

COMMISSIONED BY THE FEDERAL OFFICE FOR THE ENVIRONMENT (FOEN)

# **WORKSHOP ON EXPERIENCES WITH CLIMATE RELATED RISK AND VULNERABILITY ASSESSMENTS IN EUROPE DOCUMENTATION**

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## IMPRINT

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## 1. BACKGROUND

Many countries have put climate change adaptation on their political agenda and some have already developed national adaptation strategies. Scientific analyses such as risk and vulnerability assessments are widely used as a basis for strategy development. The approaches used are differing significantly regarding the methodology applied as well as regarding their thematic focus. Experiences in Europe highlight the increasing relevance of risk and vulnerability assessments for the development of national adaptation strategies, in particular for priority setting and adaptation measurement planning. And it's still a new thematic field showing high methodological complexity.

The Swiss Federal Office for the Environment (FOEN) and the Federal Environment Agency Germany (UBA) have therefore initiated an exchange on experiences regarding risk and vulnerability assessments. A first workshop was held in Switzerland and focussed on methodological challenges of risk and vulnerability assessments, whereas a second workshop will be held in Germany and focus on the role of risk and vulnerability assessments within the political decision making process.

### **Goals of the workshop**

The workshop on experiences with risk and vulnerability assessments aimed at providing a platform for the exchange between key European actors involved in developing and implementing such assessments. Main goals of the event were:

- › Receiving an overview of different methodological approaches of risk and vulnerability assessments in different countries;
- › Exchange and discussion on experiences and key challenges regarding the applied methodologies;
- › Getting to know the community of European key stakeholders involved in developing risk and vulnerability assessments.

The detailed programme is attached in Annex 1.

Representatives from seven European countries as well as representatives from science and other relevant institutions involved in the development of risk and vulnerability assessments were present in Berne (refer to Annex 2).

## 2. PRESENTATIONS

The seven presentations by country representatives and the re-insurance company Swiss Re outlined the main purposes of the respective assessments, a short description of the methods, main results and lessons learned. Presentation slides will be made available for the participants and can be downloaded on the website of the Swiss Federal Office for the Environment ([www.bafu.admin.ch/klimaanpassung](http://www.bafu.admin.ch/klimaanpassung)).

### 2.1. OVERVIEW OF APPROACHES

An introduction was given by **Myriam Steinemann (INFRAS)** on the 7 approaches that were presented during the workshop. The presentation was based on a questionnaire on key methodological aspects of the applied approaches that participants submitted before the workshop. The overview revealed the broadness and variety of approaches:

- › Purpose of approaches: Impact, risk and vulnerability assessments were presented. The terms (especially risk and vulnerability) were however defined differently (refer to Annex 3).
- › Scope and type of assessment methodologies: The presentations encompassed both generic and integrated (climate related) impact/ risk/ vulnerability assessments (same approach for all sectors) and approaches with different methods per sector.
- › Qualitative and quantitative approaches: Most approaches were quantitative with some semi-quantitative elements. No purely qualitative approach was presented.
- › Risk/vulnerability assessments are mostly seen as part of a risk continuum encompassing the analysis (as the basis for identifying and selecting adaptation options) as well as the planning, implementation and monitoring of measures. Most countries are still at the beginning of the risk management process and have not gone through the whole cycle yet.

### 2.2. IMPACTS AND VULNERABILITY ASSESSMENTS OF THE GERMAN ADAPTATION STRATEGY (DAS)

**Inke Schauser (Federal Environment Agency Germany UBA)** first highlighted the lack of a consistent common framework and the different use of terms such as impact, risk and vulnerability. Most assessments are impact assessments which do not consider adaptive capacities and socio-economic development. Germany is doing vulnerability assessments using the IPCC definition of vulnerability (which includes exposure, sensitivity and adaptive capacity). Inke presented how vulnerability assessments are included in the German Adaptation Strategy and how those assessments are further enhanced. Germany has within the Adaptation Strategy already gone

through a first cycle of assessing vulnerabilities, implementing and evaluating the strategy and is now starting a second round of vulnerability assessments.

Germany is currently building on two rather different approaches for vulnerability assessments:

- › “Methodology Vulnerability” is a scientific project by the Potsdam Institute for Climate Impact Research and develops a new, scientific based methodology for vulnerability assessment based on a top-down-approach and using its own definition of vulnerability. The assessment considers both climatic and non-climatic drivers and also interactions between sectors. The project looks at different adaptation options and does scenarios for different adaptation actions.
- › “Network Vulnerability” consists of federal agencies and develops jointly a vulnerability picture based on existing regional and sectoral vulnerability assessments in a bottom-up manner. The network uses the IPCC definition of vulnerability and considers only climatic drivers. It looks at adaptation capacity indicators such as GDP. It also estimates the potential/space for adaptation (e.g. winter tourism has a small potential/space for adaptation e.g. compared to agriculture).

Bringing together the results of these two tracks will be highly challenging but may provide a unique depth of analysis. There are many methodological challenges related to vulnerability assessments, e.g. related to selection and aggregation of information (how to weight information) and to cross sectoral issues. These may often imply difficult normative questions. There are many scientific gaps and these are very difficult to communicate to the ministry.

#### **Further information**

Climate Change in Germany - Vulnerability and Adaptation of Climate sensitive Sectors (in German): [www.umweltbundesamt.de/uba-info-medien/mysql\\_medien.php?anfrage=Kennummer&Suchwort=2974](http://www.umweltbundesamt.de/uba-info-medien/mysql_medien.php?anfrage=Kennummer&Suchwort=2974)

### **2.3. SECTORAL STUDIES ABOUT CLIMATE CHANGE IMPACTS IN FRANCE**

#### **Bertrand Reysset (National observatory on the effects of climate change Onerc, France)**

presented the work of an inter-ministerial multi-sectoral working group to assess the cost from climate change impacts in different sectors.

The assessments in 9 sectors followed a pragmatic approach and were conducted over a short time frame. Different approaches per sector were applied due to the unequal level of available data and the diversity of sectors, e.g.

- › extrapolation of data from 2003 heat wave and possible impacts

- › temperature/consumption models to forecast future energy demands (in collaboration with energy companies using their own impact models on energy demand);
- › use of GIS to combine transport infrastructure data (rail, road, etc.) with sea level rise and coastal flooding data.

The approaches were simple, but turned out to be very useful to start identifying hot spots and will also be used to formulate the national adaptation plan. The sectoral impact assessments revealed knowledge gaps (especially non-climatic uncertainties) and further research needs. Even if more work is needed to build a global adaptation policy, these approaches remain a possible and cost effective first step. (Except for in-kind contributions in manpower by the ministry and its public and private sector partners, no financial resources were available for the project).

The examples highlighted that cost alone may not be a sufficient indicator to decide on adaptation: economic costing of heat death of elder people may be interpreted as economically attractive, as long term caring costs may be reduced. The result depends on the assumed cost of human life cost of heat deaths with elderly people. In the end it's a political decision.

Some challenges were identified related to the lack of long term demographic and economic scenarios, the difficulty to anticipate inter-sectoral interactions.

#### **Further information**

Detailed impact assessments are available on line (French only):

[www.developpement-durable.gouv.fr/Rapport-du-groupe-de-travail,10875.html](http://www.developpement-durable.gouv.fr/Rapport-du-groupe-de-travail,10875.html)

Summary of impacts and cost assessments in English:

[www.developpementdurable.gouv.fr/IMG/pdf/rapport\\_onerc\\_3\\_ENG\\_vf\\_2.pdf](http://www.developpementdurable.gouv.fr/IMG/pdf/rapport_onerc_3_ENG_vf_2.pdf)

## **2.4. NATIONAL RISK ANALYSIS ON DISASTERS AND EMERGENCY IN SWITZERLAND**

**Markus Hohl (Federal Office for Civil Protection FOCP, Switzerland)** presented the approach and first results of the National Disaster Risk analysis.

The mission of the FOCP is to prepare for disasters and restore to normality again after a disaster. The objective of this multi- (integrated) risk analysis is to prioritise hazards (country risk analysis) and to elaborate foundations for further analyses and for planning in interdisciplinary crisis teams. Climate change is only one of several drivers.

The FOCP identified protection aims (based on the Swiss constitution) and defined 13 indicators (e.g. casualty, damaged area, reduction of economic productivity, limitations of law and order, reduction of trust) to assess potential damages in the area of population, environment,

economy and society. These are the basis for impact analysis. Very detailed scenarios (e.g. dirty bomb scenario, electrical power outage) are developed and their impacts, likelihood and plausibility are estimated. All risks are monetized (monetary values are given to each of the damage indicators).

#### **Further information**

Risk Switzerland: [www.risk-ch.ch](http://www.risk-ch.ch)

## **2.5. ASSESSMENT OF CLIMATE-RELATED RISKS AND OPPORTUNITIES IN SWITZERLAND**

**Pamela Köllner-Heck (Federal Office for the Environment, Switzerland)** presented main methodological features of the climate related risk and opportunity assessment in Switzerland.

A first sub-national assessment for the canton Aargau (representing one of the large areas in Switzerland) will be finalized in March 2013, the country wide analysis in 2016. The analysis shall provide a discussion basis for priority setting within the national adaptation strategy.

Starting point is a matrix which combines climate-related hazards and effects with the impact areas. The method looks at two climate scenarios and one socio-economic scenario. Impact areas are assessed for today's climate and socio-economic situation, under the 2 climate scenarios and under the socio-economic (and demographic) scenario. Where possible, the risks are quantified and conversion factors are defined, so that different indicator values can be compared and aggregated (monetisation). The non-quantifiable risks are expressed in qualitative terms. A magnitude is given in order to compare them with the quantified risks.

Main challenges identified are: provision of robust quantitative results for decision making given the large uncertainties; up-scaling of sub-national results to national-level, ethical questions related to monetization, how to use expert judgements as part of a mostly quantitative analysis (given the limited numbers of experts in different fields).

#### **Further information**

[www.bafu.admin.ch/klimaanpassung/11529/11578/index.html?lang=de](http://www.bafu.admin.ch/klimaanpassung/11529/11578/index.html?lang=de)

Pilot project of the risk and opportunity analysis:

[www.bafu.admin.ch/klimaanpassung/11529/11578/index.html?lang=de&download=NHzLpZeg7t.lnp6IONTU042l2Z6ln1acy4Zn4Z2qZpn02Yuq2Z6gpJCGe4F4gmym162epYbg2c\\_JjKbNoKSn6A--](http://www.bafu.admin.ch/klimaanpassung/11529/11578/index.html?lang=de&download=NHzLpZeg7t.lnp6IONTU042l2Z6ln1acy4Zn4Z2qZpn02Yuq2Z6gpJCGe4F4gmym162epYbg2c_JjKbNoKSn6A--)



## 2.6. UK CLIMATE CHANGE RISK ASSESSMENT

**Valerie Bain (HR Wallingford)** presented the major process to carry out the Climate Change Risk Assessment 2012.

According to the legislative framework (Climate change act 2008) a Climate Change Risk Assessment has to be done every five years and feed into national adaptation programme. There was a major stakeholder engagement throughout the whole process with fora, workshops, review processes etc. 11 sectors grouped into 5 larger themes (agriculture and forestry, business, health & wellbeing, buildings & infrastructure, natural environment) were analysed in detail.

The same risk assessment approach was chosen for all sectors: Choose priority risk -> assess sensitivity of each risk to climate (response functions) -> apply projections of future climate & population to each risk and assess each risk -> assign magnitude and confidence scores to each risk -> compare scores of all risks (scorecards).

The process of setting thresholds (low, medium, high consequences) is crucial for the results: These were defined in consultation with sector experts.

The lessons learned in this process are described in detail in the Recommendations report. These are related to the project structure and processes, to the methodology, to further research needs and the stakeholder engagement process. The confidence scores given to the assessment of each individual risk allow for the transparent documentation of the current level of scientific understanding.

### Further information

All the reports and summaries (e.g. Government report, CCRA Evidence report, Sector reports, Recommendations report, Method report) available under:

[www.defra.gov.uk/environment/climate/government/](http://www.defra.gov.uk/environment/climate/government/)

<http://ccra.hrwallingford.com/>

HRW climate change microsite: [www.hrwallingford.com/climate-change/](http://www.hrwallingford.com/climate-change/)

## 2.7. MAP-BASED ASSESSMENT OF VULNERABILITY TO CLIMATE CHANGE (FINLAND, NORWAY, SWEDEN)

**Stefan Fronzek (Finnish Environment Institute SYKE)** presented a map-based vulnerability assessment method employing regional indicators (MAVERIC).

The aim of the study is to quantify regional vulnerability to climate change in two specific themes: elderly and cross-country skiing. It is an indicator-based approach on municipal scale for Finland. Indicators cover both adaptive capacity indicators and exposure indicators.

- › Adaptive capacity indicators are taken from population statistics, health statistics etc. and include e.g. elderly population, elderly living alone, health care personnel, elderly welfare recipients (present day and future). Uncertainties of population forecasts are considered (probabilistic estimates) due to the huge limits/uncertainties of population forecasts.
- › Exposure indicators for the elderly related to heat stress and cold stress (e.g. change in very warm days). Probabilistic projections of climate change were considered for that.

Indicators of exposure and adaptive capacity are normalized and then combined to an index of vulnerability. The method is an attempt to develop scenarios of socio-economic indicators using population models, simple extrapolations of historic trends and survey questions about future adaptation and to combine them with future climate scenarios. The mapping component is interesting for entering in a dialogue with decision makers.

#### **Further information**

Map-based assessment of vulnerability to climate change employing regional indicators MAVERIC [www.ymparisto.fi/syke/maveric](http://www.ymparisto.fi/syke/maveric), <http://www.iav-mapping.net>

## **2.8. ECONOMICS OF CLIMATE ADAPTATION (ECA)**

**Lea Müller (Swiss Re)** gave an overview of the ECA methodology and the results of one case study conducted in the city of Hull, UK.

Natural catastrophe losses globally are on the rise mostly because of the increase of values in exposed areas, but there might also be climate change signals increasing losses already. Decision makers need to be aware of potential losses and of what can be done. ECA therefore provides a method both to *assess* and *address* the total climate risk (sum of climate risk today, economic development in future and additional risks presented by climate change). Losses include only financial losses (no losses in human lives). Measures to address climate risk include measures to avoid, reduce, prevent, transfer and retain risk.

The results of the case study of the city of Hull revealed that the economic growth as the key driver of losses until 2030. The adaptation cost curve for Hull showed that a broad range of measures have to be implemented to bring down the losses and that a large part of losses can be averted cost effectively by implementing no-regret-measures. Prevention measures are often more appropriate than insurance. However, residual risk will always remain to a certain extent.

The ECA method enables to understand the impact of climate change, to identify actions to minimize the impacts and allows integrating adaptation with economic development and sustainable growth.

### Further information

Shaping Climate-Resilient Development: a framework for decision-making, 2009,  
[http://media.swissre.com/documents/rethinking\\_shaping\\_climate\\_resilient\\_development\\_en.pdf](http://media.swissre.com/documents/rethinking_shaping_climate_resilient_development_en.pdf)

## 3. DISCUSSION

### What are the experiences, pro's and con's in using generic/consistent approaches vs. sector specific approaches?

Depending on the purpose of the assessment generic or sector specific approaches might be more appropriate

- › Generic approaches: Such approaches are appropriate for making impacts comparable (e.g. monetization can allow equal fitting for investments). Policy makers need comparison between sectors to be able to decide. Furthermore a generic approach allows bringing people from different sectors together to discuss main challenges across sectors and to find a common value set.
- › Sector based approaches are necessary for scientific reasons and for defining adaptation measures at sub-national level. To find critical points within sectors aggregated approaches may be less suitable.

### What are the experiences regarding monetarization and quantification of risks?

- › Making impacts comparable is a challenge: Normalization and monetarization is a possibility, but it doesn't mean objectivity per se. It imposes a value judgement at an early stage (normative element behind) and political discussions about that are still needed afterwards.
- › There are different types of quantification e.g. fatalities vs. economic losses. Economic losses are an important indicator, but do not reflect the whole picture.
- › Decision makers have to know that quantitative results are not more right or relevant than qualitative results.

### **What are the challenges in considering economic and social development in your assessment?**

- › Socio-economic development is often more important than climate change (e.g. expansion of settlement much more important than increase of heavy rains). Change in sensitivity/ vulnerability is key when analysing future risks.
- › It is very difficult to develop socio-economic scenarios because of inherent uncertainties (market developments, political decisions etc.) and as the interactions between sectors are very complex. Furthermore sectors are often not driven internally, e.g.: price of cereals does not depend on the climate of one country alone but e.g. the current climatic and/or political situation in other countries. Restricting system boundaries for climate change impacts to a specific country does not give the whole picture.
- › In some sectors policy changes are more important than climate change. E.g. subsidy policies in agriculture. Sensitivity analysis gives you some ideas of future.

### **Did you consider adaptive capacities in your assessment?**

- › Most approaches did not consider current adaptive capacities and changes of adaptive capacities.
- › In Germany, a difference is made between adaptation which takes places over a long time and additional space for adaptation measures from today's viewpoint. The main question is whether we have a high capacity to reduce an impact or not and where there are barriers to adaptive capacity. E.g. there is a high adaptive capacity in agriculture (many different options, also easy to implement ones), but low capacity in winter tourism. The idea is to start with no/low regret measures and to show that with adaptation measures you reduce your vulnerability. Even in some cases of high impacts there are easy to do measures (e.g. early warning systems in case of heat waves). This approach is an attempt to link action to the analytical part.
- › For some participants, adaptive capacity might be seen as a bridging element between risk analysis and adaptation planning. E.g. in some sectors adaptive capacity is linked to income (people with more money have more options). By looking at past events one can identify factors of adaptive capacity.

### **How to design approaches that provide added value for decision making?**

Key elements/challenges are:

- › The awareness raising objective of the assessments seems to have been achieved in most of the countries/cases. The difficulty is mostly related to linking risk and vulnerability assessments to adaptation planning.
- › A strong legal basis for the assessment (e.g. UK Climate change act) is important to involve different departments in the assessment and to assure relevant resources for its implementation. It is important to include different departments from the beginning to enhance acceptance and link them to action. Assessments have to create the evidence base for adaptation planning.
- › National assessments have to make many simplifications when comparing between sectors. Sector experts might assess the results as too simplistic and do not use them to set priorities in their sector.
- › Intermediate results of assessments might be regularly included in the policy making process in order to make them accessible for adaptation planning.
- › Climate change is seen as one of many drivers. Considering climate change and other drivers of change together might enhance relevance for decision making.

#### **Implementation of adaptation is often on a sub-national level. How is this treated?**

- › Implementation depends largely on the organization of a state (e.g. federal states vs. centralized state).
- › One has to be careful with downscaling national results to regional level. The national level is mainly for setting the policy agenda whereas the sub-national level is much more practical. Different approaches are needed on different levels.

#### **How to communicate results for decision making?**

- › The type and audience for communication varies strongly between countries (e.g. very broad communication incl. wider public in UK and GER vs. communication to federal departments and cantons in Switzerland).
- › Communication has to be adapted to the audience (e.g. wider public, decision makers). But even with targeted communication, results might be misinterpreted (e.g. in case of divergent trends at national compared to sub-national level).
- › It is also important to communicate that there are not only threats but also opportunities. Communicating examples of people that have already started to adapt has been successful.

**Further challenges which might be discussed at a later stage?**

- › Definitions of terms (risk, impact, vulnerability) need to be clarified.
- › A distinction can be made between climate change impacts on a national level vs. on a regional or local level.
- › The planning of adaptive measures needs also to look into barriers to their implementation.
- › The “objectivity” of climate related risk assessments should be constantly monitored throughout the processes, as values and judgement calls are inevitably part of most risk assessment processes. They should be made transparent and explicit.

**What is the value of international cooperation in this area? Would it be useful to hold such workshops on a regular basis?**

- › Participants assessed the value of further cooperation, exchange of best practices etc. as very useful.
- › There are many other persons and groups in Europe working on climate related assessments. A continuation of the exchange with other experts and on other questions would be highly appreciated.
- › HR Wallingford is working on a book on risk assessment and will approach participants for possible contributions to the book.
- › Slovenia is very interested in exchanging best practice with experts from other countries to start its own adaptation strategy.
- › A second workshop in Germany might provide further possibilities for continuing the exchange (date not clear yet).

## ANNEX

### ANNEX 1: PROGRAMME

08.30-09.00	<b>Registration, coffee</b>	
09.00-09.30	<b>Welcome and introduction</b> Welcome, objectives of the workshop  Welcome, introduction to the jointly organised event  Information on the programme of the day  Round of introductions	Paul Filliger, Federal Office for the Environment FOEN Inke Schauser, Federal Environment Agency Germany INFRAS  All
09.30-09.45	<b>Methodological overview</b>	Myriam Steinemann, INFRAS
9.45-10.25	<b>Session 1: Methodological challenges with risk and vulnerability assessments</b>  <b>Presentations:</b> - Climate Change in Germany. Vulnerability and Adaptation of climate sensitive sectors - National assessment of the cost of the impact of climate change in France	- Inke Schauser, Germany - Bertrand Reysset, France
10.25-10.55	<b>Coffee break</b>	
10.55-12.35	<b>Session 1: Methodological challenges with risk and vulnerability assessments (continued)</b>  <b>Presentations (continued):</b> - National Risk analysis on disasters and emergency in Switzerland - Assessment of climate-related risks and opportunities in Switzerland  <b>Discussion:</b> Key challenges with risk and vulnerability assessments 1. Challenges related to type of approaches (generic vs. sector specific approaches, qualitative and quantitative approaches) 2. Consideration of socio-economic development and adaptive capacities	- Markus Hohl, Switzerland - Pamela Köllner-Heck, Switzerland  All
12.35-13.45	<b>Lunch</b>	
13.45- 14.55	<b>Session 2: Further methodological challenges and way forward</b>  <b>Presentations:</b> - UK Climate Change Risk Assessment 2012 - Map-based assessment of vulnerability to climate change employing regional indicators (MAVERIC) - Economics of Climate Adaptation	- Valerie Bain, UK - Stefan Fronzek, Finland - Lea Müller, SwissRe
14.55-15.10	<b>Coffee break</b>	
15.10-16.00	<b>Session 2: Methodological challenges and way forward (continued)</b>  <b>Discussion:</b> 1. How to design approaches that provide added value for decision making 2. Further international cooperation and exchange 3. Way forward: Expectations by participants	All
16.00-16.15	<b>Feedback and next steps</b> Planned next steps/events, feedback regarding the event, closing remarks	Pamela Köllner-Heck, FOEN Inke Schauser, UBA
16.15	<b>End of the workshop</b>	

## ANNEX 2: LIST OF PARTICIPANTS

<b>Family name</b>	<b>First name</b>	<b>Institution</b>	<b>E-Mail</b>
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<b>Moderators</b>			
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## ANNEX 3: MAIN DEFINITIONS

<b>MAIN DEFINITIONS USED IN THE ASSESSMENTS</b>		
<b>Main terms</b>	<b>Definitions</b>	<b>Used by country/ institution</b>
Impact	Consequence of the realization of an hazard	FRA
	Effect of climate change on the socio-bio-physical system (e.g. flooding, rails buckling).	UK
	Severity = asset * vulnerability	ECA (Swiss Re)
Risk	Likelihood/ Probability x Impact	Switzerland (FOCP)
	Frequency of annual aggregated impacts * annual aggregated impacts	Switzerland (FOEN)
	Combines the likelihood an event will occur with the magnitude of its outcome	UK
	Risk concerns the expected value of one or more results of one or more future events and is the product of frequency and severity Risk = frequency * severity	ECA (Swiss Re)
Vulnerability	Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity (IPCC)	GER, FIN, UK
	Sensitivity * exposure	FRA
	Vulnerability is the reaction of a specific asset - a house, a person, etc. - to a hazard. Vulnerability is a function of hazard and assets. Vulnerability = f (hazard intensity, asset type)	ECA (Swiss Re)

Table 1