Adaptation to Climate Change in Alpine Regions

UN-ISDR Global Platform
Roundtable Mountains of Risk
May 12, 2011
Geneva

Thomas Probst, Roland Hohmann, Pamela Koellner-Heck
Swiss Federal Office for the Environment, Climate Division
Climate change in Switzerland

Global warming 2000-2009 compared to reference period 1951-1980

Source: NASA Earth Observatory 2011
Climate change in Switzerland

Risks

Sources: Hansruedi Burgener 2005 / PLANAT, Walter Weiss, welt.de, Schweizerisches Tropeninstitut
Climate change in Switzerland

Opportunities

Sources: GCOS Schweiz, www.biel-seeland.ch
Swiss adaptation strategy
Federal Council mandate (August 2009)

Develop a strategy for adaptation to climate change
- Analyse climate change related risks
- Define objectives for coping with the consequences
- Enable coordination of adaptation actions
Swiss adaptation strategy

Objectives

1. Seize the opportunities provided by climate change
2. Minimize the risks of climate change, protect population, material assets and natural resources
3. Increase the adaptive capacity of all systems
## Swiss adaptation strategy

### Synthesis: biggest challenges

<table>
<thead>
<tr>
<th>Natural Hazards</th>
<th>Challenge</th>
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<tbody>
<tr>
<td></td>
<td>Increasing flood risk</td>
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<tr>
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<td>Increasing slope instability and mass movements</td>
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<tr>
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<td>More frequent and intense heat waves in cities</td>
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<td>More frequent and intense droughts</td>
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<td>Spreading vermin, invasive species and pathogens</td>
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<td>Changing site conditions and productive capacities</td>
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<td>Changing habitats and species distribution</td>
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<td>Improving the knowledge base</td>
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<td>Raising awareness and willingness to adapt</td>
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<td>Fostering cooperation</td>
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</table>

*Adaptation to climate change in alpine regions*

T. Probst, R. Hohmann, P. Koellner-Heck / FOEN
Swiss adaptation strategy

Flood risk

Increasing frequency/intensity in winter, spring and early summer
- rise in winter precipitation
- rise in snow line
- rise in heavy precipitation
- coinciding snow melt and heavy precipitation

Buochs 2005 / Engelberger Aa river, source: PLANAT
Swiss adaptation strategy
Slope instability and mass movements

Glacier retreat
Rosegg glacier

Source: www.gletscherarchiv.de
Swiss adaptation strategy
Slope instability and mass movements

Landslides
Stieregg / Grindelwald glacier 2005
Swiss adaptation strategy
Slope instability and mass movements

Rockfalls
Gurtnellen 2006
Swiss adaptation strategy

Next steps

1. Climatologic basis
2. Objectives & principles
3. Most affected sectors
4. Sectoral strategies
5. Interface analysis
6. Synthesis

Implementation!
Implementation
Integrated risk management

- **Avoid risk:**
  mapping and land-use planning

- **Limit risk:**
  constructive and organisational measures

- **Manage residual risk:**
  self responsibility and insurance

- **Consider climate change:**
  in all steps of IRM
Implementation
Hazard maps

- Landslides
- Rockfalls
- Avalanches
- Floods

Legend:
- Realized
  - 0 - 5%
  - 6 - 33%
  - 34 - 66%
  - 67 - 100%

Source: BAFU 2011
Implementation
Climate-proof measures

Grindelwald village

Glacial lake / landslide 2009

Grindelwald glacier
Implementation
Climate-proof measures

- Permanent monitoring of lake level and glacier
- Early warning system: glacier avalanches, glacial lake outburst, flooding
- Warning of population via local radio

Sources: Christoph Haemmmig / GEOTEST, OIK
Implementation
Climate-proof measures

Artificial draining gallery
Longitudinal cross-section

Source: Christoph Haemmig / GEOTEST
Implementation

Climate-proof measures

- Length: 2'130 m
- Profile: width 3.2 m; height 4.6 m
- Slope: 18% - 22%
- Construction: January - October 2009

Sources: Christoph Haemming / GEOTEST, OIK
Cooperation in the Alpine Space
Transnational projects

Sources: Alpine Space Programme, ASP projects, www.wikipedia.de
Cooperation in the Alpine Space

PLANALP

Alpine Convention (since 1995)
Framework for sustainable development of the Alpine region

Platform on natural hazards PLANALP (since 2005)
High-level experts from international, national, regional institutions
- Discuss concepts for integrated natural hazards reduction
- Identify best practices
- Implement corresponding measures
- Intensify cross-border exchange
Climate change in Switzerland
20th century

- Global mean temperature: +0.6°C
- Europe: +0.9°C
- Switzerland: +1.0°C (south) / +1.3°C (east) / +1.6°C (west)

Annual mean temperature Switzerland 1864-2010

Deviation from mean temperature 1961-1990

- years above mean 1961–1990
- years below mean 1961–1990
- 20-year weighted mean (Gaussian lowpass filter)

Source: MeteoSwiss 2011
Climate change in Switzerland

Future

Temperature (changes compared to 1990)

median 2050
summer: +2.7°C
winter: +1.8°C

CH north

Source: OcCC 2007

median 2050
summer: +2.8°C
winter: +1.8°C

CH south

Source: OcCC 2007
Adaptation to climate change in alpine regions

Climate change in Switzerland

**Future**

**Precipitation** (changes compared to 1990)

**median 2050**
- summer: -17%
- winter: +8%

**CH north**

**median 2050**
- summer: -19%
- winter: +11%

**Source**: OcCC 2007

Adaptation to climate change in alpine regions

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Climate change in Switzerland
Impacts

<table>
<thead>
<tr>
<th>Climate Change (temperature, precipitation, pressure)</th>
<th>Water</th>
<th>Soil</th>
<th>Air</th>
<th>Biology</th>
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<tbody>
<tr>
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<table>
<thead>
<tr>
<th>Sectors</th>
<th>Adaptation measures</th>
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<tr>
<td>Agriculture</td>
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<tr>
<td>Forest management</td>
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<tr>
<td>Energy</td>
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<td>Water management</td>
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<td>Tourism</td>
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<td>Biodiversity management</td>
<td>●</td>
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<td>Spatial development</td>
<td>●</td>
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<tr>
<td>Health</td>
<td>●</td>
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<tr>
<td>Natural hazards</td>
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● (Mutual) Interaction between climate change impact and adaptation measure
Climate change in Switzerland
Economic effects

... on Swiss national economy until 2100:
- 0.5%-1.6% of GDP/y climate change damages
- 2005-2100: 1 Bio. CHF/y (median)

... on Swiss exports until 2050:
- 1.4%-3.1% of exports endangered = 0.5%-1.1% GDP

... on tourism in the Bernese Alps until 2030:
- Winter revenues: -200 Mio. CHF/y (-30%)
- Summer revenues: +80 Mio. CHF/y (+7%)

Swiss adaptation strategy
Interdepartmental Panel Climate

Federal Council

DETEC
DDPS
FDEA
FDHA
FDF

FOEN
FOs
FOs
FOs
FOs

Interdepartmental Panel Climate
coordination of Swiss climate policy post 2012

WG1
WG2
WG3
WG4
WG5
WG6

Swiss Adaptation Strategy
Swiss adaptation strategy
Sectoral strategies

<table>
<thead>
<tr>
<th>Sector</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>WATER</td>
<td>Water management</td>
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<tr>
<td>NATHAZ</td>
<td>Natural hazards prevention</td>
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<tr>
<td>AGRIC</td>
<td>Agriculture</td>
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<td>FOREST</td>
<td>Forest management</td>
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<td>ENERGY</td>
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<td>SPACE</td>
<td>Spatial development</td>
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<td>HEALTH</td>
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<tr>
<td>BIODIV</td>
<td>Biodiversity management</td>
</tr>
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</table>

Climate change impacts

Fields of action

Adaptation goals

Adaptation options
Swiss adaptation strategy

Content

PART A: THE ADAPTATION STRATEGY
1. Background
2. Objectives and principles
3. The biggest common challenges for adaptation
4. Outlook: steps of implementation

PART B: ANNEXES
5. Methodology
6. Climate scenarios
7. Sectoral adaptation strategies
8. Interfaces between the sectoral strategies
## Swiss adaptation strategy

### Flood risk

<table>
<thead>
<tr>
<th>problems</th>
<th>options</th>
</tr>
</thead>
</table>
| **NATHAZ** | - finalize/update hazard maps  
- climate-proof technical prevention  
- monitoring and early warning |
| increasing damage potential to  
- settlements and buildings  
- road and train infrastructure  
- supply and disposal infrastructure  
- population | |
| **SPACE** | - implement hazard map restrictions  
- keep endangered areas undeveloped  
- preserve space for rivers  
- create flood retention areas |
| **WATER** | - multi purpose reservoirs  
- lake regulation and management |

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## Swiss adaptation strategy

### Slope instability and mass movements

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<thead>
<tr>
<th>problems</th>
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</thead>
</table>
| **NATHAZ** | increasing damage potential to settlements and buildings  
- glacier/permafrost/slope monitoring  
- review current protection concepts  
- finalize hazard maps  
- climate-proof technical prevention |
| **SPACE** |  
- road and train infrastructure  
- implement hazard map restrictions  
- keep endangered areas undeveloped |
| **FOREST** |  
- energy supply infrastructure  
- dams  
- adjust/transform protection forests  
- new technical protection measures |
| **ENERGY** |  
- sensitize for new risks |
| **WATER** |  
- sensitize for new risks |