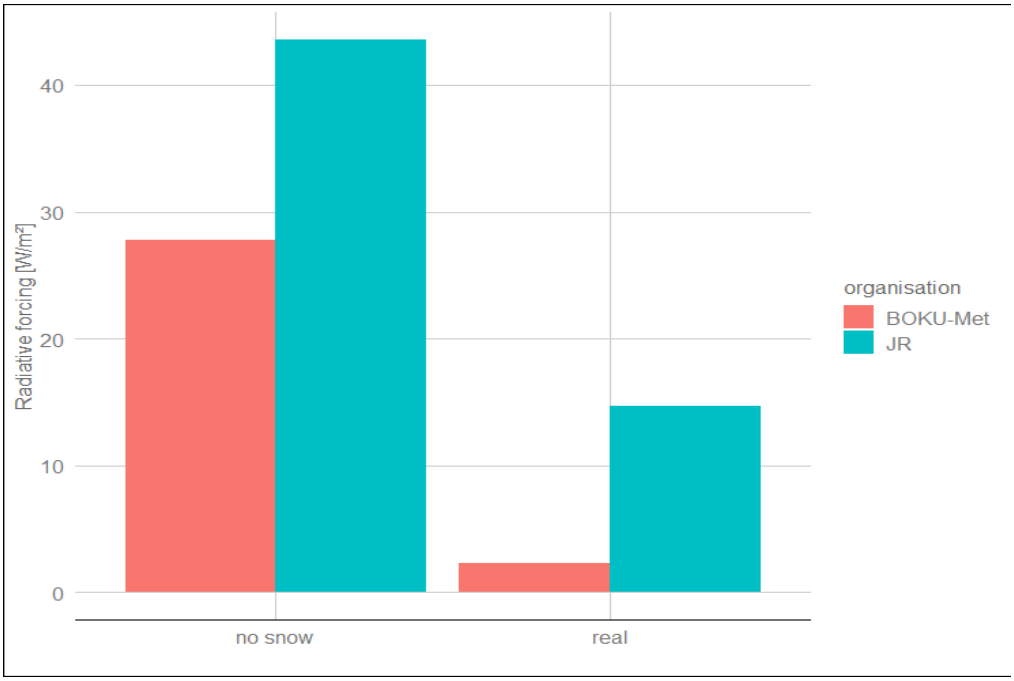

Fig. 5: Comparison of BOKU-Met and JR study results

A comparison of the two approaches showed that the JR study overestimated the results obtained for real snow conditions using the BOKU-Met approach by a factor of six. Differences were lower in the scenario with no snow cover in the whole area, but this is an unrealistic situation. Another consideration is that snow making is not carried out when there is no natural snow at all. There has to be a minimum snow cover of 150 mm snow equivalent, which means that naturally snow-covered areas are still covered by artificial snow, as the snow depth is not sufficient for skiing, but the albedo effect is already attained.

Finally, this study concluded that simplistic radiation models, such as the one used by Joanneum Research, cannot give a good estimate of the radiation budget for complex terrain structures as in mountainous areas. The BOKU-Met approach showed that adding a tree correction to the model to take account of the physiogeographic characteristics of the Saalbach-Hinterglemm ski area and the effects of multiple reflection, shading and a "canyon effect" significantly reduced the cooling effect of artificial snow. It is therefore highly

questionable whether artificial snow has a positive effect, even if only the carbon emissions for snow making are considered, and it may be concluded that this approach is too simplistic.

5 StartClim2018.D: Business for Climate (B4C) – Business strategies for climate change mitigation and adaptation

In the Paris Agreement of 2015, the international community pledged to keep global warming well below 2°C and to undertake efforts to limit the temperature increase to 1.5°C compared with pre-industrial levels. According to the Intergovernmental Panel on Climate Change, to reach the 1.5°C target, global greenhouse gas emissions must be reduced to net zero by 2050, so that total emissions do not exceed the quantity that can be compensated in other ways.

For industrialised countries, the Paris Agreement implies a far-reaching decarbonisation of their economies and societies by withdrawing from fossil energy and raw materials. Figure 6 shows possible pathways in the different emission sectors for reducing greenhouse gas emissions by 81% overall compared with 1990, based on the transition scenario developed by Environment Agency Austria and project partners in 2017. In some sectors of the Austrian economy, decarbonisation offers clear new business areas for companies. In other sectors, opportunities for a low-carbon transformation are less obvious, because of the energy intensity of production processes or the emission intensity of the raw materials and fuels used.

Using innovative national and international examples, this study identified the most important approaches and strategies that provide opportunities for businesses and are also compatible with climate change mitigation and adaptation. The focus was on those sectors where decarbonisation is still considered a challenge, such as energy-intensive industries and the building and transport sectors. For that purpose, a comprehensive literature review as well as guideline-based interviews with experts from public administration, business and research were carried out. The opportunities, risks and barriers connected with these strategies were discussed and the necessary framework for their successful implementation in Austria were surveyed.

The interviews revealed that the companies interviewed were already engaging intensively with decarbonisation. In iron and steel-making, in the petrochemical and to some extent in the chemical industry and that in transport, **hydrogen produced with electricity from renewable sources** (“green hydrogen”) plays a role as a zero-emission raw material or fuel. The construction materials industry is developing low-carbon cement and ecological insulation materials. The **electrification** of industrial production processes, passenger car powertrains and the energy supply of buildings are also important strategies for emission reduction through the shift from fossil energy to renewable electricity.

Since the implementation of these strategies would lead to a strong rise in demand for renewable electricity – according to one interview partner from the research community, two to three times the amount of today’s total electricity demand would have to be produced from renewables – measures that foster the **efficient, cascading utilisation of energy and raw materials** are considered very important. Examples include energy recovery or the re-use of industrial waste heat in factories and for supplying thermal energy to buildings, the thermal renovation of buildings and the recycling of raw materials. **Sector coupling**, i.e., the increasing integration of industry, transport, buildings and energy supply by means of renewable electricity, also offers potential for raising the energy efficiency of the system as a whole. Furthermore, since the availability of electricity from renewable sources is volatile and decentralised, **storage technologies** for electricity like power to gas, or for thermal energy in buildings, are becoming increasingly important. Finally, measures to reduce energy consumption, improved energy storage and cooling also offer synergies with climate change adaptation.

In order to keep energy consumption by 2050 at a level consistent with the climate targets, additionally, **changes in consumer behaviour** are key. In mobility, for example, this includes switching to public transport, cycling and walking; and in the consumption of goods a shift to longer-lasting products and generally more resource-saving lifestyles.

From the literature review and the interviews, Austrian competences and thus **economic potential** emerge in several of the decarbonisation strategies identified, e.g., hydrogen production via electrolysis and methanation based on hydrogen; fuel cell-driven propulsion systems and hydrogen filling stations; the construction of battery packs, their fitting into vehicles and battery-charging technologies; passive house-building technologies and solar thermal energy generation, thermal storage technologies and heat pumps for buildings and industry; and mechanical and chemical recycling and carbon capture. According to the interviewees, some of the approaches surveyed are already economically interesting, for instance industrial waste heat utilisation or bio-refinery.

To implement the identified strategies successfully and more broadly, the interview partners suggested adapting the **legal framework conditions**; in addition, **infrastructure development** for electricity generation from renewables, green hydrogen production, thermal energy supply lines and sector coupling; **economic incentives** like phasing out environmentally harmful subsidies, or price incentives that ensure the affordability of electricity from renewables compared with fossil-based electricity for the production of green hydrogen; research funding for approaches that are not yet technologically mature; and **information and networking initiatives**, especially for implementing sector coupling and to encourage the efficient, cascading utilisation of energy and raw materials, to learn from and coordinate with each other and to find partners for new, cross-industry business models; for instance, one interview partner suggested setting up a public register with information on where which material and energy flows occur as “waste” and who would be interested in using them.

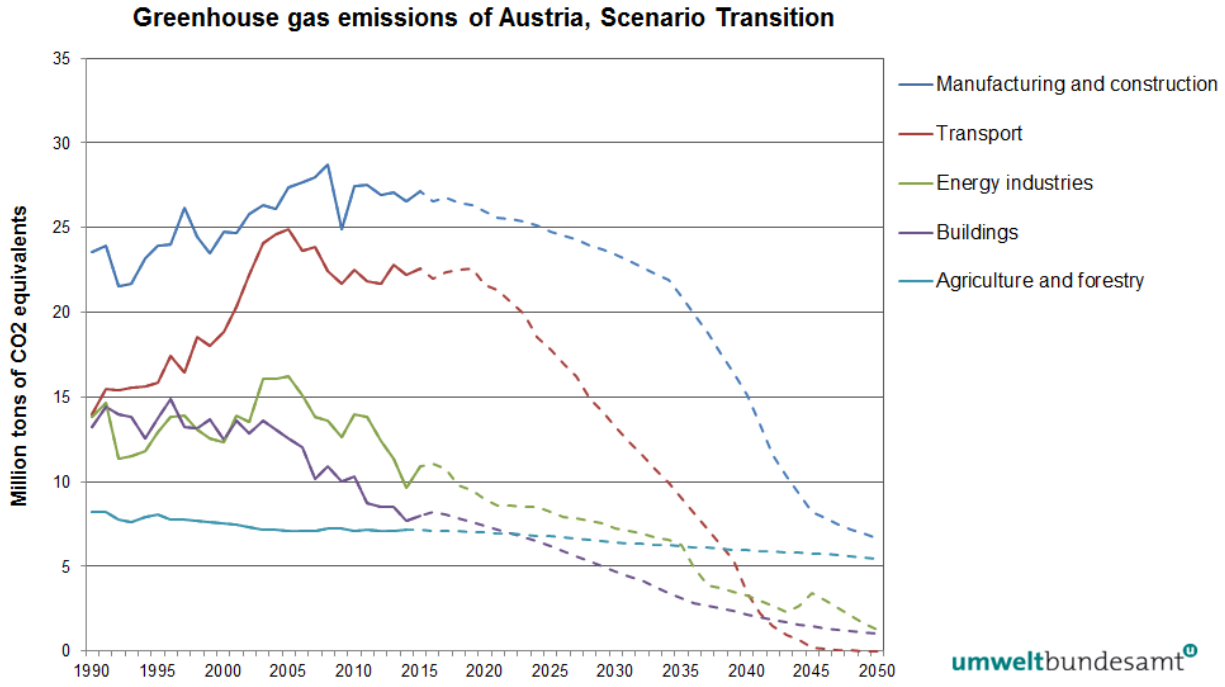

Fig. 6: Fields of action for the 2050 climate targets. Source: Environment Agency Austria. Data from 1990 to 2015 (solid lines) are taken from the Greenhouse Gas Emission Inventory of Environment Agency Austria. The projections from 2016 to 2050 (dashed lines) are taken from the Energy and Greenhouse Gas Scenarios that Environment Agency Austria prepared in 2017 as part of an Austrian consortium in fulfilment of an EU reporting obligation on behalf of the Austrian Federal Ministry for Sustainability and Tourism.

6 StartClim2018.E: Analysis of a strategy for awareness-raising in flood risk management – Evaluation of an innovative educational concept as a basis for civil protection

In order to minimise the potential negative effects of climate change, such as extreme storm weather events and subsequent flood damage, a suitable strategy concept and action plan are required. A fundamental field of action is awareness-raising to reduce vulnerability and increase the resilience of the population. Awareness-raising measures in flood-risk management are conducted by various agencies in Austria (ministries, federal provinces, etc.). Often, their effects are not evaluated, hence possible weaknesses in the information strategies are not identified and therefore the same mistakes are repeated. One aim of the project was to evaluate and scientifically monitor one of these awareness-raising measures ("Selbstschutz Hochwasser" information campaign). The evaluation was carried out with the help of a telephone survey and focused on the effect of the educational measure, on self-provision and self-protection. The campaign was launched by the federal province of Styria as part of the Styrian flood risk management programme (HORST), which is based on four strategies (including "awareness-raising"). Through the analysis and evaluation of the information campaign and the overall strategy, optimisation possibilities were identified, leading to improvements in the measure and strategy. Another goal of the project was to provide basic knowledge regarding effective educational measures (good practice examples) by means of a literature research. The results of the literature research, the optimisation possibilities and the evaluation were then presented and discussed in a stakeholder workshop. Within the workshop, improvement measures for the ongoing information campaign were developed and implemented together with the participants, based on the knowledge gained from the previous working steps. A further evaluation is required to demonstrate the effects of the actions.

The basic knowledge obtained through literature research and the findings gained from the evaluations and analyses of the case studies (HORST, "Selbstschutz Hochwasser") served as the basis for deriving strategy recommendations for an effective education concept in flood-risk management.

The first step was to analyse the HORST awareness-raising strategy, which showed that the federal province of Styria is already implementing a large number of measures. They can be divided into four groups (informing citizens, training, research, and event documentation and analysis). Most of them are still running or run at regular intervals. Potential for improvement has been identified in the area of training, which could be a major future focus.

The current "Selbstschutz Hochwasser" information campaign aims to inform and educate citizens about possible threats in their communities and about possibilities for self-protection and self-provision. The idea is to increase awareness and willingness for self-prevention measures by means of lectures by the Civil Protection Association and fire brigades. The information event is to be held in every Styrian municipality. At the time of the evaluation, it had already taken place in around a quarter (70 out of 287) of the municipalities throughout Styria. The two surveys clearly showed that the willingness to take precautionary measures increased after attending the event. Some 66% (68 out of 102 interviewees) stated that they had already taken precautionary measures or planned to do so. In a previous study (n = 180), 70% of respondents said that self-protection was too difficult. Belief in the effectiveness of such measures was also strengthened by the information event. Another study also conducted a survey (n = 159) and asked the participants if they could think of any ways to prevent flood damage in their homes. Here, 59% (95 out of 159) said they had few if any opportunities to prevent damage. In the current project, 50% (51 out of 102) expected that self-protection measures would have a very good (6%) or good (44%) impact (table 1).

	100% protection 1	2	3	4	No protection 5
Current Study (n=102)	6%	44%	40%	9%	1%

Table 1: Feeling of protection of self-protection measures from interviewees

In addition, the awareness of their own vulnerability could be increased too. Around 92% (94 out of 102) knew whether or not their own property was in a hazard zone according to the hazard maps. The evaluation also revealed that the key message of the information campaign ("self-protection is possible and important") was understood by the participants.

Within the stakeholder workshop, improvement measures were discussed and some were included in the ongoing information campaign. Examples of these were the preparation of FAQs with standardised responses, focusing on a combination of the information event with other events (town hall meetings) or other lectures by the Civil Protection Association (blackout, cybercrime), the creation of feedback opportunities and the more targeted promotion of the event. These measures will be used to adapt the existing information campaign. In addition, the workshop showed the benefits of scientific support of an ongoing information campaign: strengths and weaknesses can be identified and constantly remedied. The participants in the workshop also decided that the campaign should be extended, partly because of the positive results of the evaluation, and should specifically target districts with low penetration rates. The impact of the implemented improvement measures could not be clearly demonstrated by the second survey, not only because of the smaller sample size (n = 35) but also because the questionnaire had already been prepared before the improvements were drafted and many of the measures were thus not well reflected in the questions.

Based on the insights gained from the analyses and the evaluation and the literature review, the following strategic recommendations were elaborated:

- Combination of different measures
- Clear distribution and marketing strategies
- Accompanying analyses and evaluations of measures taken
- Target group oriented design of the measures
- Use of contemporary media and formats
- Support of research

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StartClim2018.E

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List of Figures

Annex

The following projects were part of StartClim2010 to StartClim2017. All StartClim reports can be found online on the StartClim webpage (www.startclim.at).

Contributions to StartClim2010

StartClim2010.A: Fields of action and responsible actors for climate change adaptation of public parks in cities
Institute of Landscape Development, Recreation and Conservation Planning (ILEN), BOKU: Stephanie Drlik, Andreas Muhar

StartClim2010.B: Recommendations for an adaptation of urban open and green spaces in Austrian cities and city regions
PlanSinn GmbH, Office for Planning and Communication: Erik Meinharter
Federal Environment Agency: Maria Balas

StartClim2010.C: The social costs of adaptation: approaches to an evaluation of adaptation options (SALDO)
Wegener Center for Climate and Global Change, University Graz: Birgit Bednar-Friedl, Olivia Koland, Janine Raab
Federal Environment Agency: Martin König

StartClim2010.D: Integrated precautionary and adaptation measures for the Marchfeld region
Institute for Sustainable Economic Development, BOKU: Christine Heumesser, Mathias Kirchner, Erwin Schmid, Franziska Strauss

StartClim2010.E: Ecological and silvicultural characteristics of European larch (Larix decidua Mill.) – consequences for forest management in Austria in consideration of climate change
Institute of Silviculture, BOKU: Eduard Hochbichler, Gabriele Wolfslehner, Roland Koeck, F. Arbeiter
Federal Research and Training Centre for Forests, Natural Hazards and Landscape: Herfried Steiner, Georg Frank
Institute of Meteorology, BOKU: Herbert Formayer

Startclim2010.F: Hot town, summer in the city – effects of hot days on recreational and leisure behaviour and sightseeing programmes of city tourists as exemplified by the case of Vienna
Institute of Landscape Development, Recreation and Conservation Planning (ILEN), BOKU: Christiane Brandenburg, Brigitte Allex, Ursula Liebl, Christina Czachs
Institute of Meteorology, BOKU: Thomas Gerersdorfer

StartClim2010.G: Knowledge-based platform to optimise operations strategies in handling natural hazards
Austrian Red Cross: Jürgen Högl, Clemens Liehr, Gerry Foitik
Institute of Production and Logistics, BOKU: Manfred Gronalt, Magdalena Schweiger, Patrick Hirsch

Contributions to StartClim2011

StartCim2011.A: Climatic influence on voltinism and spread of the spruce bark beetle, Ips typographus, in alpine areas
Institute of Forest Entomology, Forest Pathology & Forest Protection, BOKU: Axel Schopf, Emma Blackwell, Veronika Wimmer

StartClim2011.B: Analyzing Austria's forest disturbance regime as basis for the development of climate change adaptation strategies
Institute of Silviculture, BOKU: Rupert Seidl, Dominik Thom
Institute of Forest Protection, Federal Research and Training Center for Forests, Natural Hazards, and Landscape (BFW): Hannes Krehan, Gottfried Steyrer

StartClim2011.C: Effects of soil drying on the transpiration of Austrian tree species
University of Innsbruck: Georg Wohlfahrt, Stefan Mayr, Christoph Irschick, Sabrina Obwegeser, Petra Schattanek, Teresa Weber, Dorian Hammerl, Regina Penz

StartClim2011.D: Adapting Austrian forestry to climate change: Assessing the drought tolerance of Austria's autochthonous tree species
Institute of Botany, BOKU: Gerhard Karrer, Gabriele Bassler
Institute of Forest Ecology, BOKU: Helmut Schume, Bradley Matthews
Vienna Institute for Nature Conservation and Analyis, V.I.N.C.A: Wolfgang Willner

Contributions to StartClim2012

StartClim2012.A: Cover crops as a source or sink of soil greenhouse gas emissions?
Division of Agronomy, Department of Crop Sciences, BOKU: Gernot Bodner, Andreas Klik, Sophie Zechmeister-Boltenstern

StartClim2012.B: Effects of climate change on soil functions: metadata analysis
Federal Research and Training Centre for Forests, Natural Hazards, and Landscape (BFW): Michael Englisch, Barbara Kitzler, Kerstin Michel, Michael Tatzber
Federal Agency for Water Management, Institute for Land & Water Management Research (BAW-IKT): Thomas Bauer, Peter Strauss
Austrian Agency for Health and Food Safety (AGES): Andreas Baumgarten, Hans-Peter Haslmayr
Federal Environment Agency: Alexandra Freudenschuß

StartClim2012.C: Disturbance of forest stands and humus loss
Institute of Forest Ecology, BOKU: Douglas Godbold, Mathias Mayer, Boris Rewald

StartClim2012.D: To count with and on wood: adaptations of tools and data (German: Holz BZR)
Kompetenzzentrum Holz GmbH: Tobias Stern, Franziska Hesser, Georg Winner, Sebastian Koch
Institute of Marketing and Innovation, BOKU: Leyla Jazayeri-Thomas, Verena Aspalter, Martin Braun, Wolfgang Huber, Peter Schwarzbauer
Institute of Wood Science and Technology, BOKU: Robert Stingl, Marie Louise Zukal, Alfred Teischinger
Federal Environment Agency: Peter Weiss, Alexandra Freudenschuß

StartClim2012.E: Snow line climatology within the Alpine region, derived from re-analysis data
Institute of Meteorology, BOKU: Herbert Formayer, Imran Nadeem

StartClim2012.F: Values as performance indicators: a path towards a proactive climate protection
Centre for Global Change and Sustainability, BOKU: Maria Miguel Ribeiro, Julia Buchebner

Contributions to StartClim2013

StartClim2013.A: Thermal stress for brown trout in the headwaters of the river Traun during summer
Harald Ficker, M.Sc.

StartClim2013.B: Loss of floodplains and flood risk in the context of climate change

Institute of Water Management, Hydrology and Hydraulic Engineering, BOKU: Helmut Habersack, Bernhard Schober, Daniel Haspel

StartClim2013.C: Runoff scenarios in the Ötztal valley (Tyrol, Austria) considering changes to the cryosphere as a result of climate change
alpS GmbH: Matthias Huttenlau, Katrin Schneider, Kay Helfricht, Klaus Schneeberger
Institute of Meteorology, BOKU: Herbert Formayer

StartClim2013.D: Recommendations for changes to regional development and spatial planning in areas of high flood risk
PlanSinn GmbH - Office for Planning & Communication: Bettina Dreiseitl-Wanschura, Erik Meinharter, Annemarie Sulzberger
Rambøll Group: Herbert Dreiseitl
Federal Environment Agency GmbH: Theresa Stickler, Jochen Bürgel

StartClim2013.E: How and where will Austrian river systems respond to climate change? An interdisciplinary analysis of fish fauna and nutrients
Institute of Hydrobiology and Aquatic Ecosystem Management, BOKU: Thomas Hein, Andreas Melcher, Florian Pletterbauer
Department of Integrative Zoology, University of Vienna: Irene Zweimüller

StartClim2013.F: GIAClim – Gender Impact Assessment in the context of climate change adaptation and natural hazards
Institute of Landscape Planning, BOKU: Doris Damyanovic, Florian Reinwald, Britta Fuchs, Eva Maria Pircher
Institute of Landscape Development, Recreation and Conservation Planning, BOKU: Christiane Brandenburg, Brigitte Allex
Institute of Mountain Risk Engineering, BOKU: Johannes Hübl, Julia Eisl

StartClim2013.G: Validation of the applicability of the SIMAGRIO-W wireworm prognosis model, based on soil temperature and moisture measurements, in Eastern Austrian agriculture
Bio Forschung Austria: Patrick Hann, Katharina Wechselberger, Rudi Schmid, Claus Trska, Birgit Putz, Markus Diethart, Bernhard Kromp
Zentralstelle der Länder für EDV-gestützte Entscheidungshilfen und Programme im Pflanzenschutz (ZEPP): Jeanette Jung
Institute of Meteorology, BOKU: Josef Eitzinger

Contributions to StartClim2014

StartClim2014.A: SNORRE - Screening of remarkable weather
Zentralanstalt für Meteorologie und Geodynamik (ZAMG): Christoph Matulla, Brigitta Hollosi
Federal Environment Agency: Maria Balas

StartClim2014.B: Developing a method for assessing climate change effects on productivity and animal welfare as well as adaptation potential of livestock husbandry
Institute of Livestock Sciences, BOKU: Stefan Hörtenhuber, Werner Zollitsch

StartClim2014.C: Effects of ambient temperature on performance and health traits in dairy cattle when considering husbandry factors
Institute of Livestock Sciences, BOKU: Birgit Fürst-Waltl, Verena Auer
ZuchtData EDV-Dienstleistungen GmbH: Christa Egger-Danner, Franz Steininger
Institute of Meteorology, BOKU: Herbert Formayer, David Leidinger
Höhere Bundeslehr- und Forschungsanstalt für Landwirtschaft Raumberg-Gumpenstein: Elfriede Ofner-Schröck, Eduard Zentner
LKV Austria: Karl Zottl

StartClim2014.D: On the importance of climate change for nutrition and diseases of alpine game
Gesellschaft für Wildtier und Lebensraum (GWL): Armin Deutz, Gunther Greßmann
Höhere Bundeslehr- und Forschungsanstalt für Landwirtschaft Raumberg-Gumpenstein: Thomas Guggenberger, Albin Blaschka

StartClim2014.E: Weather-independent tourism offers based on Nature experience offers - relevance and innovative development options
Institute of Landscape Development, Recreation and Conservation Planning, BOKU: Ulrike Pröbstl-Haider, Verena Melzer

StartClim2014.F: permAT – Long-term monitoring of permafrost and periglacial processes and its role for natural hazard prevention: Possible strategies for Austria
Department of Geography and Regional Science, University of Graz: Andreas Kellerer-Pirklbauer, Christoph Gitschthaler, Michael Avian
Zentralanstalt für Meteorologie und Geodynamik (ZAMG): Annett Bartsch, Stefan Reisenhofer, Gernot Weyss, Claudia Riedl

Contributions to StartClim2015

StartClim2015.A: Re-inventing prevention? - An analysis and evaluation of approaches and tools for flood and heavy precipitation self-provision and private prevention (RE-Invent)
Institut für Interdisziplinäre Gebirgsforschung IGF, Österreichische Akademie der Wissenschaften: Axel Borsdorf, Stefanie Rohland
Wegener Center für Klima und Globalen Wandel, Universität Graz: Philipp Babcicky, Sebastian Seebauer
Landesfeuerwehrverband Vorarlberg: Clemens Pfurtscheller

StartClim2015.B: RELOCATE – Relocation of flood-prone households in the Eferding basin: Accompanying research on social impacts
Wegener Center für Klima und Globalen Wandel, Universität Graz: Philipp Babcicky,
Sebastian Seebauer

StartClim2015.C: Monitoring the effects of climate change on the Austrian bird fauna
BirdLife Österreich: Erwin Nemeth, Norbert Teufelbauer
Zentralanstalt für Meteorologie und Geodynamik (ZAMG): Ingeborg Auer, Brigitta Hollòsi

StartClim2015.D: Maintaining the protective services in Austrian forests under conditions of climate change
Institut für Waldbau, BOKU: Manfred Lexer, Florian Irauschek, Werner Rammer

StartClim2015.E: Risk assessments for selected protection forest types of the Eastern Alps (Austria and Southern Tyrol) with reference to the disturbance regimes storm/snow damage/drought - bark beetle– forest fire and climate change
Institut für Forstentomologie, Forstpathologie und Forstschutz, BOKU: Axel Schopf, Peter Baier,
Sigrid Netherer, Josef Pennerstorfer

Contributions to StartClim2016

StartClim2016.A: Monitoring to assess biodiversity effects of climate change
Umweltbundesamt GmbH: Stefan Schindler, Franz Essl, Wolfgang Rabitsch, Maria Stejskal-Tiefenbach

StartClim2016.B: Impact of climate change on the activity phases of animals using the example of amphibians in Austria and the use of plant phenology as an indicator
Institut für Landschaftsentwicklung, Erholungs- und Naturschutzplanung, BOKU: Christina Czachs, Christiane Brandenburg, Birgit Gantner, Manfred Pintar, Caren Hanreich
Institut für Meteorologie, BOKU: Erich Mursch-Radlgruber

StartClim2016.C: BioRaw
Bundesforschungs- und Ausbildungszentrum für Wald, Naturgefahren und Landschaft: Michael Englisch, Robert Jandl, Rainer Reiter
Umweltbundesamt GmbH: Andreas Bartel, Rosemarie Stangl, Gerhard Zethner, Helmut Gaugitsch, Wolfgang Lexer

StartClim2016.D: Raising awareness as driver of social transformation in the context of climate change? How local and regional authorities raise awareness about climate change in the frame of e5 and KEM initiatives.
Österreichisches Institut für Raumplanung: Ursula Mollay, Joanne Tordy
MSC SORA: Evelyn Hacker, Florian Oberhuber

StartClim2016.E: Detection of bark beetle infestation using an unmanned aerial vehicle (UAV)
Institut für Vermessung, Fernerkundung und Landinformation, BOKU: Markus Immitzer, Kathrin Einzmann, Clement Atzberger

StartClim2016.F: Migration, climate change and social and economic inequalities
Ludwig Boltzmann Institut für Menschenrechte: Monika Mayrhofer, Margit Ammer

Contributions to StartClim2017

StartClim2017.A: ClimBau – The Paris Agreement and the effects on the domestic building- and real estate industry
bauXund forschung und beratung GmbH: DI Mag. Lukas Clementschitsch, Dr. Thomas Belazzi
Institut für Meteorologie, BOKU: Ass. Prof. Dr. Herbert Formayer,
raum & kommunikation GmbH: Dr. Robert Korab

StartClim2017.B: Multiscale Evaluation of damage caused by extreme weather situations
Zentralanstalt für Meteorologie und Geodynamik (ZAMG): Dr. Theresa Schellander-Gorgas, Konrad Andre, Mag. Michael Hofstätter

StartClim2017.C: EXTEND (EXTreme EveNts Documentation)Documentation of physical and social consequences of extreme events
Institut für Landschaftsplanung, BOKU: Assoc. Prof. Dipl.-Ing. Dr. Doris Damyanovic, DI Karin Weber, DI Florian Reinwald,
Institut für Alpine Naturgefahren: Dr. Maria Papathoma-Köhle, DI Susanna Wernhart, Univ.Prof. Dipl.-Ing. Dr.nat.techn. Johannes Hübl

StartClim2017.D: Monitoring of alien mosquitoes of the genus Aedes in Austria
Institut für Parasitologie, Veterinärmedizinische Universität Wien: Mag. Dr. Hans-Peter Fuehrer, Mag. Carina Zittra, Ellen Schöner PhD