

PUBLIZIERBARER ENDBERICHT

A) Projektdaten

Kurztitel:	CAPITAL-ADAPT
Langtitel:	Die Rolle von Human- und Sozialkapital in Umgang mit dem und Anpassung an den Klimawandel
Programm:	ACRP3
Dauer:	1.1.2011-31.12.2012 (24 Monate)
KoordinatorIn/ ProjekteinreicherIn:	SERI Nachhaltigkeitsforschungs- und kommunikations GmbH, Dr. ⁱⁿ Ines Omann
Kontaktperson Name:	Dr. ⁱⁿ Ines Omann
Kontaktperson Adresse:	Garnisonsgasse 7/17, 1090 Wien/Austria
Kontaktperson Telefon:	+43 1 969 0728 28
Kontaktperson E-Mail:	ines.omann@seri.at
Projekt- und KooperationspartnerIn (inkl. Bundesland):	Umweltbundesamt, Wien
Schlagwörter:	Klimawandelanpassung, Humankapital, Sozialkapital, Anpassungsmaßnahmen
Projektgesamtkosten:	€ 246.204,--
Fördersumme:	€ 246.204,--
Klimafonds-Nr:	K10AC1K00013 (B068677)
Erstellt am:	18.03.2013

Inhalt

1 Executive Summary	3
Brief description of the project (initial situation, targets, methodology – activities).....	3
Results and conclusions of the project.....	3
Outlook and summary.....	4
2 Hintergrund und Zielsetzung.....	5
Initial situation / motivation of the project	5
Objectives of the project	5
3 Projekthinhalt und Ergebnis(se)	5
a. CAPITAL-ADAPT framework.....	5
b. Results of exposure analysis in the case studies.....	6
c. Human and Social Capital Indicators.....	10
d. Six steps to the measures – the handbook.....	13
e. Measures for Virgen and Klosterneuburg	15
f. Evaluation of the stakeholder process.....	15
g. Stakeholder-orientation: Transparency and project website	16
4 Schlussfolgerungen und Empfehlungen	17
Findings of the project	17
Recommended further steps.....	19
Relevant target groups for further work.....	19
Outlook	20
5 Methodik	21
a. Development of the CAPITAL-ADAPT framework	21
b. Scoping Interviews and Stakeholder Analysis	21
c. Stakeholder Workshops	21
d. Analysis of vulnerability hotspots.....	22
e. Handbook development	23
f. Developing strategies and policies	23
g. Comparing with adaptation measures identified in a Scottish Case Study.....	23
6 Arbeits- und Zeitplan.....	24
7 Publikationen und Disseminierungsaktivitäten	24
Cited literature	25
Further literature used	26

Projektübersicht

1 Executive Summary

Brief description of the project (initial situation, targets, methodology – activities)

Adaptation to climate change is a key challenge at the regional and local levels, where climate change impacts are directly experienced. An effective regional and local adaptation strategy depends on the availability of five forms of capital (natural, manufactured, financial, human and social). Based on case studies in Virgen and Klosterneuburg, the CAPITAL-ADAPT project explored in particular how social and human capital can be used in adaptation to climate change at the local level.

The CAPITAL-ADAPT project addressed the following research questions:

1. How much and what kinds of human and social capital are available in each case study regions (Virgen and Klosterneuburg) to cope with climate change?
2. How much and what kinds of human and social capital are available in each case study region to adapt to climate change in the future by improving the coping capacity?
3. Where are the current hotspots of vulnerability to climate change in the case study regions based on a comparison of exposure to climate change and coping capacity (in particular as measured by human and social capital)?
4. What measures and policy options are available for enhancing human and social capital of a region and thus improving the capacity to respond to climate change?

The methodologies used in the project combined the use of scientific expertise in climate impact assessment and human/social capital analysis with a high degree of stakeholder involvement:

1. *Development of a conceptual framework*
2. *Interviews*
3. *Stakeholder Analysis*
4. *Stakeholder workshops*
5. *Analysis of vulnerability hotspots in the case study region*
6. *Comparison of adaptation measures in Virgen and Klosterneuburg with those from a case study in Scotland*

Results and conclusions of the project

The framework of the EU-funded CLIMSAVE project (www.climsave.eu) was customized to fit the Austrian situation. The framework includes both external pressures on the human-environment system (e.g. climate change) as well as the capacity of the system to cope with them and the capacity of the system to adapt. As a result of changes in the amount of capital, decision-makers may decide to mitigate or adapt.

1. *Exposure analysis in the case studies:* In the Virgen case study, we found that it is especially exposed to climate change due to its topographical features. Changes in seasonal precipitation, drought in summer and melting of permafrost are consequences that can be observed. The analysis of social structures showed that quality of life in the village is perceived to be very high. Associations have many active members and political participation is encouraged. Some of the challenges in Virgen are common to many rural communities: An ageing community with fewer children and a lack of local employment possibilities. Klosterneuburg on the other hand, is being affected by an increasing number of extraordinarily hot days, in particular threatening the health of children and older people. Infrastructure, agriculture and ecosystems are exposed to changes, too. Community life is characterized by the coexistence of a suburban anonymous lifestyle and strongly integrated local groups with their own identity and social life. Political participation is a challenge due to the weak social cohesion. Another challenge is the low awareness about different strategies for adaptation to and mitigation of climate change.

2. *Human and Social Capital Indicators:* The project focussed on the availability of human and social capital and the possibilities for using them to cope with and adapt to climate change. Human capital depends to some extent on the availability of social capital which describes relationships, relations of trust, reciprocity, and exchange; the evolution of common rules and the role of networks. Social capital is used by individuals for their own as well as for the collective good. General human capital indicators can be broadly categorized into demographic components, employment situation, formal and informal education, information and knowledge, attitudes, governance, and health (Tinch et al. 2012). With the indicators chosen for the two case studies were unemployment rate, years of education and (average) life expectancy. Crucial to this selection was their availability on a local scale and their relevance for climate change adaptation. For some of the data a primary data collection had to be conducted. Scoping Interviews in the case studies showed that the perception of human and social capital varies locally. For future self-assessment of human and social capital at the local level, a set of questions has been developed.
3. *The handbook:* This step-by-step guide for community actors is based on the experience made throughout the project and has been edited with the audience's needs in mind. The six steps are: forming an adaptation team, collecting information on the impacts of climate change, evaluating human and social potentials of the community, identifying vulnerability hotspots, developing measures and implementation of the measures.
4. *Measures for Virgen and Klosterneuburg:* Deriving from the results of the workshops combined with the results of the previous research, a catalogue of measures was elaborated in order to show appropriate measures to enhance the social and human capital for a better adaptation to climate change triggered events. It has been revised several times to best provide information and should be kept up to date. For different "vulnerability hot spots", different priorities for measures have been identified. Awareness raising and providing information about natural hazards are important in both communities. In addition, Virgen is focusing on agriculture & forestry and tourism, while Klosterneuburg is mainly concerned about heat waves & health effects as well as local biodiversity & species composition in-situ.
5. *Stakeholder-orientation:* Throughout the process, the stakeholder engagement has been monitored and evaluated. This demonstrated the benefits of this participatory approach but also the difficulties in communication about the issue of climate change adaptation. To ensure full transparency and openness of the process for participating stakeholders, a project homepage was developed. It offers background information on climate change in general, the project process and links to similar projects as well as additional information such as news updates and the possibility for a newsletter subscription and download of documents.
6. *Comparison with adaptation measures in Scotland:* The adaptation measures in Virgen and Klosterneuburg have been compared with the adaptation measures developed by stakeholders in a case study in Scotland carried out within the EU-funded CLIMSAVE project. This comparison has highlighted the value of using socio-economic scenarios in the development of adaptation options and the different emphasis on the use of human and social capital in the case studies.

Outlook and summary

The results of the project point to four concrete avenues for further research. First of all, the value of considering the use of human and social capital for adaptation to climate change in an urban and a rural area was shown. Second, emerging from the comparison of the Austrian and Scottish case studies, the importance of considering socio-economic scenarios was demonstrated. In order to develop robust adaptation measures, changes of the socio-economic context have to be considered. Third, the CAPITAL-ADAPT project shows the value of considering adaptation options that use social and human capital as alternatives to conventional options. To cope with climate change and to identify hot-spots of vulnerability to climate change, maps of the availability of the five

forms of capital at the selected level are required. Finally, considering that the international climate change negotiations have been unable to agree on targets for climate change mitigation, it is time to begin thinking about adaptation to so-called “high-end” scenarios.

2 Hintergrund und Zielsetzung

Initial situation / motivation of the project

Climate change is already observed and has many impacts at the local level, such as flooding, heat waves, permafrost melting and droughts. In addition to climate change mitigation, in particular through reducing emissions of greenhouse gases, adaptation is required in order to reduce vulnerability to climate change and improve human well-being. In addition to technical measures, such as flood control and irrigation, there is a need to explore measures that use human and social capital for adaptation to climate change.

Objectives of the project

The questions to be addressed in the CAPITAL-ADAPT project are the following:

1. How much and what kinds of human and social capital are available in each case study regions (Virgen and Klosterneuburg) to cope with climate change?
2. How much and what kinds of human and social capital are available in each case study region to adapt to climate change in the future by improving the coping capacity?
3. Where are the current hotspots of vulnerability to climate change in the case study regions based on a comparison of exposure to climate change and coping capacity (in particular as measured by human and social capital)?
4. What measures and policy options are available for enhancing human and social capital of a region and thus improving the capacity to respond to climate change?

3 Projektinhalt und Ergebnis(se)

a. CAPITAL-ADAPT framework

The basis for the following framework was developed together with Mark Rounsevell within the EU-funded CLIMSAVE project and customized to fit the focus of the project (human and social capital) and the case study regions. It demonstrates how the interlinkages between the human-environment systems, different forms of capitals (nature, human, social, financial, and manufactured capital), adaptation/adaptive capacity, coping capacity, vulnerability, exposure and climate change can be appropriately conceptualized.

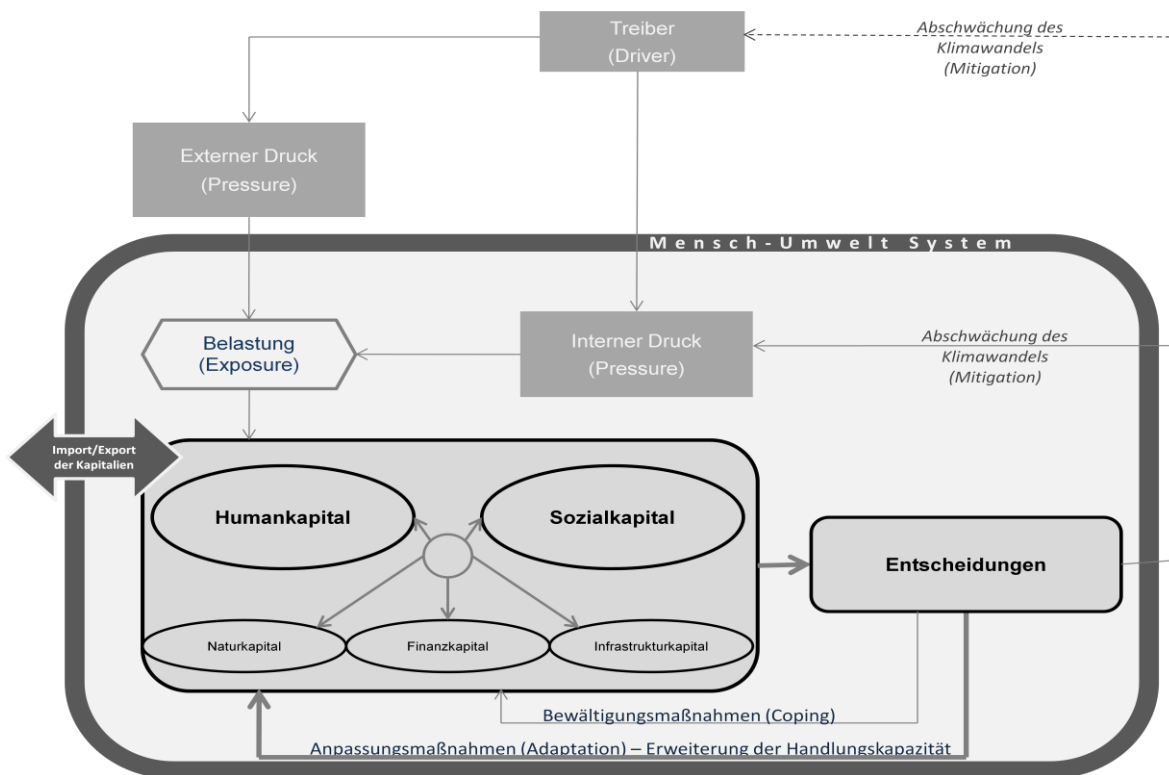


Figure 1 CAPITAL-ADAPT Framework

The dark boxes indicate drivers and pressures. The pressures act on the human-environment system but their effect on that system is moderated by exposure (i.e. how severely a system is actually affected), which is thus included in a hexagonal box with no shading.

Within the large box in the human-environment system are the five types of capital, which determine both the capacity of the system to cope with the pressures and the capacity of the system to adapt (and thus increase coping capacity) over the longer term. As a result of changes in the amount of capital, responses by decision-makers may be to decide to mitigate (by reducing drivers of change or pressures on the system) or adapt (by using various forms of capital).

b. Results of exposure analysis in the case studies

In the Virgen case study, we found that it is especially exposed to climate change due to its topographical features. Changes in seasonal precipitation, drought in summer and melting of permafrost are consequences that can be observed. The analysis of social structures showed that quality of life in the village is perceived to be very high. Associations have many active members and political participation is encouraged. Some of the challenges in Virgen are characteristic of many rural communities: an ageing community with fewer children and a lack of local employment possibilities.

Klosterneuburg on the other hand, is being affected by an increasing number of extraordinarily hot days, threatening the health of older people. Infrastructure, agriculture and ecosystems are exposed to changes, too. Community life is characterized by a coexistence of a suburban anonymous lifestyle and strongly integrated small communities with their own identity and social life. Political participation is a challenge due to the weak social cohesion. Another challenge is the awareness about different strategies for adaptation to and mitigation of climate change.

The following summary shows the main fields of social as well as climate change exposure in the two case study regions.

Virgen

The analysis of social structures in Virgen showed that quality of life and living in the village is perceived to be very high. Associations have many active members and political participation is encouraged, for example by including citizens in specific community boards. Some of the challenges in Virgen are characteristic for many communities: An ageing community with fewer children and a lack of local employment possibilities. Virgen suffers from a scarcity of jobs and a big part of the workforce commutes out of the village. A quarter of the commuters have their workplace in other regions (Salzburg and North Tyrol) and more than 10% even abroad (mainly in Bavaria). Both summer and winter tourism play a big role in Virgen's economy. Summer tourism has been decreasing over the past years and winter tourism is increasing, which means that seasonal differences are levelling out.

Human capital summary

One of the strengths of Virgen lies in the great expertise that exists in the community in particular in the artisanal sector, as well as adequate educational facilities for children and adolescents. Adult education was mentioned in interviews with local inhabitants as a challenge: While courses like cooking or sports work well, there is a lack of interest in courses offered on more complex topics, like language courses.

During the first workshop, a lack of entrepreneurship has been discussed, especially in the field of tourism. The training of entrepreneurial skills could be reinforced to strengthen the community's economy.

Virgen's out-migration is counterbalanced by an equally high in-migration untypic for the region. Nevertheless, Virgen faces the challenges of an ageing population, too.

Social capital summary

Questionnaire results in Virgen show, that Virgen is perceived to a place with a high living standard and a high quality of life. The perception of a high quality of life is connected to the beauty of nature and the environment, but also to a vibrant social life and a strong community life altogether. Despite the problem of jobs scarcity, the community succeeds in creating a strong identity and connection to the homeland. Virgen's inhabitants describe themselves as down to earth but open-minded and helpful people who engage actively in community life and common action, which is manifested in a high number of volunteers in Virgen's more than twenty associations. All in all, social cohesion is relatively high on the micro- and meso-levels. Regulatory requirements like the association laws hinder people from taking on responsibilities within associations. Concerning volunteer activities the increasing importance of female members in emergency services was mentioned – the high rate of male commuters leads to a lack of emergency forces in place.

Climate data

Thanks to its geographical position between the Virger North chain and the Lasörlinggruppe, the village of Virgen has a particularly pleasant climate. The alignment of the valley leads to particularly long hours of sunshine. The average annual precipitation is about 800 mm, which is relatively low compared to adjacent regions.

Virgen is especially exposed to climate change due to its topographical features. Changes in precipitation in winter, decreasing precipitation in summer and melting of permafrost are consequences that can be observed.

Temperature

Until the period 2021/2050 an increase of the mean annual temperature is expected. The model HADCM3¹/CCLM/A1B shows an increase in the average temperature in the region of East Tyrol of about 2.3 - 2.5° C. In addition, an increase of summer days (days with > 25° C) (Figure 2) is expected by the middle of the century by up to 3-6 days / year. In contrast, frost days (days with daily minimum temperature <0° C) will decrease depending on the model, by up to 23-25 days / year.

¹ HadCM3 (Hadley Centre Coupled Model, version 3) and ECHAM5 are global climate models, COSMO CLM (CCLM) is a regional model

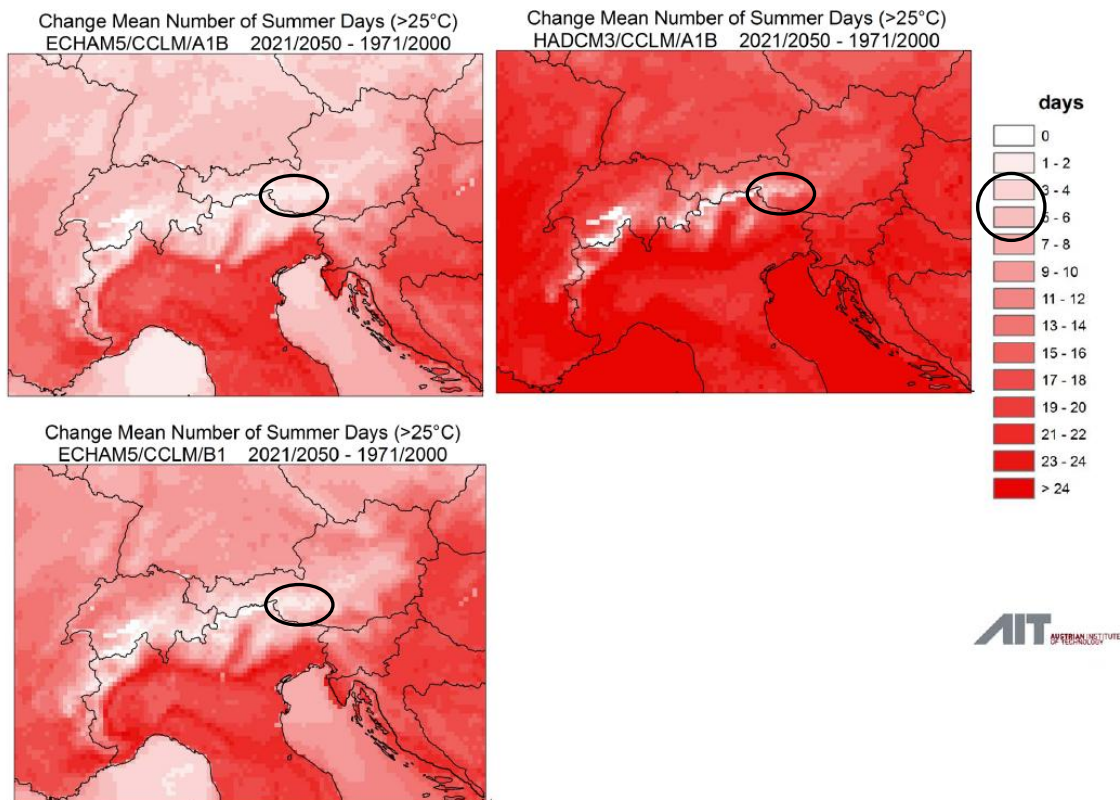


Figure 2 Change Mean Number of Summer Days 2021/2050 - 1971/2000 (3 model combination) (Loibl 2011)

Precipitation

Scenarios (HadCM3/CLM-A1B) show that annual precipitation remains fairly constant (Loibl 2011), while the seasonal changes of precipitation in the region of Virgen follow a trend of decrease in summer precipitation and an increase in winter precipitation. Similarly, the scenarios show that more intense rainfalls (particularly small-scale) and increased rainfall variability may occur in the summer.

Snow cover duration

Along with temperature and precipitation change, a change in snow cover and snow cover duration is expected. Existing studies show a decrease of days with continuous snow cover in the Alps (Lautenschlager 2009). Even for the region around Virgen scenarios show a decrease in the snow cover duration by up to 30 - 50%.

Klosterneuburg

Community life in Klosterneuburg is characterized by a coexistence of a suburban anonymous lifestyle and strongly integrated communities with their own identity and social life. Political participation is a challenge, as well as putting knowledge about climate change into practice.

Human capital summary

Klosterneuburg has a good structure of educational institutions in compulsory education and also offers advanced training facilities in the area. In spite of this offer, many students commute to the close-by capital Vienna.

Klosterneuburg promotes the image of a "green city" with good recreational facilities. Despite the personal recreational features, social contacts in public areas are quite limited. The population of the Municipality of Klosterneuburg is growing since about 40 years, yet the aging population and the associated high care provision and facility needs are an important issue.

Social capital summary

A dense and diverse variety of clubs is available to the citizens of Klosterneuburg, Nevertheless, it is mostly a very limited number of engaged citizens active in these associations. A wider participation and involvement would be desirable to increase social capital.

A challenge in Klosterneuburg is a rapid urbanization, bringing about an increasing anonymity of inhabitants. A high rate of in-migration from the nearby capital Vienna leads to a changing community structure and a lack of integration of new inhabitants into the structures.

Climate data

The area of Klosterneuburg is climatically allocated within the Pannonian climate, which is characterized by hot summers and dry winters.

Temperature

All model calculations of reclip:century show an increase in annual average temperature up to the period 2021/2050 (Loibl 2011). The model HADCM3/CCLM/A1B for example, shows an increase of about 2.5 to 2.8° C in to the period 2021/2050. The average number of summer days (days with > 25° C) (Figure 3) per year increases by approximately 35% (increase of approximately 17-22 days / year). Far more important than summer days - especially for densely populated areas like Klosterneuburg – are the days with > 30° C and heat waves. Here, studies suggest a doubling of those days by the middle of the century (Kromp-Kolb 2007). In contrast, due to temperature rise in the future there is a decrease in frost days, by up to 25-28 days per year.

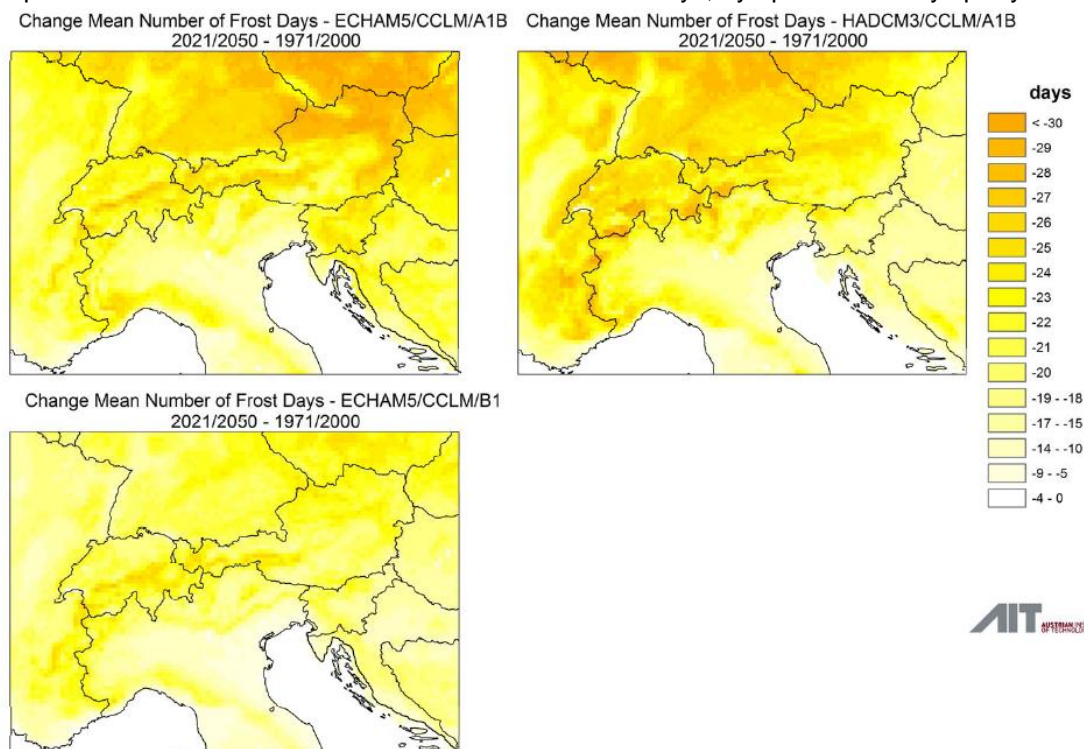


Figure 3 Change Mean Number of Summer Days 2021/2050 - 1971/2000 (3 model combination)²

Precipitation

In the scenarios the annual rainfall is fairly constant. However, there are changes in the seasonal distribution of precipitation. The model calculations of reclip:century show for Klosterneuburg and surroundings a decrease of summer precipitation and an increase in winter precipitation. The scenarios show that small-scale heavy precipitation events occur more frequently and there is an increased variability of precipitation in the summer.

c. Human and Social Capital Indicators

In the project, a set of indicators for human and social capital was compiled to assess the community's capacities and vulnerabilities. This was used to identify vulnerability hotspots as basis for discussing future measures to increase coping capacity to deal with future climate change.

The emphasis in this project lies on the availability of human and social capital and the possibilities for using this capacity to cope with and adapt to climate change. Human capital depends to some extent on the availability of social capital. Social capital describes relationships, relations of trust, reciprocity, and exchange; the evolution of common rules; and the role of networks. It encompasses the involvement of civil society and collective action. Social capital theory provides an explanation for how individuals use their relationships with other actors in societies for their own and for the collective good. The collective good, or welfare, has both material elements and wider spiritual and social dimensions (Adger 2003). Both social and human capitals are important dimensions of adaptive and coping capacity.

When assessing the coping capacity or the adaptive capacity of a group or system, within this project it was found necessary to develop specific indicators of adaptive and/or coping capacity based on characteristics of societies and environments (Omann 2010). The definition and use of indicators is also guided by the objective of the assessment, whether they are used for comparison or to develop recommendations for policy makers. In short, not all indicators serve the same purposes.

Table 1 describes human capital indicators, which have been compiled from different sources and have been applied in various fields (natural sciences, management, population statistics). The indicators are broadly categorized into demographic components (which also apply to social capital), employment situation, formal and informal education, information and knowledge, attitudes, governance, and health (Tinch 2012). Table 2 describes overall indicators for social capital.

Table 1 Indicators of human capital (Tinch 2012)

Indicator categories	Possible indicators of human capital					
Demographic	Demographic structure (<i>population size/density, age, male/female, dependency ratio, etc.</i>)	Grade of urbanization	Class structure (<i>annual household income, education level, housing situation etc.</i>)	Level of development (<i>education level, link to manufactured capital</i>)	Seasonal/ permanent residents	Dependency ratio (relation working, non-working population)
Employment	Unemployment rate	Gender balance	Level of qualification	Income/ income structure		
Education	Educational commitment (<i>total education spending, per education type, private/public</i>)	Education quality (<i>literacy rate</i>)	Training/ lifelong learning (<i>hours of training per year</i>)	Years of education (<i>minimum required, total</i>)		
Information and knowledge	Access to information (<i>internet access, libraries, etc.</i>)	Skills/ life experience (<i>average total years of work/ education</i>)	Skills specific to local environment	Computer skills (<i>no of individuals never used a computer</i>)		

Attitudes	New ideas-design, innovation	Willingness to undertake adaptation	Understanding of anticipated impacts	Ability to appropriately deploy resources	Cultural norms, values, risk perceptions	
Governance	Exchange of innovations in adaptation with other populations	Managerial ability	Prevailing policy and institutional framework, participation	Diversification of human capital	Regional cooperation, National adaptation strategy (<i>existence of a NAS</i>)	
Health	Health spending/governance (<i>public health expenditure as % of GDP</i>)	Nutrition (<i>calorie supply per capita</i>)	Life expectancy (<i>at year of birth</i>)	Sanitation	Health care personnel per inhabitants	Healthy Life Years, Disability Free Life Expectancy

Table 2 Indicators of social capital(Tinch 2012)

	Micro-Indicators (<i>individual level, close relationships with strong emotional ties</i>)	Meso-Indicators (<i>characteristics of neighbourhoods, or communities that may affect social capital within those areas</i>)	Macro-Indicators (<i>level of major communities and values: political, ideological, social, cultural and spiritual context</i>)
Demographic factors	Age, sex, health, family characteristics (e.g. marriage), resources (education, employment), attitudes and values, characteristics of living area.		
Bonding	Number of close friends and confidants	Number of acquaintances and friends	Frequency of attendance of likeminded communities (politics, religion, etc.)
	Structure of the close relations (where are the close confidants [family, friends, work, etc.], time spent with them, etc.)	Structure of the acquaintance-relations (where are they [family, neighbours, clubs, church, workplace, civic associations, virtual communities, etc.], time spent with them, etc.)	Type of likeminded communities and common beliefs which give a sense of community and a feeling of belonging (e.g. politics, ideologies, work, art, music, spirituality, etc.)
	Trust in close confidants	Trust in neighbours, workplaces, etc.	Evolution of common norms, rules (formal)
		Community engagement (group involvement, informal socializing, social trust, giving and volunteering, participation in activities, civic engagement, membership in voluntary associations)	Transparency
		Willingness to cooperate with	

		other communities, etc.	
Bridging	Structure of the close relations (where are the close confidants [family, friends, work, etc.], time spent with them, etc.)	Willingness to cooperate with other communities, etc.	
		Information (news of internet, daily newspaper reading, TV watching, internet-based “virtual communities”)	
		Community engagement (group involvement, informal socializing, social trust, giving and volunteering, participation in activities, civic engagement, membership in voluntary associations)	

From this broad compilation of possible indicators of human and social capital, Capital-Adapt chose indicators to be tested in the two case studies: unemployment rate, years of education and (average) life expectancy. Criteria for this selection were the availability of data on a local scale and the relevance for climate change adaptation.

More detailed data on social capital on a local level were hardly available; therefore a primary data collection was conducted in one case study. Scoping interviews in the case studies showed that the perception of human and social capital varies locally.

Since communities across Austria and Europe vary in many aspects like size, social and economic structure, etc., the indicators on the community level must be adaptable to each community's particularities. Based on the interviews and participatory workshops in Virgen and Klosterneuburg, a general list of indicators was developed and four steps were defined that guide communities in assessing their specific relevant social and human capital indicators. These steps are (1) a first appraisal of the community based on general knowledge about it, (2) the identification of gaps in knowledge and of key persons that can provide the necessary information, (3) the interviewing of these key knowledge holders (for example, stakeholders in the health sector in order to find out about the health status of the population) and (4) the definition of key indicators for the community's human and social capital based on the following list.

Table 3 Key questions and relevance for climate change for human capital

Human capital	Key questions and relevance for climate change
Staff and experts	How many people in your municipality are professionally concerned with climate change adaptation measures and operational plans?
Volunteers and voluntary groups	How many people in your municipality could voluntarily participate in climate change adaptation measures and operational plans?
Age structure	Are there any old or young people in your municipality who are especially vulnerable?
Health status	How is the medical condition of the population of your municipality? Are there any people especially prone to heat or cold waves because of their medical condition or people who can't leave an exposed zone fast enough?
Proportion of Commuters	Are there any commuters who work outside your municipality and who would be missing if there were any measures applied? Which impacts would that have on your municipality, e.g. on organizations such as the volunteer fire brigade?
Awareness and	Are there people in your municipality (including trained specialists) who are

knowledge of climate change	aware of the hazards of climate change? Do people know how to avoid these hazards? Are extreme weather conditions and climate change taken into consideration especially if new buildings are put up? Are impacts of climate change taken into consideration if infrastructure projects (streets, energy supply etc.) are implemented?
-----------------------------	--

Table 4 Key questions and relevance for climate change for social capital

Social capital	Key questions and relevance for climate change
Contact persons for climate related issues	How many contact persons and institutions are there in your municipality, federal or state government to supply people on their way to climate adaptation?
Services of the community	Which services and supplies (information, funding, assistance in case of emergency, warning systems and operational plans) are offered by your municipality?
Efficiency of early-warning systems and emergency response	For which hazards are there warning systems available? How many people and who exactly can be reached by this warning system? Is it possible to reach all levels fast and at an early stage?
Knowledge transfer and exchange	Are there efforts to enable the exchange of personal experiences and knowledge between citizens and municipality? Are there initiatives for mutual learning between different groups such as farmers, foresters, nurses, doctors etc.? Which mechanisms are there for the municipality government to learn from citizens?
Education and training	Are there any municipal, federal, state or other institutions offering continuing education?
Task forces	How many and which task forces are there?
Institutional structures and voluntary associations	Are there established structures and associations which, on one hand can contribute to the exchange of knowledge and experiences and, on the other hand can support the implementation of adaptation measures?
Subpopulation	How many subgroups are there in your municipality? Are all of them integrated sufficiently? Are there groups which can only be reached difficultly (e.g. people with migration background, owners of weekend and holiday houses, people excluded from the community, newly moved in people etc.)?
Help from relatives and friends	How many people can help me (as a private person) in case of catastrophe or with adaptation measures?

These indicators are not for regional comparison, but represent the features and characteristics of a specific system: the community. This list was combined and further simplified for use in the handbook, which is described in detail in the next section.

d. Six steps to the measures – the handbook

In order to develop guidelines for community actors to develop climate change adaptation measures, the project team reflected on their own approach during the stakeholder process and translated these steps into actions that can be taken on the local level without scientific expertise. A main prerequisite for measures is the development of awareness raising, as many stakeholders were found to have little or no knowledge about the relevance of climate change adaptation. Another insight was that good practices are especially helpful, so examples of the two case studies have been integrated throughout the handbook. In line with recent studies that have shown the importance of a participatory approach for the effective implementation on the ground (Bohunovsky et al. 2010), (Jäger and Moll 2010) practical tips for successful work with stakeholders and citizens have been included

throughout the handbook. The handbook favours and recommends a participatory approach to working on climate change adaptation in order to guarantee the development of locally relevant and easily applicable measures.

Step 1

The project team found that an important first step is a person or a team who focus on the topic of adaptation. The handbook suggests forming a team and approaching people within the community who could be interested in supporting it. These could be key persons in the community, people who have a good overview of the structures of the community, who have specific knowledge about climate change, who are interested in the development of the community in general, who are engaged in organizations and are willing to dedicate resources (especially time) to the process. Also people who are negative about such a project should be approached. Having a broader participatory basis has a number of advantages and makes the results more durable. The integration of different points of views and different priorities helps to develop more robust and accepted measures as well as guarantees a smoother implementation process.

Experience has shown that technological measures alone are not enough to tackle climate change, a social process is necessary too.

A crucial point for participatory approaches to an adaptation process is the right choice of methods according to the group size, the level of participation (information, consultation, cooperation), and the know-how of the participants.

Step 2

As a second step, the handbook suggests a “diagnosis” – the collection of information on the impacts of climate change. The difficulty is the uncertainty of local climate change impacts, especially in the alpine region. Nevertheless, the scenarios are unambiguous enough to make statements about the approximate mean temperature rise that leads to an increase in the number of hot days and hot spells as well as changes in precipitation. For specific scenarios on a local scale it is necessary to consult experts as the available data need to be interpreted. Correctly interpreted, the research results allow quite detailed insights into the probable climate characteristics of 2050 and 2100 on a local scale. The key factors of differences in the climate change impacts are altitude, the geological characteristics but also infrastructure and land use.

A first helpful step, without specific climate change expertise, is the analysis of climate (change) impacts and natural hazards of previous decades. Local knowledge and the citizens’ experience is the key to getting an overview of the status quo.

Step 3

Human and social potentials for climate change adaptation are the focus in the third step of the handbook. The concept of human and social capital is introduced here aiming at identifying the strengths and the weaknesses of the community with respect to health, knowledge, skills and motivations of the community members as well as the social cohesion, mutual exchange and networking on the community level.

Various dimensions and indicators of human and social capital were discussed during the project and a short list of the most useful indicators on the local level that relate to climate change adaptation was developed. For the use by stakeholders in the handbook they were grouped into four thematic fields: *aid, organization, knowledge, age and health*. Information that is usually more easily accessible in communities was prioritized over data that require primary data collection.

Step 4

Identifying vulnerability hotspots, the fourth step in the handbook, reveals the sectors or thematic fields with the most urgent need for action. It was found that identifying geographical hotspots is only partly possible and useful within the case study communities. That is why the focus was shifted to thematic hotspots. Hotspots are those areas in community that are especially affected by the (current and expected) impacts of climate change and have little or no resources to cope with these changes. Adaptation measures should especially address those hotspots. The handbook suggests a list of most commonly impacted sectors: Agriculture, forestry, health, natural hazards, water, awareness, ecosystems, settlement development, building and living.

It is suggested to examine these sectors with regard to current and possible future impacts of climate change, people concerned, current coping capacity and challenges concerning human and social capital.

Step 5

The fifth step in the handbook aims at developing measures for climate change adaptation. For measures in the fields of human and social capital the project team found it crucial to develop them in a participatory manner, since this facilitates the implementation of adaptation measures as will be discussed later on. Seven guiding questions are presented to lead the climate change adaptation team to relevant and realizable measures. Exemplary measures in some of the sectors are presented as a starting point for the climate change adaptation team.

Step 6

The last step is the implementation of the adaptation measures developed. The priorities of the measures have to be agreed on and competences and responsibilities should be clarified. The content and order of activities have to be planned. The handbook concludes with six practical hints that are useful when implementing measures in a participatory manner.

The handbook is the central dissemination instrument of the project results to the target group of local stakeholders. To prevent the excessive use of a specific scientific language in that publication, a journalist/meteorologist within the project team reviewed the handbook texts considering the expected audience. The project team then introduced the medical analogies in order to make the complex issue more tangible.

e. Measures for Virgen and Klosterneuburg

In order to give concrete guidelines for innovation in the face of climate change, two separate sets of measures have been developed, one for each case study. Their identified “hot spots” for recommended action show some differences, so the selected measures are location specific.

However, the starting point for the catalogues of measures was research considering socio-economic data and individual assessments (interviews) of already existing human and social capital. These data were complemented by an assessment of the climate effects based on Austrian climate scenarios and relevant scientific literature on the topic. Based on these findings and a first stakeholder workshop (Feb. 2012), first measures were developed and reviewed in a second stakeholder workshop (March 2012).

Deriving from the results of the workshops, a catalogue of measures was elaborated in order to show appropriate measures to enhance the social and human capital for a better adaptation to climate change triggered events. It has been revised several times to provide useful information. It can be seen as a corpus of measures and clarifies where people can get specific information on the topic and which stakeholder should be involved in a strategy to reduce negative local effects of climate change. Still, in order to maintain its function of providing information, the catalogue has to be kept up to date.

Because of the difference of the identified “hot spots”, different priorities for measures have been identified. Apart from awareness raising and providing information and natural hazards, which are obviously important to both communities, Virgen is focusing on agriculture & forestry and tourism, while Klosterneuburg is mainly concerned about heatwaves & health effects as well as local biodiversity & species composition in-situ. The catalogues are attached to this report. It is considered to be a “living document”, a working tool for further communities.

f. Evaluation of the stakeholder process

In our case studies, the stakeholder processes aimed at (1) providing access to local knowledge, (2) a participatory formulation of climate change adaptation measures, and (3) raising the awareness for the importance of human and social capital within this process.

Conducting interviews at the beginning of the process helped to get insights that cannot be drawn from data. This is true for climate change impacts but even more for human and social capital information that is hardly available on the local level.

It appeared to be challenging to point out the importance of human and social capitals to the stakeholders, as the stakeholders are much more used to thinking about technical and infrastructural measures. Nevertheless, throughout the process the researchers introduced the benefits of focussing on human and social capital repeatedly which also results in adaptation measures linked to human and social capital.

Given the very specific focus of the project on climate change adaptation, repeated efforts had to be made to highlighting the difference between mitigation and adaptation and raising the awareness about the necessity of anticipatory action towards increasing coping capacity. Grüneis (2012) shows that a big challenge for the

stakeholder engagement and the participatory design is the fact that many people do not feel concerned about climate change and it is thus not easy to keep the motivation for participation high.

The stakeholder feedback that was asked for during the third workshop in Virgen showed that the process as well as its outcomes for the community (i.e. the catalogue of adaptation measures and the handbook) were considered very useful to them. A major mudflow in August 2012 (just about two months before that last workshop) had confronted them with the possible dangers of climate change impacts and the importance of human and social capital to deal with the effects.

g. Stakeholder-orientation: Transparency and project website

One important result of the project was the creation of the project homepage (www.klimanetz.at). The presentation of the process and results was important to meet the goals of transparency and traceability in order to provide an orientation framework for the participating stakeholders. The homepage offers background information on climate change in general, the project process and links to similar projects as well as additional information such as news updates and the possibility for a newsletter subscription. The project (including measures and results), the case studies and the hand book can be accessed separately and easily. Presentations and information on the topic such as presentations at diverse conferences (e.g. Austrian Climate Day), and links to relevant newsletters (like the climate change adaptation newsletter) are provided.

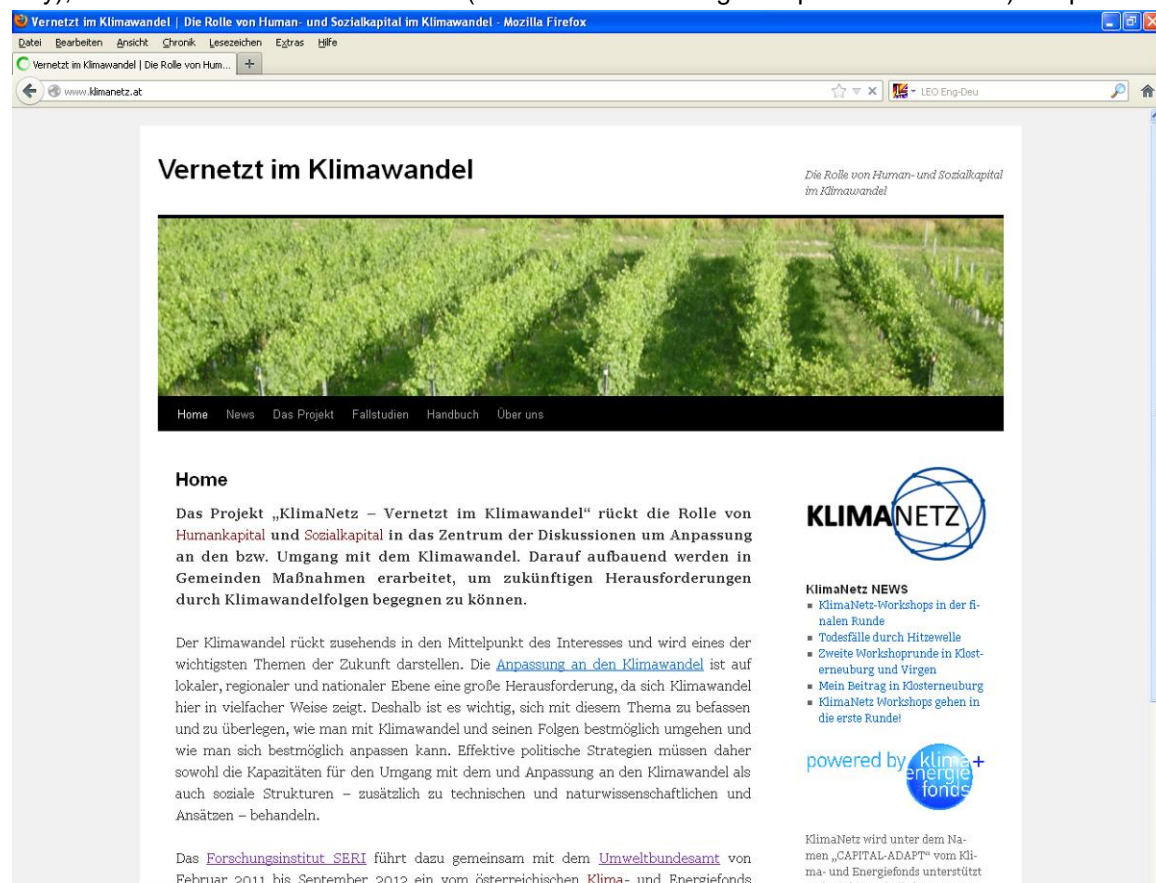


Figure 4 The homepage of the CAPITAL-ADAPT project



Figure 5 The organisation of the homepage

4 Schlussfolgerungen und Empfehlungen

Findings of the project

Comparing the adaptation measures in Scotland, Virgen and Klosterneuburg

Three important differences between the (related) studies are significant for this comparison. First, the Scottish adaptation measures are based on four stakeholder-developed socio-economic scenarios; recognizing that in addition to the possibility of different climatic scenarios in the future, there are different ways in which the economy and society could develop and that both the climatic and socio-economic scenarios influence the possible choice of adaptation options. Second, the adaptation options for Scotland are selected for the country as a whole, since this was a national-level case study and the aim was to use the CLIMSAVE Integrated Assessment Platform (IAP) to test the results of adaptation options. In Virgen and Klosterneuburg, the adaptation options are selected for the particular local context of the case studies. Third, in the CAPITAL-ADAPT case studies, the emphasis was on human and social capital, while in the Scottish case study all five forms of capital were considered with less emphasis on human and social capital, since the latter are not used as inputs for the models underlying the IAP. Despite these differences, however, some interesting conclusions can be drawn from the comparison.

As Mark Rounsevell has shown, the Scottish stakeholders were asked to prioritize the top 5 adaptation measures during the final workshop and these showed considerable differences between the socio-economic scenarios. Table 5 shows which options prioritized by the Scottish stakeholders are also considered in the catalogues produced for Virgen and Klosterneuburg. The common measures are, as also found across the scenarios in the Scottish study, in flood management and natural resource management. The major difference is with respect to human capital. This is a central focus of the CAPITAL-ADAPT project and as a result the catalogues for Virgen and Klosterneuburg contain a broad variety of measures to increase awareness about climate change and its impacts. In the Scottish Study, adaptation measures in the area of human capital were considered but not prioritized. The Mactopia and The Scottish Play scenarios list each 7 measures related to human capital, Tartan Spring lists 2 measures and Mad Max only 1 measure. Overall, the Scottish stakeholders put much less emphasis on measures to increase human and social capital.

In terms of intra-case-study learning, therefore two major conclusions can be drawn. The Scottish stakeholders could enhance their portfolio of adaptation options through studying the wide range of options that enhance social and human capital, which were developed in the Austrian case study. The Austrian stakeholders could develop more robust options through development and/or use of a set of socio-economic scenarios, since the Scottish case study shows that some adaptation measures depend strongly on the socio-economic context.

Table 5 Comparing Adaptation Options in Scotland, Virgen and Klosterneuburg

Scenario	Adaptation options	Virgen	Klosterneuburg
MacTopia	Innovation to enhance social capital	X	X
	Maintaining food security, but balancing food with other needs from the land, i.e. energy production and re-forestation		
	Regulatory frameworks for land use planning to enhance infrastructural capital	X	X
	Flood management (including moving people from flood risk zones)		
	Maintaining surplus water supplies for export	(X)	X
Tartan Spring	Natural resource optimisation		X
	Private sector provides – public sector pays		
	Maximise newly available land and sea		
	Stimulating international exchange		
	Reactive and patchy reaction to climate change		
Mad Max	Technical improvements to agricultural production	X	

	Natural resources management, especially water management Safeguarding resource management for the haves Exporting food (especially meat) to profit the haves The have-nots have few adaptation options, including low tech use of natural resources	X	X
The Scottish Play	Flood management Increasing artificial surfaces Greening cities Multifunctional land use Self-sufficiency in food production	(X)	X X

Indicators

When assessing the coping capacity or the adaptive capacity of a group or system, within this project it was found necessary to develop specific indicators depending on the characteristics of the groups or systems. In other words, indicators of adaptive and/or coping capacity must be based on system characteristics. The definition and use of indicators also is guided by the objective of the assessment, whether they are used for comparison or to develop recommendations for policy makers. In short, not all indicators serve the same purposes.

Keeping in mind that the meaningfulness of indicators is limited in general, the carefully selected indicators thus showed a good result. However, the available data is not sufficient to constitute the real value of human and social capital for this purpose (e.g. it is possible to gather data about school graduation, but not about the level of trust, reciprocity, and exchange). Indicators can be seen as solid basis for such data gathering but must be complemented by local stakeholder contributions. Hence, generalization for other municipalities in Austria is not appropriate.

We suspect that the process might be difficult to be implemented in small municipalities since climate change impacts are difficult to measure. Tables 3 and 4 provide a basis for further interpretation of accessible data under scientific supervision.

Measures

Awareness raising can be seen as a crucial factor for various other developments (e.g. acceptance) among the stakeholders and population, technological measures etc. The topic of climate change might not be considered by everyone, therefore it is especially important to inform about crucial services while solutions are offered at the same time. Here, it is relevant to avoid focussing on catastrophic scenarios and work with positive formulations in order to encourage intensive engagement with the topic.

Furthermore, we learned that the differentiation between climate adaptation and climate protection is difficult for stakeholders. Concerning climate adaptation, most of the stakeholders thought of technological devices and strategies while they were not aware of the inherent value of human and social capital. Thus, our service in particular was awareness raising concerning features of local societies which can be utilized quite easily.

Working with stakeholders, a reflection of the language used might be important: As it turned out, it was crucial to use a simple intelligible language to clarify the facts without getting too emotional.

In order to implement the measures, the existing infrastructures and networks should be used as a basis for using human and social capital. In Austria, the national adaptation strategy might be a starting point to build on existing structures in order to facilitate certain integration in national campaigns. It was found that the strengthening of existing structures to achieve efficiency and effectiveness was especially important.

This implies that decision-makers should provide support for the implementation of measures as well as climate expertise and process support since climate change is one of the most important current challenges.

Participative character of the project

During the project it was found that especially concerning human and social capital local knowledge integration is essential. As there is hardly any data available on human and social capital, there is no alternative way to access that knowledge. Also concerning weather events and changes over longer periods of time, the information on what is being observed locally is a necessary complement to the available data.

The existing knowledge concerning climate change adaptation turned out to be very low in general and frequently adaptation was confused with climate change mitigation. In comparison with other issues, climate change is generally not perceived as an urgent and pressing issue.

Talking about climate change adaptation, mainly infrastructural measures were in the focus of the stakeholders. Before the workshop participation, measures aimed at increasing human and social capital were generally not thought of. A major focus was then set on awareness raising concerning climate change adaptation as well as human and social capital.

Hotspots

Hotspots are those sectors in a community that are especially affected by climate change and only have little or no resources or capacities in coping with those changes. Identifying those vulnerability hotspots is important for developing adaptation measures. It was found that identifying geographical hotspots is only partly possible and useful within the case study communities. That is why the focus was shifted to thematic hotspots. Hotspots are those areas in community that are especially affected by the (current and expected) impacts of climate change and have little or no resources to cope with these changes. Adaptation measures should especially address those hotspots.

The following sectors are usually most strongly impacted: Agriculture, forestry, health, natural hazards, water, awareness, ecosystems, settlement development, building and living.

It is suggested to test these sectors on current and possible future impacts of climate change, people concerned, current coping capacity and challenges concerning human and social capital.

Recommended further steps

The Austrian National Adaptation strategy that was developed by one project partner in parallel is the basis for the provincial adaptation plans that are being developed as a result. Both national and provincial plans have to consider and encourage adaptation measures on a community level.

For the next ACRP call one possible project idea could be the development of further (or general) measure catalogues. One emerging research question in the course of the project was concerned with different ways of communication in order to provide strategies for reaching and empowering people.

Regarding the publication of results, the handbook is being disseminated to various interested parties. Additionally, news is going to be published in newsletters (SERI and UBA) and on homepages such as partizipation.at, klimawandelanpassung.at etc.

A further proposal is to build on advanced insights of the CLIMSAVE project, where an innovative methodology has been applied to show regional differences of coping capacity in user-friendly GIS-based maps. This methodology can be used to generate such maps for the Austrian federal states and to present indicators of natural, financial, infrastructural, human and social capital in relation to coping capacity. Those indicators can serve politicians, experts and other stakeholders to evaluate the need for action in various sectors (social, ecology, infrastructure, etc.) in the respective region.

In the Austrian case, the participants have discussed responses to a climate scenario under the assumption that the socio-economic context is roughly the same as today. This is an unrealistic assumption and leads to the risk that adaptation options are selected and implemented but fail because of socio-economic developments to which they are not suited. This could be avoided through the development of a set of socio-economic scenarios for the national and provincial levels in Austria and a focus on adaptation options that are robust, i.e. that work for all socio-economic contexts.

Relevant target groups for further work

The presented measures have especially been developed for the two case study regions, but can be used for other municipalities all over Austria, which have similarities to the two chosen ones. This is true for many rural communities or medium-sized cities. The handbook on the other hand can be used by all communities facing climate change.

The contribution of this project to operationalising human and social capital served the purpose of identifying the local coping and adaptive capacity in relation to climate change. The insights of this project can be beneficial to future attempts to explore comparable and standardized indicators for human and social capital on a local level.

All over Europe, climate change adaptation strategies are now being developed and implemented on national and regional levels. The comparison of adaptation measures in Scotland and the two case studies of the CAPITAL-ADAPT project shows that complementary to national and regional level, developing adaptation strategies to climate change on a local level is needed in order to meet the specific needs of the communities.

The CAPITAL-ADAPT project provides the basis for the implementation of climate change adaptation measures in the case study municipalities. In order to put them into practice, the support of all different groups within the municipality is needed. Associations, the local Red Cross, doctors, politicians, teachers and other significant people could be put in charge in order to ease the implementation of these measures.

A next step would be to develop local and regional adequate adaptation measures within different socio-economic scenarios. Not all measures are possible or useful in all scenarios. For instance in a growth-oriented, self-centred world social capital might be low and not available for measures requiring trust and solidarity. A new project could analyse together with the stakeholders measures for different scenario settings.

Outlook

The results of the project point to four concrete avenues for further research. First, on the basis of two case studies the CAPITAL-ADAPT project has been able to show the value of considering the use of human and social capital for adaptation to climate change in one urban area and one rural area. More robust conclusions could be drawn, if similar research were to be carried out in more urban and rural communities. It would be extremely valuable to continue this research, for example, in very urbanized areas such as Vienna and Graz, as well as in rural areas where the focus is on agriculture such as in the Marchfeld.

Second, the comparison of the Austrian and Scottish case studies shows quite clearly the importance of considering socio-economic scenarios. In the Austrian case, the participants have discussed responses to a climate scenario under the assumption that the socio-economic context is roughly the same as today. This is an unrealistic assumption and leads to the risk that adaptation options are selected and implemented but fail because of socio-economic developments to which they are not suited. This could be avoided through the development of a set of socio-economic scenarios for the national and provincial levels in Austria and a focus on adaptation options that are robust, i.e. that work for all socio-economic contexts.

Third, the results of the CAPITAL-ADAPT project show the value of considering adaptation options that use social and human capital. These options are an interesting alternative to conventional options that rely on use of manufactured capital and bring societal co-benefits. Social and human capital both contribute to the ability to cope with climate change. In order for decision-makers at the national and provincial level to identify hot-spots of vulnerability to climate change, maps of the availability of the five forms of capital at the selected level are required. These maps could be generated using the methodology developed in the EU-funded CLIMSAVE project.

Fourth, given that the international climate change negotiations have been unable to agree on ambitious targets for climate change mitigation, it is time to begin thinking about adaptation to do-called “high-end” scenarios. What do adaptation pathways for a 6°C temperature increase look like? Which options using social and human capital are robust to potential tipping points associated with “high-end” climate scenarios? Are there synergies between adaptation and mitigation pathways that can be exploited?

B) Projektdetails

5 Methodik

a. Development of the CAPITAL-ADAPT framework

The framework for analysis (pictured in chapter 4) builds on Porritt's (2007) capitals approach (Porritt 2007). A framework including all five types of capital (manufactured, financial, natural, human and social) was developed in the EU-funded CLIMSAVE project (Omann 2010). Putting human and social capital in the centre, the CLIMSAVE framework was customized for the CAPITAL-ADAPT project. Literature research was carried out in order to identify the interlinkages between human-environment systems, of the five forms of capital, adaptation/adaptive capacity, coping capacity, vulnerability, exposure and climate change. Environmental change expert Mark Rounsevell, subcontracted in the CAPITAL-ADAPT project assisted in the framework consolidation with his feedback and inputs.

b. Scoping Interviews and Stakeholder Analysis

The starting point for both case study regions (Virgen and Klosterneuburg) was a desktop analysis of available statistical data on both socio-demographic as well as climatic features. In addition, on-site interviews were conducted in June and July 2011. In Virgen, nine representatives of the administration and members of the community were interviewed with problem-focused, guided interviews. In Klosterneuburg 17 personal interviews as well as two written interviews were carried out. The interviews focussed on two main topics: The social and community life as well as perceived changes in weather and climate and their consequences for individuals and the community. Interviews were conducted by 1-2 interviewers and lasted between 20 and 60 minutes. They were all recorded and afterwards analysed. In Virgen, an additional standardized quantitative survey has been conducted with 50 respondents on social structures and social capital in the community.

In a first step, the impacts of climate change in the community and region were identified by a closer examination of past events caused by weather and climate factors. This served as a first guide to where vulnerability can be identified. In parallel, these analyses were supplemented by an extensive research for scientific studies dealing with climate change impacts on alpine and eastern Austria. Climate change exposure was analysed based on newly available scenario data on a local level from the research project reclip:century (Loibl 2011). The expected impacts of the scenarios on the local level in the two case study regions have been explored.

c. Stakeholder Workshops

The first set of workshops titled "Das Klima im Wandel: Bereiten wir uns vor!?" (A changing climate: Let's be prepared?) was held in Virgen and in Klosterneuburg. The four and a half hour workshop program was designed and run by both project partners. In Virgen, 13 stakeholders were present at the workshop in the local school, while in Klosterneuburg 10 stakeholders participated in the workshop held in a museum. First, the goal and process of the project were presented and discussed with the stakeholders. After a second presentation on results of the climate change exposure analysis, a participatory method was used to supplement the results with information and views of the stakeholders. The last part of the workshop was future climate change and its local impacts on different sectors. The presentation on impacts of climate change led to a discussion on how individuals and groups are being affected by climate change. A planned participatory identification of geographically localized vulnerability hotspots was difficult to do, which led to the insight that thematic vulnerability hotspots are more appropriate. All results and discussion statements were recorded and analysed. They were used to supplement the collected data and analysis of the interviews.



Fig. 0: Workshop Klosterneuburg October 2011

The second set of workshops focussed on strategies, policies and measures for coping with and adapting to climate change, in particular by mobilizing social and human capital. Prior to the workshop an online form was set up on the project website in order to allow citizens and stakeholders to report on which human and social capital oriented measures for climate change adaptation they could think of. A participatory workshop setting was chosen in order to connect to existing activities and encourage participants to engage in the future in projects that increase the adaptive capacity. A short, imaginary radio news broadcast situated in the year 2040 was played to the participants to help them imagine the possible effects of the expected climate change in their community. Next, a setting was introduced to allow participants to talk to each other about their current adaptation strategies and the changes they expect for the year 2040.

A major focus was on the meaning of climate change adaptation and the possibilities on different levels. As analytic concepts the differentiation between climate change adaptation and mitigation is clear, but in the communication with stakeholders it turned out to be difficult to talk about one without the other. After that, the identified hotspots were presented and discussed along sectors.

The final part of the workshop was the discussion and refinement of measures to be implemented in the respective community, which was done using the participatory world café method.



Fig. 0 Workshop Virgen April 2012

In Virgen, a third workshop was held where the pre-final version of the handbook as well as the catalogue of measures developed for Virgen were presented. Ten participants discussed with the project team about the quality of the handbook and the possibility of implementing the suggested measures in the community. Many of the inputs were used to improve the handbook, but all in all the feedback suggested that the handbook was already useful for their community and for other communities.

d. Analysis of vulnerability hotspots

Hotspots of vulnerability were identified by comparing the exposure to climate change and other pressures with the available amounts of capital in the region. Exposure of the region is characterized by the degree, duration, nature and/or extent to which the region is in contact with, or subject to the pressure.

Firstly, the concept of a vulnerability hotspot had to be elaborated. This was done in collaboration with Mark Rounsevell (Subcontractor) who assisted in adapting the definition from the CLIMSAVE project for the CAPITAL-ADAPT project.

Based on the data collected along sectors, a matrix was developed that included information about the pressure of local climate change, the status quo impact and status quo coping capacity, the persons concerned, the challenges for human and social capital, (possible) measures and who should take them. An additional research on data which are publicly available, was conducted.

For all those fields within the matrix where information gaps were identified, a questionnaire for expert interviews was developed and the interviews were conducted via telephone to fill the knowledge gaps. In Klosterneuburg, eight additional interviews were conducted in total, in Virgen four. The matrix structure was refined after the analysis to accommodate the results.

The matrix indicates the needs for action. This is the basis for developing measures in a following step.

e. Handbook development

Based on the experience gained throughout the project, the purpose, target group and style of the handbook was refined by the project team. A taskforce to produce the handbook was set up with one member of each project partner, a journalist and a designer. It was agreed that the core part of the handbook would contain six practical steps to identify challenges related to human and social capital and develop measures to improve the respective form of capital based on the identified local impacts of climate change in the future. A crucial point was to explain the importance of adaptation measures, how they differ from mitigation measures and the relevance of human and social capital for the community in the beginning of the handbook in a non-scientific way that connects to the reality of the potential reader.

In an editorial working session a medical analogy of a “sick climate”, a “climate doctor” and the “medicine” was introduced in order to make the complex issue more understandable.

This handbook is now being disseminated through various channels: the project website, newsletters, climate change adaptation platform, etc.

f. Developing strategies and policies

The strategies and policies were developed to serve a twofold purpose. Firstly, they should be specific measures that can be implemented on the community level by the two case study communities. Secondly, they should also serve as exemplary measures for communities with similar characteristics. The measures are focused on strengthening the human and social capital of the community and with that the adaptive capacity to support adaptation to events caused by climate change. The measures developed are complementary to the handbook that explains in six steps how measures can be developed.

The development of specific measures was based on the project partners’ experience and best practice examples of different climate adaptation projects (see Annex for the full list that includes the CIPRA-database CC-Alps, Tatenbank, Klimzug-projects, etc.). Measures concerning adaptation to heat waves were discussed in detail within two networking meetings with a representative of the STOPHOT-project (ACRP 3rd call). All measures were tested on coherence with the Austrian national adaptation strategy that has been developed in parallel by one project partner..

A stakeholder workshop was held in Virgen to cross-check the applicability of the measures in the local context. Those end-user requirements from the stakeholder dialogue were integrated in the findings.

g. Comparing with adaptation measures identified in a Scottish Case Study

In parallel to the CAPITAL-ADAPT project, the EU-funded CLIMSAVE project has been carrying out a case study on adaptation to climate change in Scotland. Mark Rounsevell of the University of Edinburgh was commissioned to provide a summary of the results of the Scottish case study, (see Annex 11 for the report) which were then compared with the CAPITAL-ADAPT results. The Scottish case study has involved three meetings with stakeholders: to develop socio-economic scenarios, to identify climate change adaptation options for each of the scenarios and to test these options using the integrated assessment platform developed in the CLIMSAVE project. The results of the Scottish case study show the value of considering a set of socio-economic scenarios, since some adaptation options are not feasible in all socio-economic contexts. While there is considerable overlap in the adaptation options identified in Austria and Scotland, there are also some interesting differences, which underlines the utility of cross-national knowledge exchange.

6 Arbeits- und Zeitplan

Table 6 Adjusted work and time schedule

Working Package and Milestones	Working Month																							
	01/11	02/11	03/11	04/11	05/11	06/11	07/11	08/11	09/11	10/11	11/11	12/11	01/12	02/12	03/12	04/12	05/12	06/12	07/12	08/12	09/12	10/12	11/12	12/12
0 Project Management	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
0 Kick-off meeting																								
0 Project team meetings																								
0 Final report																								
1 Consolidation of the Framework																								
1 Phone conference with Mark Rounsevell																								
1 Adaptation framework adapted for Austria																								
2 Scoping in the Case Studies																								
2 Stakeholder analysis finished																								
2 Interviews finished																								
2 First stakeholder workshop																								
2 WP 2 report																								
3 Determination of Vulnerability Hot-Spots																								
3 Meeting with Mark Rounsevell																								
3 Definition of vulnerability hotspot																								
4 Strategies and Policies																								
4 Second stakeholder workshop																								
4 Meeting with Mark Rounsevell																								
4 List with policies																								
5 Production of Handbook																								
5 Third stakeholder workshop: feedback on handbook																								
5 Handbook online																								

7 Publikationen und Disseminierungsaktivitäten

The dissemination activities during the project term as described above include the stakeholder workshops, the project website, the handbook and the catalogue of measures developed (see also annex).

In addition, a presentation was held at the 13th Austrian Climate Day (June 2012):

Balas, Maria, Jäger, J.: KlimaNetz - Vernetzt im Klimawandel: Die Rolle von Human- und Sozialkapital in Umgang und Anpassung an den Klimawandel. Präsentation am 13. Österreichischen Klimatag. 2012

The stakeholder involvement during the project period was topic of a master thesis at the University of Natural Resources and Life Sciences, Vienna:

Grüneis, Heidelinde: Instrumentelle und substanzielle Herausforderungen der Stakeholder-Beteiligung in regionalen, transdisziplinären Klimawandelprojekten. 2012 [master thesis]

A journal article for the Regional Environmental Change is currently in preparation:

Jäger, Jill, Campregher, C., Omann, I.: Indicators of human and social capital at multiple scale levels for use in assessment of climate change adaptation options. [in preparation] 2013.

Diese Projektbeschreibung wurde von der Fördernehmerin/dem Fördernehmer erstellt. Für die Richtigkeit, Vollständigkeit und Aktualität der Inhalte übernimmt der Klima- und Energiefonds keine Haftung.

Deutsche Zusammenfassung

Das Potenzial einer Region, auf klimabedingte Veränderungen reagieren zu können, wird neben verfügbaren Technologien und Ressourcen auch zu einem hohen Grad vom bestehendem Human- und Sozialkapital bestimmt. Ziel von KlimaNetz war es, diese individuellen und gesellschaftlichen Faktoren in Form von Human- und Sozialkapital zu untersuchen und wissenschaftlich fundierte Indikatoren zu entwickeln, welche diese messen können.

Die entwickelten Indikatoren wurden in zwei Fallstudien (Virgen in Osttirol und Klosterneuburg) angewandt, um die vorhandenen Kapazitäten mit lokalen Stakeholdern zu diskutieren und eine Verbesserung der regionalen Strategien im Bereich Human- und Sozialkapital für den Umgang mit den Auswirkungen des Klimawandels zu erörtern.

Sie wurden weiters genutzt, um "Vulnerabilitäts-Hotspots" in den Fallstudienregionen zu identifizieren, die aufzeigen, welche Maßnahmen in welchen Bereichen zur Stärkung der Umgangs- und Anpassungskapazitäten gebraucht werden.

KlimaNetz gilt insbesondere aufgrund des klaren Fokus auf Maßnahmen wie Bildung, öffentliches Bewusstsein, soziale Netzwerke, Freiwilligenorganisationen und institutionellen Änderungen als Antwort auf den Klimawandel als besonders innovativ.

Der im Projekt verfolgte Ansatz wurde in Form eines Handbuchs erarbeitet mit dessen Hilfe Gemeinden das für die Anpassung an den Klimawandel wesentliche Human- und Sozialkapitals abschätzen können.

Bibliography

Cited literature

- Adger, W. 2003. Social capital, collective action, and adaptation to climate change. *Economic geography* 79(4): 387-404.
- Bohunovsky, L., A. Stocker, A. Großmann, H. Hutterer, G. Arends, J. Haslinger, M. I. Wolter, R. Madlener, and A. Endl. 2010. Szenarien eines nachhaltigeren Energiekonsums. Ausbau erneuerbarer Energien, Erhöhung der Energieeffizienz und Verhaltensänderungen im Energieverbrauch bis 2020. Vienna.
- Grueneis, H. 2012. Instrumentelle und substanzielle Herausforderungen der Stakeholder-Beteiligung in regionalen, transdisziplinären Klimawandelprojekten. Das Beispiel KlimaNetz.thesis, Universität für Bodenkultur, Wien.
- Jäger, J. and P. Moll. 2010. Adaptation to climate change: tools and methods. *Regional Environmental Change* 11(2): 213-215.
- Kromp-Kolb, H., Formayer, H., Clementschitsch, L. 2007. Auswirkungen des Klimawandels auf Wien unter besonderer Berücksichtigung von Klimaszenarien. Wien: Institut für Meteorologie und Physik, Universität für Bodenkultur - Studie im Auftrag der Magistratsdirektion der Stadt Wien – Klimaschutzkoordination.
- Lautenschlager, M., Keuler, K., Wunram, C., Keup-Thiel, E., Schubert M., Will, A., Rockel, B., Boehm U. 2009. Climate Simulation with CLM Scenario A1B run no.2, Data Stream 3: European region MPI-M/MaD. World Data Center for Climate.
- Loibl, W. e. a. 2011. reclip:century. Entwicklung eines Basisdatensatzes regionalisierter Klimaszenarien. ACRP-Endbericht, Klima- und Energiefonds.
- Omann, I., Jäger, Jill, Grünberger, Sigrid & Wesely, Julia. 2010. Deliverable D5.1: Report on the development of the conceptual framework for the vulnerability assessment.
- Otto-Banaszak, I., P. Matczak, J. Wesseler, and F. Wechsung. 2010. Different perceptions of adaptation to climate change: a mental model approach applied to the evidence from expert interviews. *Regional Environmental Change*: 1-12.
- Porritt, J. 2007. Capitalism as if the World Matters: Earthscan/James & James.
- Tinch, R., Omann, I., Jaeger, J., Harrison P.A., Wesely, J. 2012. Deliverable D4.1: Report describing the adaptive capacity methodology.

Tuinstra, W., J. Jager, and P. Weaver. 2008. Learning and evaluation in integrated sustainability assessment. *International Journal of Innovation and Sustainable Development* 3(1): 128-152.

Further literature used

Chapter 2.2.3a

Rounsevell, M. D. A., Cojocaru, G., Harrison, P. A., Holman, I., Jaeger, J., Omann, I., Tinch, R. 2012. Climate change adaptation in the assessment of vulnerability hotspots. Paper accepted for presentation at the Adaptations Futures Conference, Arizona, May 2012.
<http://www.adaptation.arizona.edu/adaptation2012/program>

Chapter 3b:

- Balas, M.; Uhl, M.; Essl, F.; Felderer, A.; Prutsch, A. & Formayer, H. (2010): Klimaänderungsszenarien und Vulnerabilität – Aktivitätsfelder Gesundheit, Natürliche Ökosysteme und Biodiversität, Verkehrsinfrastruktur, Energie, Bauen und Wohnen. Im Auftrag des Klima- und Energiefonds. Wien.
- BMLFUW: Kronberger, B.; Balas, M.; Prutsch, A. 2012: Die österreichische Strategie zur Anpassung an den Klimawandel – Teil II Aktionsplan. Wien.
- DIRNBÖCK, T.; ESSL, F. & RABITSCH, W. (2010): Disproportional risk for habitat loss of high-altitude endemic species under climate change. *Global Change Biology*, doi: 10.1111/j.1365-2486.2010.02266.x.
- Eitzinger, J.; Kersebaum, K.C. & Formayer, H. (2009): Landwirtschaft im Klimawandel. Auswirkungen und Anpassungsstrategien für die Land- und Forstwirtschaft in Mitteleuropa. Agrimedia GmbH. Clenze, Deutschland.
- ESSL, F.; DULLINGER, S. & KLEINBAUER, I. (2009): Changes in the spatio-temporal patterns and habitat preferences of *Ambrosia artemisiifolia* during its invasion of Austria. *Preslia* 81: 119–133.
- GRABHERR, G.; GOTTFRIED, M. & PAULI, H. (2010): Climate Change Impacts in Alpine Environments. *Geography Compass* 4/8 (2010): 1133–1153. 10.1111/j.1749-8198.2010.00356.x
- Haas, W.; Weisz, U.; Balas, M.; McCallum, S.; Lexer, W.; Pazdernik, K.; Prutsch, A.; Radunsky, K.; Formayer, H.; Kromp-Kolb, H. & Schwarzl, I. (2008): Identifikation von Handlungsempfehlungen zur Anpassung an den Klimawandel in Österreich: 1. Phase, 2008, AustroClim. Im Auftrag des BMLFUW. Wien.
- HEMMER, W.; SCHAUER, U.; TRINCA, A.M. & NEUMANN, C. (2009): Prävalenz der Ragweed-Pollen in Ostösterreich. Endbericht 2009. Im Auftrag der NÖ Landesregierung (Hrsg.) St. Pölten.
- INTERPRAEVENT (Hrsg.) (2009): Alpine Naturkatastrophen: Lawinen Muren Felsstürze Hochwässer. Mit Beiträgen von Johannes Hübl, Arben Kociu, Hannes Krissl, Erich Lang, Eugen Länger, Andrea Moser, Andreas Pichler, Christian Rachoy, Florian Rudolf-Miklau, Ingo Schnetzer, Florian Sitter, Christoph Skolaut, Nils Tilch, Reinhold Totschnig. Leopold Stocker, Graz – Stuttgart. Internationale Forschungsgesellschaft PRAEVENT.
- KLEINBAUER, I.; DULLINGER, S.; ESSL, F. & PETERSEIL, J. (2006): Ein allergener Neophyt und seine potentielle Ausbreitung in Österreich – Arealodynamik der Ambrosie (*Ambrosia artemisiifolia*) unter dem Einfluss des Klimawandels. In *StartClim2005 Klimawandel und Gesundheit*. Wien.
- KLEINBAUER, I.; DULLINGER, S. & ESSL, F. (2009): Ausbreitungspotenzial ausgewählter neophytischer Gefäßpflanzenarten unter Klimawandelszenarien. F&E-Vorhaben „Neobiota und Klimawandel“. Endbericht.
- KROMP, B.; GRÜNBACHER, E.-M.; FORMAYER, H. & HANN, P. (2006): Einflüsse des Klimawandels auf landwirtschaftliche Schädlinge und Nützlinge im Biologischen Landbau Ostösterreichs. In *StartClim2005: Klimawandel und Gesundheit*. Wien.
- KROMP-KOLB, H. & GERERSDORFER, T. (Hrsg.) (2003): Auswirkungen von Klimaänderungen auf die Tierwelt – derzeitiger Wissensstand fokussiert auf den Alpenraum und Österreich. Studie im Auftrag des BMLFUW. Wien.
- KRAINER, K. (2007): Permafrost und Naturgefahren in Österreich. In: *Ländlicher Raum*. Online-Fachzeitschrift des Bundesministeriums für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft. Jahrgang 2007.
- KRANZL, L.; HAAS, R.; KALT, G.; MÜLLER, A.; NAKICENOVIC, N.; REDL, C.; FORMAYER, H.; HAAS, P.; LEXER, M.J.; SEIDL, R.; SCHORGHUBER, S.; NACHTNEBEL, H.P. & STANZEL, P. (2010b): Ableitung von prioritären Maßnahmen zur

Adaption des Energiesystems an den Klimawandel. Endbericht. Gefördert durch den Klima- und Energiefonds (Energie der Zukunft)

- LENZ, S. (2009): Vulnerabilität Kritischer Infrastrukturen. Bundesamt für Bevölkerungsschutz und Katastrophenhilfe, Bonn.
- Loibl, W.; Züger, J.; Köstl, M.; Suklitsch, M.; Prein, A. F.; Truhetz, H.; Heinrich, G.A.; Gobiet, A.; Formayer, H.; Schicker, I.; Nadeem, I.; Haas, P.; Schöner, W.; Anders, I. & Matulla, C. (2011): reclip:century – regionalisierte Klimaszenarien für Österreich. Vortrag im Rahmen der Veranstaltung „Klimafolgenforschung in Österreich: Aktuelle Projekte im Überblick. 17./18. Mai 2011. Wien.
- Moshhammer, H.; Hutter, H.P.; Frank, A.; Gerersdorfer, T.; Hlava, A.; Sprinzl, G. & Leitner, B. (2006): Einflüsse der Temperatur auf Mortalität und Morbidität in Wien. In: StartClim2005 Klimawandel und Gesundheit. Wien.
- Moshhammer, H.; Hutter, H.-P. & Gerersdorfer, T. (2009): Einfluss von Adaptionsmaßnahmen auf das akute Sterberisiko in Wien durch Temperaturextreme. Wien.
- MUTHERS, S.; MATZERAKIS, A. & KOCH, E. (2010): Climate change and Mortality in Vienna – A Human Biometeorological Analysis Based on Regional Climate Modeling. International Journal of Environmental Research and Public Health. p 2965–2977.
- PRETTENTHALER, F.; GOBIET, A.; HABSBURG-LOTHRINGEN, C.; STEINACKER, R.; TÖGLHOFFER, C. & TÜRK, A. (2007): Auswirkungen des Klimawandels auf Heiz- und Kühlenergiebedarf in Österreich, In: Startclim 2006 Klimawandel und Gesundheit, Tourismus, Energie. Wien.
- Schöner, W.; Böhm, R. & Haslinger, K. (2011): Anpassungsstrategien an den Klimawandel für Österreichs Wasserwirtschaft. Studie der Zentralanstalt für Meteorologie und Geodynamik und der Technischen Universität Wien im Auftrag von Bund und Ländern. <http://wasser.lebensministerium.at/>

Chapter 3f (literature base for the development of measures):

AdaptAlp: www.adaptalp.org

Alp-Water-Scarce <http://www.alpwaterscarce.eu/>

Balas, M.; Stickler, T.; Lexer, W. & Felderer, A. (2011): Ausarbeitung sozialer Aspekte des Klimawandels und von Handlungsempfehlungen für die Raumordnung als Beitrag zum Policy Paper – Auf dem Weg zu einer nationalen Anpassungsstrategie. Im Auftrag des Klima- und Energiefonds. Wien.

Cipra: cc alps. Good Practice – Beispielhafte Klimamaßnahmen: <http://www.cipra.org/de/klimaprojekte/cc.alps/ergebnisse/good-practice>

CLISP – Climate Change Adaptation by Spatial Planning in the Alpine Space (2011b): Pütz, M.; Kruse, S.; Casanova, E. & Butterling, M.: Climate Change Fitness of Spatial Planning. WP5 Synthesis Report. www.clisp.eu

CLISP – Climate Change Adaptation by Spatial Planning in the Alpine Space (2011c): Pütz, M.; Kruse, S. & Butterling, M.: Bewertung der Klimawandel-Fitness der Raumplanung. Ein Leitfaden für PlanerInnen. www.clisp.eu

CLISP – Climate Change Adaptation by Spatial Planning in the Alpine Space (2011e): Zeidler, A.: Risk Governance and Risk Communication. WP6 Synthesis Report www.clisp.eu

Klimzug projects: <http://www.klimzug.de/de/94.php>

Kronberger, B., Balas, M., Prutsch, A. (2012): Österreichische Strategie zur Anpassung an den Klimawandel – Teil II Aktionsplan. BMLFUW. Wien.

PermaNET synthesis report: Wassermanagement und Wasserknappheit in den Alpen- Handlungsempfehlungen für die Wasserwirtschaft und politische Entscheidungsträger. <http://www.permanet-alpinespace.eu/>

Tatenbank – Datenbank für Maßnahmen zur Anpassung an den Klimawandel www.anpassung.net

Chapter 2.2.4c

Jäger, Jill, Campreggher, C., Omann, I.: Indicators of human and social capital at multiple scale levels for use in assessment of climate change adaptation options. [in preparation] 2013.