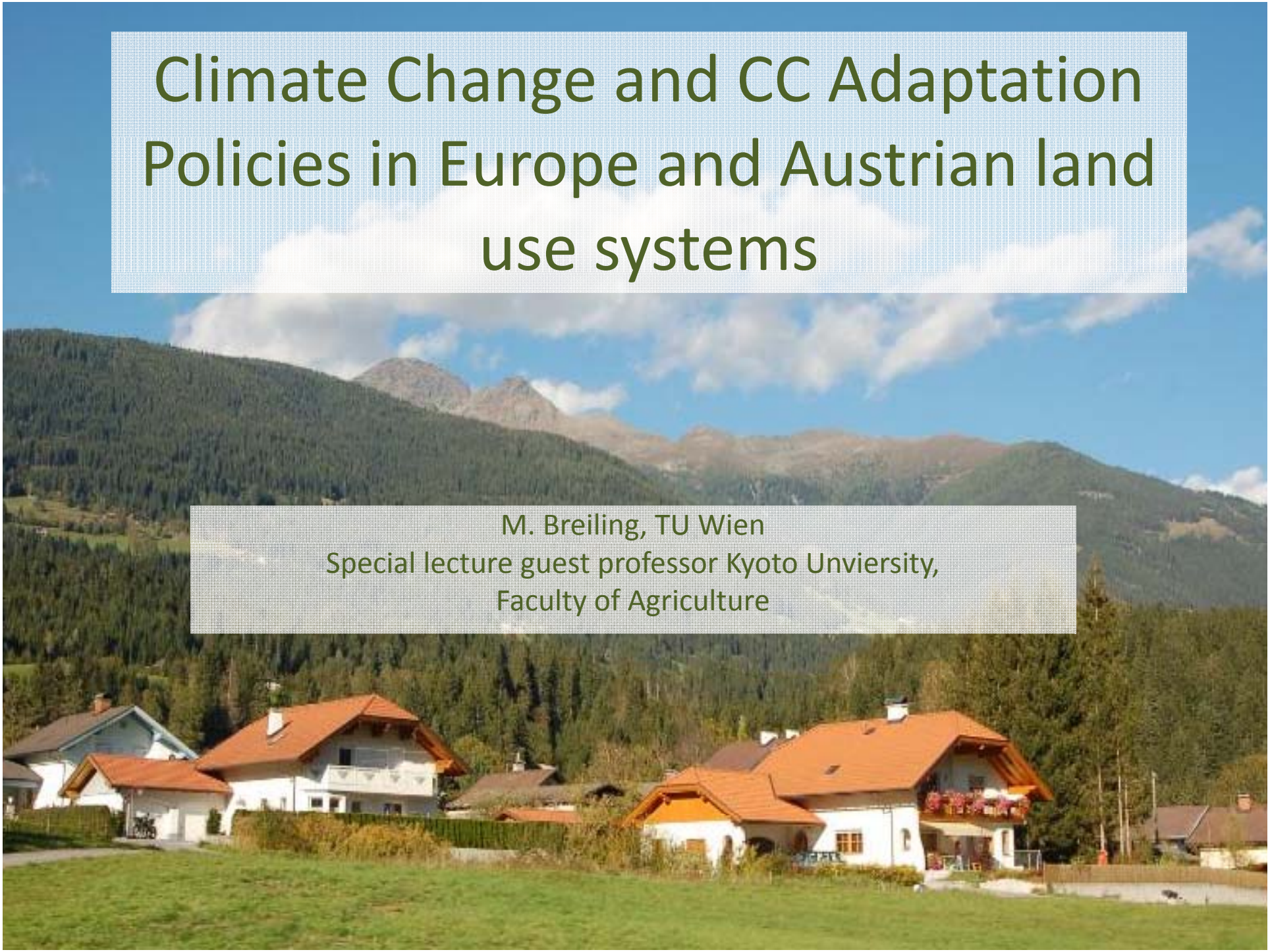
# Climate Change and CC Adaptation Policies in Europe and Austrian land use systems



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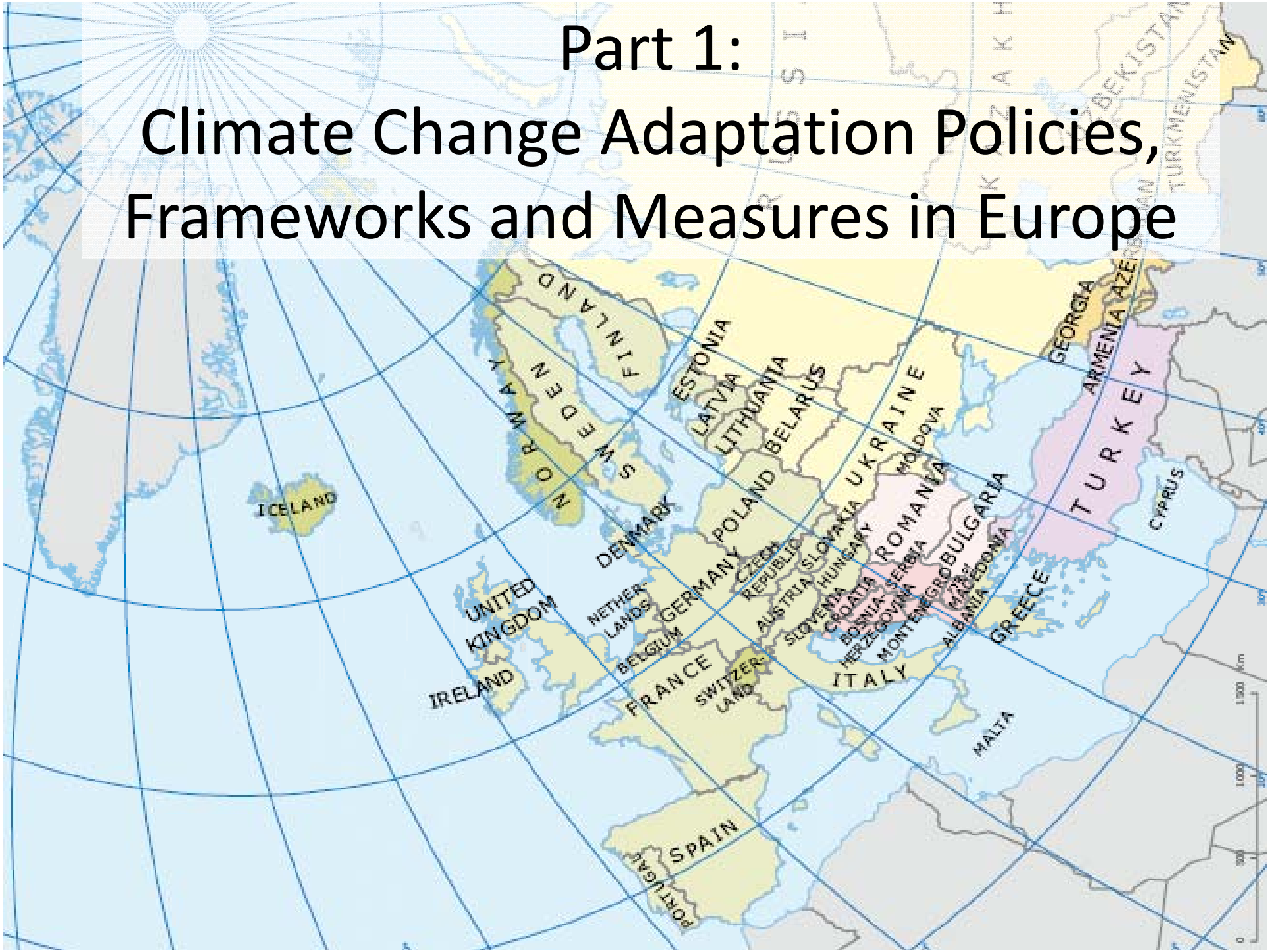
# Overview

- Presentation will be divided into two parts
- Part 1: Land Use Practices & Climate Change Adaptation Policies, Frameworks and Measures in Europe
  - Gives the overview of what is happening in Europe
- Part 2: National Land Use Practices and Climate Change Adaptation (Austria)
  - Provides
    - a more detailed case study of Austria
- Part 3: Local Land Use Practices and Climate Change Adaptation (Hermagor district)

# Part 1:
# Climate Change Adaptation Policies, Frameworks and Measures in Europe



# The Case of Europe

- Land Use Planning in Europe needs prognosis of climate change directions
  - IPCC 4th assessment report gives evidence that climate change is going on
  - A general trend of changes in temperature, precipitation and other climate parameters according to regions
  - An anticipation of the occurence of future extreme events is needed
  - Climate variability either remains stable or may follow a different path

# Mitigation

- Some 20% of climate change are related to land use and changes of land use
  - depletion of sinks by converting forests to agricultural land
    - In most European countries we have today an increase in forest areas and sinks
  - emissions of GHG from agricultural production
    - Rice and methane emissions play only a minor role in Europe
    - Inputs to agricultural production are a main problem

# Mitigation and Kyoto

- Kyoto aims of 1997 will not be reached
  - All EU countries signed the Kyoto protocol
    - Only former communist countries with system switch and economic decline or countries previously in war will reach the target
  - Stopping of adverse climate change impacts cannot be reached
    - Even if there would be no emissions, complex atmospheric reactions will go on for several decades
- New post 2012 goals will be negotiated in Copenhagen in December 2009
  - Aim to stop CC at 2°C as compared to 0.8°C warming today
    - Major changes have to be expected with this warming rate
    - Even more drastic changes become likely if targets cannot be achieved

# Mitigation versus Adaptation

- Until 2007 and the 4th assessment report of the IPCC
  - Mitigation was favoured by policy
    - More easy to apply by general laws and standards
    - Targeted to new innovative technologies
  - Climate change was not “certain”
    - Despite many signs and records from observations and monitoring
    - The end of the Kyoto process was more distant, now 2012 and the failure of the Kyoto aims is approaching
  - Change of policy needed
    - from mitigation with adaptation to
    - Adaptation with mitigation

# Adaptation

- Is needed everywhere in Europe and the world
  - To make local adjustments to accelerating change
  - We cannot stop or even stabilize climate change
    - The impacts of today to which we adapt are emissions from years ago
    - The emissions of today are impacts of the coming decades
  - Climate change induced disruptions are likely to increase
  - Development planning needs to consider currently unknown and unexpected surprises
- Targets every location or economic activity
  - Is not straight forward
    - Some stakeholders profit from climate change
    - Depends on the degree of change

# White Paper on CC-Adaptation in Europe

- April 1st, 2009: WHITE PAPER ON CC-ADAPTATION issued
  - Adapting to climate change: Towards a European framework for action
    - Why Europe needs an adaptation strategy
    - Objectives and Action of the proposed EU framework
    - Instruments and Financing
    - Working in Partnership
    - External dimension and cooperation under UNFCCC

# Adaptation in urban areas

- Damage can be most distinct in case of extreme events
  - Floods
  - Droughts
  - Integrated planning with surrounding rural areas is needed
- Urban areas have little problem with permanent increase of temperature
  - adapt to more comfortable situations by climate conditioning systems
  - Consist to a high degree of artificial environment
    - Indoor and excluded from outdoor natural environment
    - Can be regulated
  - At the expense of increased resource use and higher greenhouse gas emissions
    - Adaptation in particular easy for rich communities
  - Europe did not yet experience major urban resource scarcity
    - This however is expected for the next decades
  - Most citizens do not know the connections
    - Here in particular information work is needed

# Adaptation in rural areas

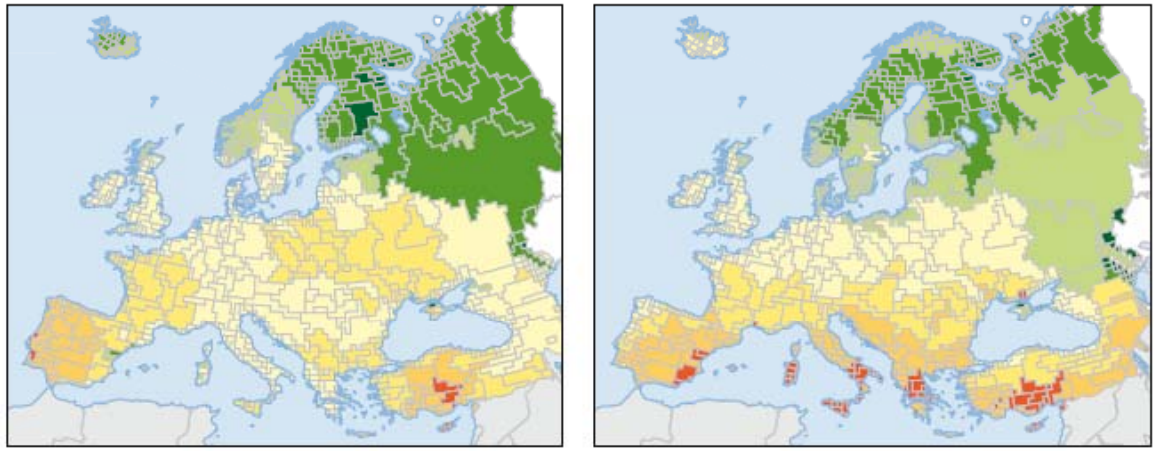
- Adaptation to climate change is mainly targeted to rural areas
  - Usually over 95% of land area
    - Still dependent on natural environment
    - Technical adjustments only on particular locations
    - Planning for new situations is needed
      - Assuming a stop at 2°C warming
  - Major activities in rural areas
    - Agriculture & Forestry
    - Tourism

# Winners and losers of climate change

- So far, some European countries or sectors rather profited from changed climate patterns
  - warmer conditions in agriculture and forestry
    - Latitudes > 50° countries in general, e.g. Scandinavia
    - Mountainous countries with altitudes above 2000m sea level with regard to increase of vegetation period
  - Producers for climate change adaptation technologies
    - In agriculture, energy and tourism sectors
  - Other European countries are endangered, in particular due increased risks of water availability and droughts
    - Mediterranean countries with latitudes < 40°
    - Dry lowlands and agricultural production areas

# Example river runoff

**Projected changes in annual river discharge in Europe for the 2070s compared with 2000**



Based on data from two different climate models:
ECHAM4 (left) and HadCM3 (right)

Decreases — Small changes — Increases

− 50 % − 25 % − 10 % + 10 % + 25 % + 50 %

Outside report coverage

Source EEA 2008

# Land use policies get integrated with climate use

- Coordinated EU climate adaptation actions are planned according to sectors
  - Agriculture
    - Combination with Agenda 2000 and CAP
  - Water
    - Integration with water directives WFWD, GWD, FD,
  - Biodiversity
    - Integration with habitat directive
    - Natura 2000 areas with 20% of EU territory
  - Fisheries
  - Energy networks
    - Common electricity networks in EU
    - Increase share of renewable energy sources to 20% by 2020

# Structural measures on European Level

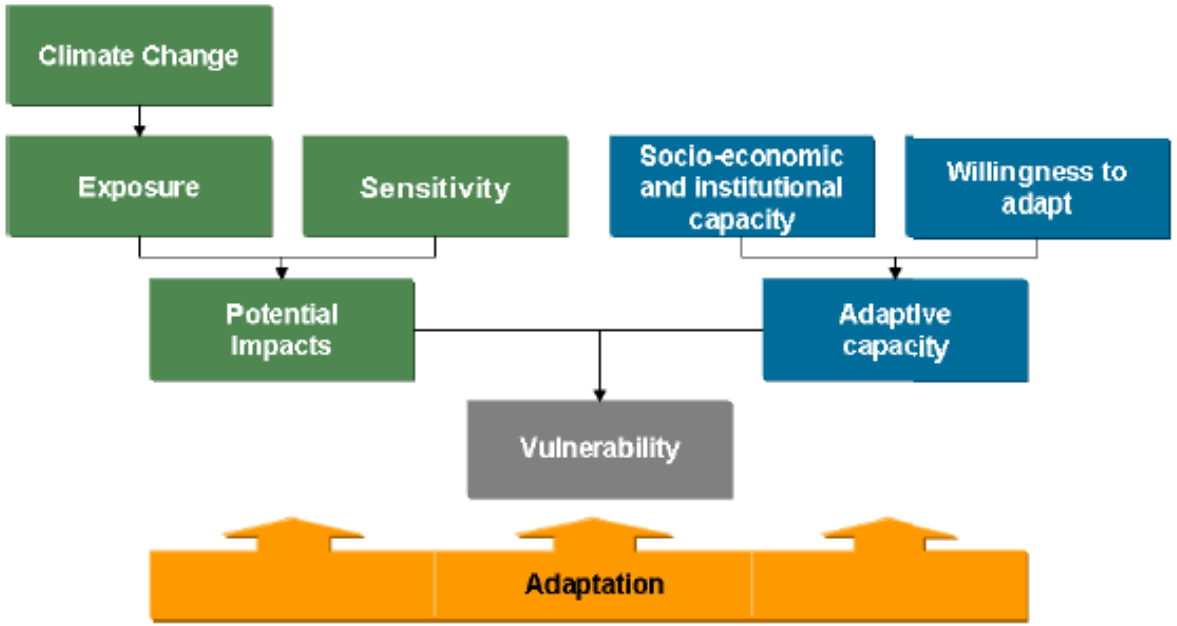
- White paper of 2009 may lead to a new European climate directive
- The EU has a particularly strong supportive role
  - when the impact of climate change transcends the boundaries of individual countries
    - River basins
    - Bio-geographic regions
- In addition there are other directives
  - In need to be adjusted to future environment conditions
    - The EU water framework directive WFWD
      - Daughter directive on floods and extreme events
      - Daughter directive on ground water resources
    - The EU habitat directive HD

# Indicator Report to prepare for adaptation according countries


- Enhanced monitoring of climate change, and in particular its effects on society and the environment.
- Climate-change impact scenarios at the appropriate level of spatial detail
- Better understanding of the socio-economic and institutional aspects of vulnerability and adaptation
- Information on good practices of adaptation actions, in synergy with mitigation actions, and their costs

# Mainstreaming actions to decrease vulnerability

- The Adaptive management to climate change
- Robust decision making under uncertainty



# Mainstreaming adaptation action at EU level (1)

- Due to regional variability and severity of climate impacts most adaptation measures will be taken at:
  - National
  - Regional
  - Local level
- Adaptation will require solidarity among EU Member States to ensure
  - regions most affected by climate change will be capable of taking the measures

# Mainstreaming adaptation action at EU level (2)

- Article 4 of the UNFCCC14 requires national or regional adaptation strategies.
  - Some EU Member States have prepared national adaptation strategies,
  - others have yet to do so
- Exchange best practices between Member States on climate
  - E.g. the bio-fuel electricity generation plant
  - The GHG emission neutral community Bruck an der Leitha Austria

# What is Europe Planning Next

- Building a stronger knowledge base
  - Better access to a wide range of data
  - Name most vulnerable areas as compared to others
  - Name best practice examples
- Consider climate change impact in key EU policies
- Combining different policy measures to best effect
  - Innovative funding including market based schemes
  - Supporting wider international efforts on adaptation
    - Non EU countries
    - Developing countries

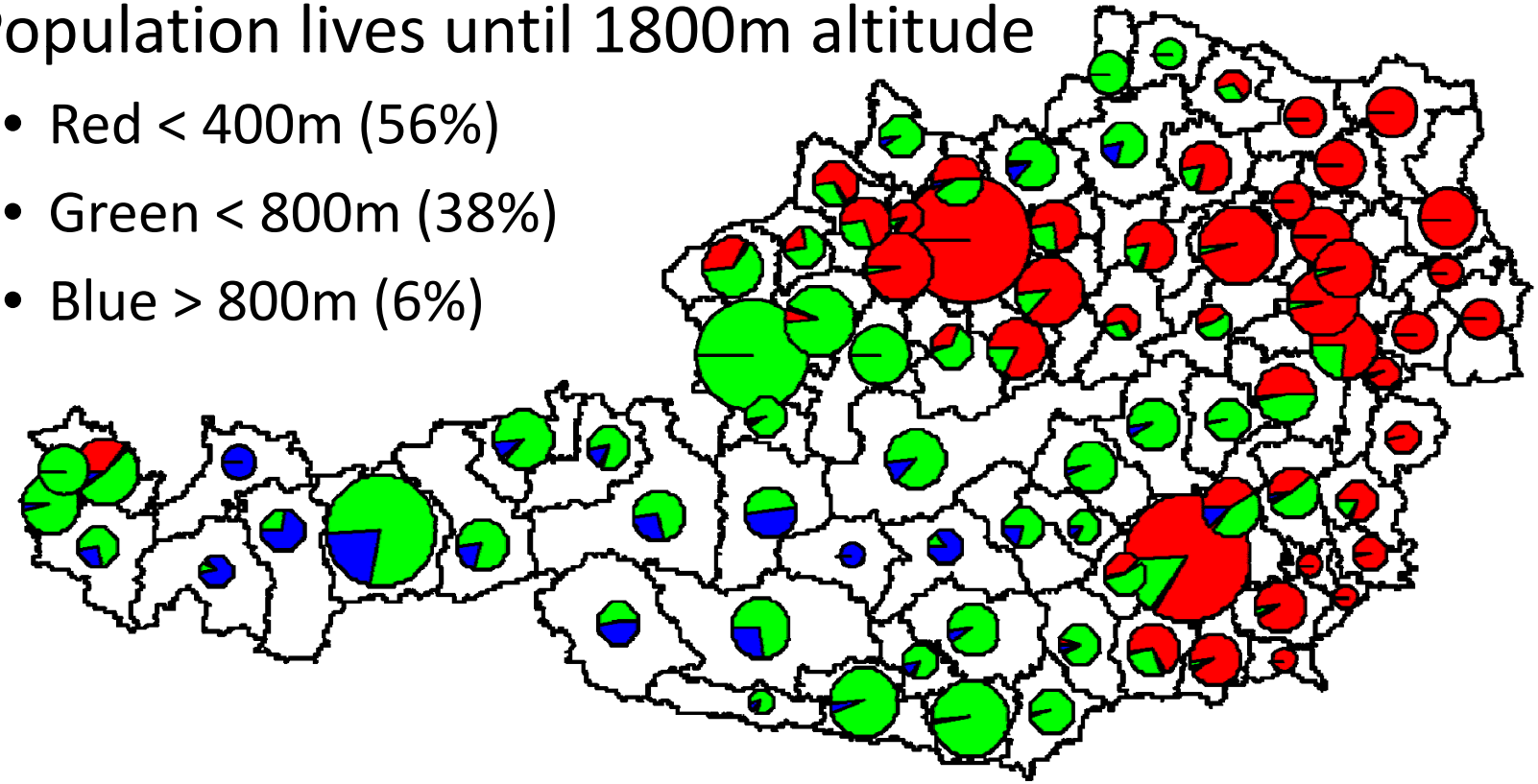
# Part 2:
# Climate Change Adaptation on National Sca

# Position of Austria in Europe


- Two thirds of the country are mountainous
- Since 1995 part of the EU

# Austria (84,000km², 8.2 million)

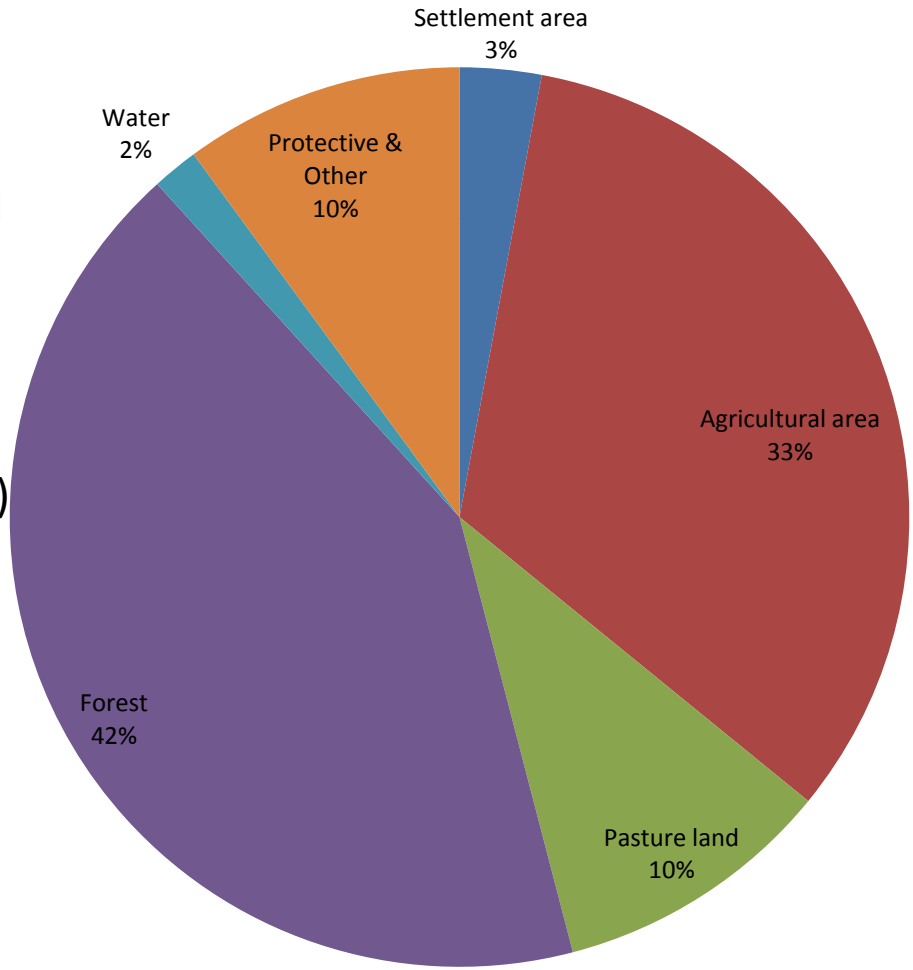
- Particular Role of Altitude
  - Physical altitude 133m to 3797m
  - Population lives until 1800m altitude
    - Red < 400m (56%)
    - Green < 800m (38%)
    - Blue > 800m (6%)



# Land Use in Austria 2005 according to six categories (1 to 6)

Six major types of Austrian land uses

1) Agriculture is arable land, horticulture and wineyards (33%)
2) Pasture is for life stock and skiing (10%)
3) Forest is productive forest (42%)
4) Water includes surface water system (2%)
5) Protective Forests, Rocks and Others (10%)
6) Settlement and traffic areas (3%)



# Climate Change Adaptation in Austrian Land Use (1a)

- Adaptation in agriculture could be the easier part of adaptation (33% of land)
  - Austria becomes increasingly suitable for rice production
    - Often problems with international agreements, e.g. GATT
    - Trade-offs with importers
  - Wine production becomes possible in higher altitude regions as frost is on retreat
  - Mediterranean plants/fruits can be soon harvested
    - » Occasional examples of orange trees

# Climate Change Adaptation in Austrian Land Use (1b)

- Energy plants (bio-fuels) are a compromise with high relevance for climate change
  - New emerging domestic supply to compensate for fossil fuels imports
  - Avoid competition at the food market
    - Bio-fuels (ethanol, biodiesel) supported by state
    - However, oil price is decisive for economic feasibility

# Climate Change Adaptation in Austrian Land Use (2)

- Pasture lands are particularly in mountain regions (10% of the land)
  - Harvests may get higher due to warmer climate
  - sensitive to precipitation pattern changes
  - More erosion due to longer dry periods and more extreme events
  - Species mix in pastures will change
    - Some produce large root volumes and prohibit ersosion

# Climate Change Adaptation in Land Use (3)

- Productive forests (42% of all land) are forests
  - Are sinks of CO2
  - Forest area is growing
    - » Marginal agricultural land is afforested everywhere in Austria
    - » Forest area increases, e.g. a new form of use are energy forests, usually harvested after 10 or 15 years as compared to 70 years of traditional agriculture

# Climate Change Adaptation in Austrian Land Use (4)

- Water areas (2% of all land)
  - No major change so far
    - Strong interaction with mountains, glaciers and snow
    - Melting water keeps lake systems and river runoff and surrounding land at constant temperatures
    - If glaciers are “consumed” a sudden change in conditions of adjacent land can be expected as well
    - Changes in aquatic flora and fauna can be expected suddenly
      - This may trigger more changes in adjacent land

# Climate Change Adaptation in Austrian Land Use (5)

- Protective forests in mountains and other terrain like Alpine rocks (10% of all land)
  - Resilience will decrease
    - forest cycles are more than 100 years in this altitude zone
    - Climate change is too fast
    - Slowly growing problem
      - Tolerance of two, three decades
  - Vulnerability will increase
    - Forest plant societies will experience stress and change with proceeding climate change
    - Beetles and harmful parasites will find better condition
    - A neglect of forest work is usually not connected to climate change but works together with it
    - Likelihood of more extreme events due to climate change

# Climate Change Adaptation in Austrian Land Use (6a)

- Settlement and traffic areas (3% of land)
  - Are mostly in urban areas
    - But a significant part in rural areas as well
  - Settlement areas – usually indoor - can easily be adapted to any climate condition
    - The time of staying indoor is increasing
    - The space occupied by a single person is increasing
      - So an average person does not suffer from climate change conditions
    - Technical means of adaptation like air conditioning
      - exist only since recently
        - » But cost resources and result in additional climate change

# Climate Change Adaptation in Austrian Land Use (6b)

- Urban green structures
- Siting new objects in climatically favored positions
- Biological means of adaptation are often underrepresented
- Shading design with plants
- Introduce water for cooling

# New combinations climate adaptation and mitigation affecting different land use categories

- Pellet heating systems
  - All over Austria new systems established
  - Often a local community venture where many citizens are integrated
- Electricity generation
  - In Vienna there is the largest bio-fuel electricity generation plant in Europe with 38MW capacity
  - Sufficient to support approximately 100,000 people with energy
- Public subsidies needed
  - current fossil fuel energy prices are still too low for bio

# Relation Land Use and Rural Economic Activities

- Initially land use and economic activity was the same
  - Categories of land use were established some 100 years ago
  - Agricultural activity refered to agricultural land use
  - New categories of land use – tourism - build up on these traditional land uses
  - Summer tourism widely depends on water
    - Water – primarilly the lake system - is a key attraction in summer tourism
  - Winter tourism strongly relates to pastures
    - Mountain pastures with right inclination were the start of skiing
    - Forests are cleared and converted to pastures
      - Not for cattle breeding, but for tourism

# Rural Income in Austria (1)

- Austria still gains about 10% of GDP in the rural areas with approximately 97% of its land
  - Very high for an industrialized country
    - 1.8% in agriculture and forestry
    - 3.5% in summer tourism
    - 4.5% in winter tourism
  - Austrian rural population widely remained on place
  - Rural income is comparable to urban income
    - Rural people in Austria are generally rich
  - Contrast to other industrial countries of Europe
    - Generally no rural tourism tradition in Europe´s industrialized countries
    - Rural migration due to lacking alternatives to agriculture

# Rural Income in Austria (2)

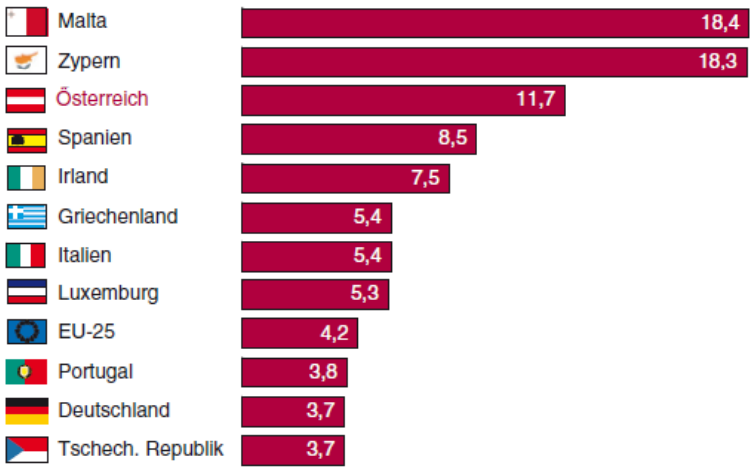
- In general agriculture is getting less intensive
  - 189,300 farms in Austria (2005)
    - 74,400 still fulltime farms
      - Tourism gives main occupation outside agriculture and many activities are related to tourism
    - 11% or more than 20,000 of Austrian farms produce organically
      - this is highest number in EU
    - Average Farm Size is 40 ha (2005)
      - As compared to other European countries the agriculture is still small scale and extensive
      - In comparison to Japan, agriculture is large scale and resembles Hokkaido

# Rural Income in Austria (3)

- Rural Tourism is excellently developed in Austria
  - There are 67,700 tourist companies in Austria (2008)
  - Summer 60 million guest nights
    - Peak was reached in 1980 with 80 million guest nights, since then declining
  - Winter 60 million guest nights
    - Peak is reached in recent years 2005/06 and 2006/07
  - Tourism is the main income
    - As winter guest nights brings € 120.- as compared to summer € 88.- more earnings are made in winter
  - Winter brings nowadays almost as much as summer.
    - If interest in winter tourism continues, the income in winter and biologically inactive time will be larger than summer

# Tourism intensity in Europe and Austria in 2006

- Tourism in Europe is primarily rural
  - Beach and coastal tourism
  - Mountain tourism
- There is a heavy weight on summer tourism in Europe
- Austria has a very high tourist intensity
  - Guest nights account for 11.7 per inhabitant
    - is very high and 3rd of Europe 25
    - Only small islands like Malta with 18.4 and Cyprus 18.3 get higher intensities due to summer season
  - However, in particular winter season is growing and threatened by climate change



# Climate Change Adaptation in Summer Tourism

- Mountains may become more attractive
  - Better use of existing tourist facilities could be a consequence
  - Still relative cool temperature during hottest month
  - Comparative advantage to Southern European Mediterranean countries
  - But summer tourism is not considered to be as exclusive as wintertourism
- Risk in particular for high Alpine tourism are likely to grow
  - More rock fall
  - Higher risk of hang sliding after heavy rainfalls
  - More torrents

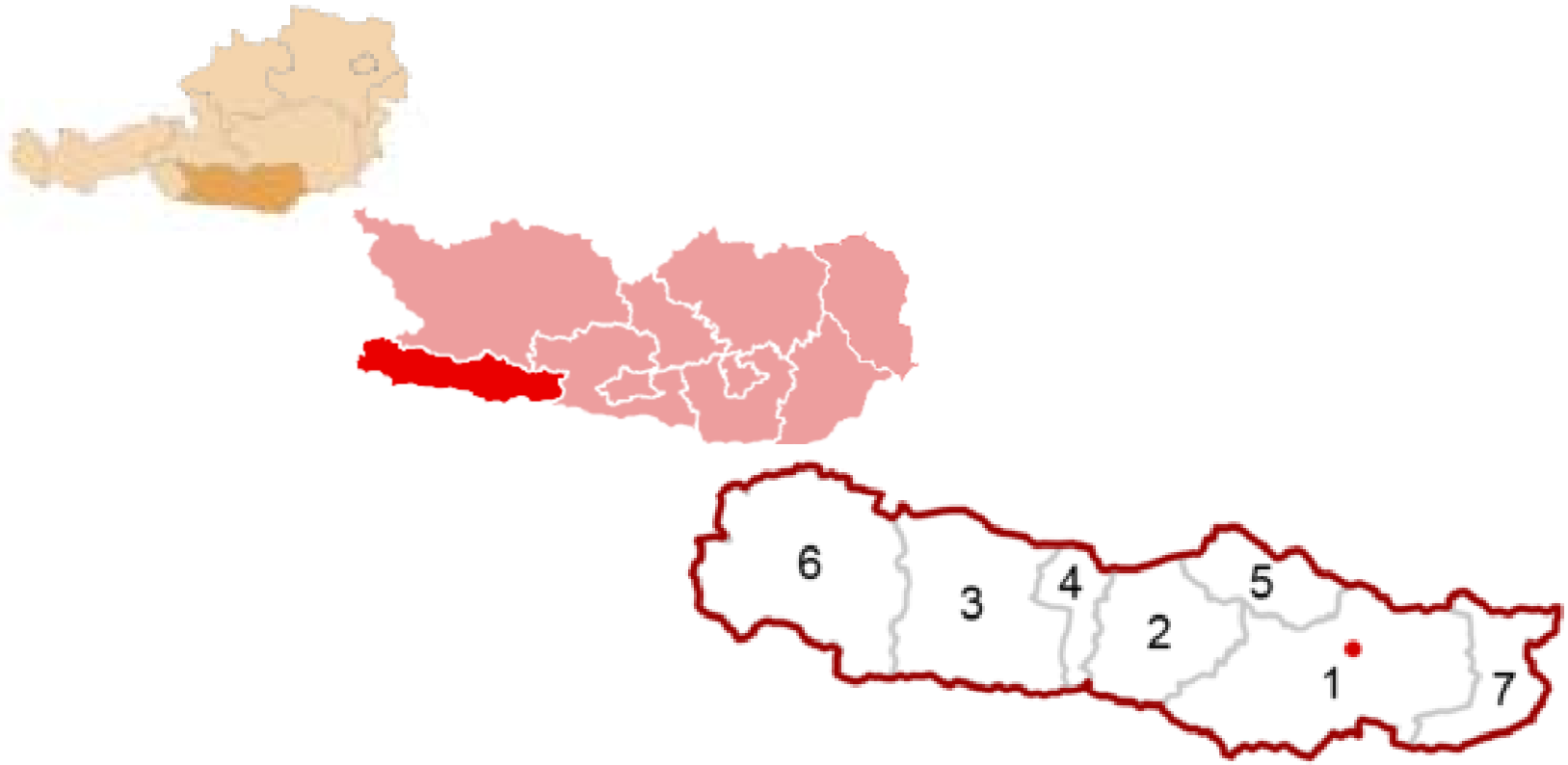
# Climate Change Adaptation in Winter Tourism

- So far climate change worked in favour of rural economy
  - Large investments were undertaken in rural Austria for
    - Modernizing skiing infrastructure
      - Skilifts
      - Artificial snow making facilities
      - Widen skitracks for better mechanical preparation
    - Support of rural communities
      - To finance ever increasing cost of adaptation
      - Otherwise financial collaps comes before climate collaps
  - Backslash of winter tourism has to be expected
    - Roughly half of rural income is directly at risk
    - Indirectly even more

# CCA policy to save global biodiversity….

# …in urban Vienna

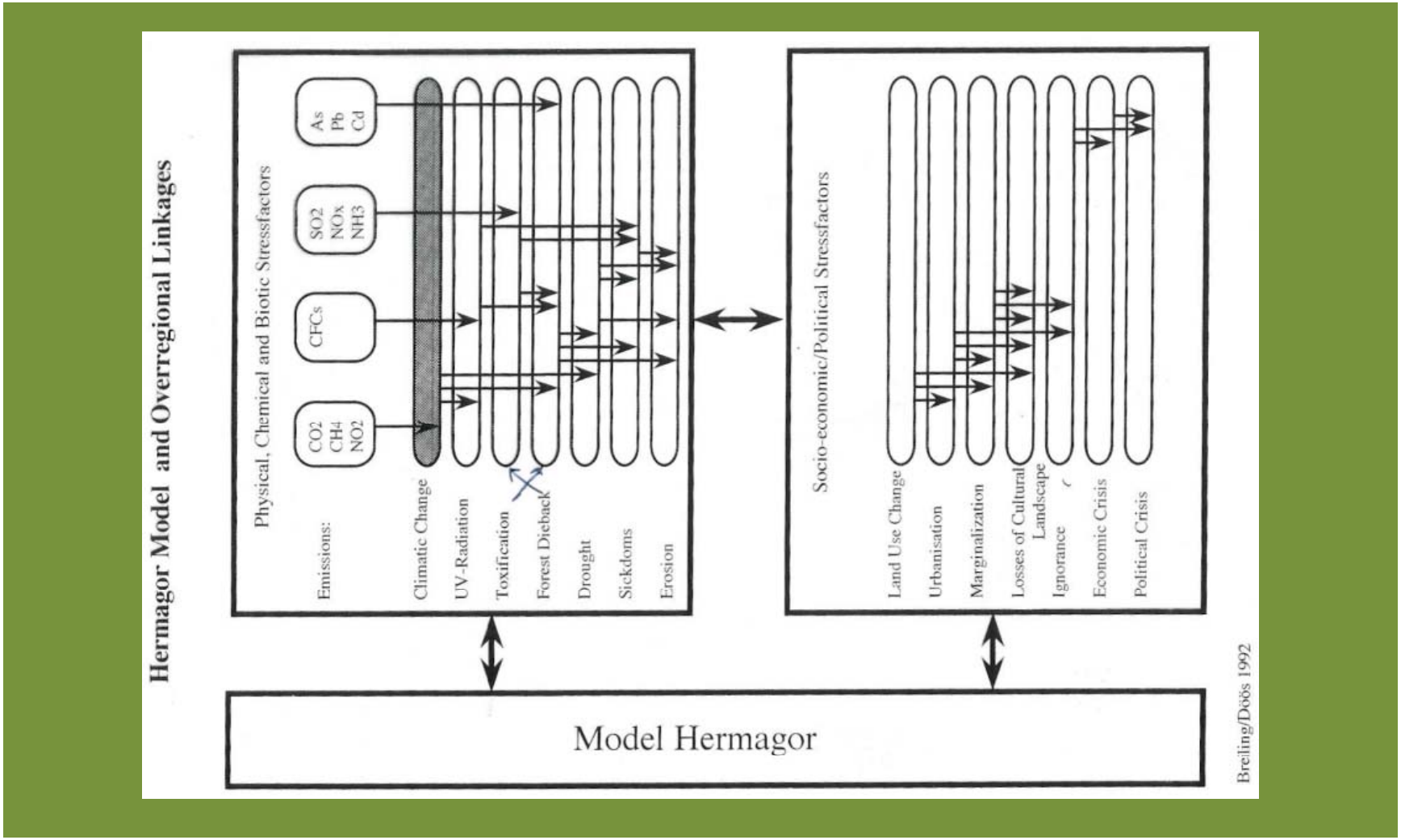
# Part 3: CCA on local scale, Hermagor district



# PhD Work 1988 to 1993

- What determines the future of a periphery Alpine region?
- Socio-economic changes or physical changes?
- What is more important, action from inside or action from outside?
- Inside model considered population, land use and hydrology submodels
- Exogenous factors were taken from the political agenda of that time
- Climate change was already important, but less important what it is currently

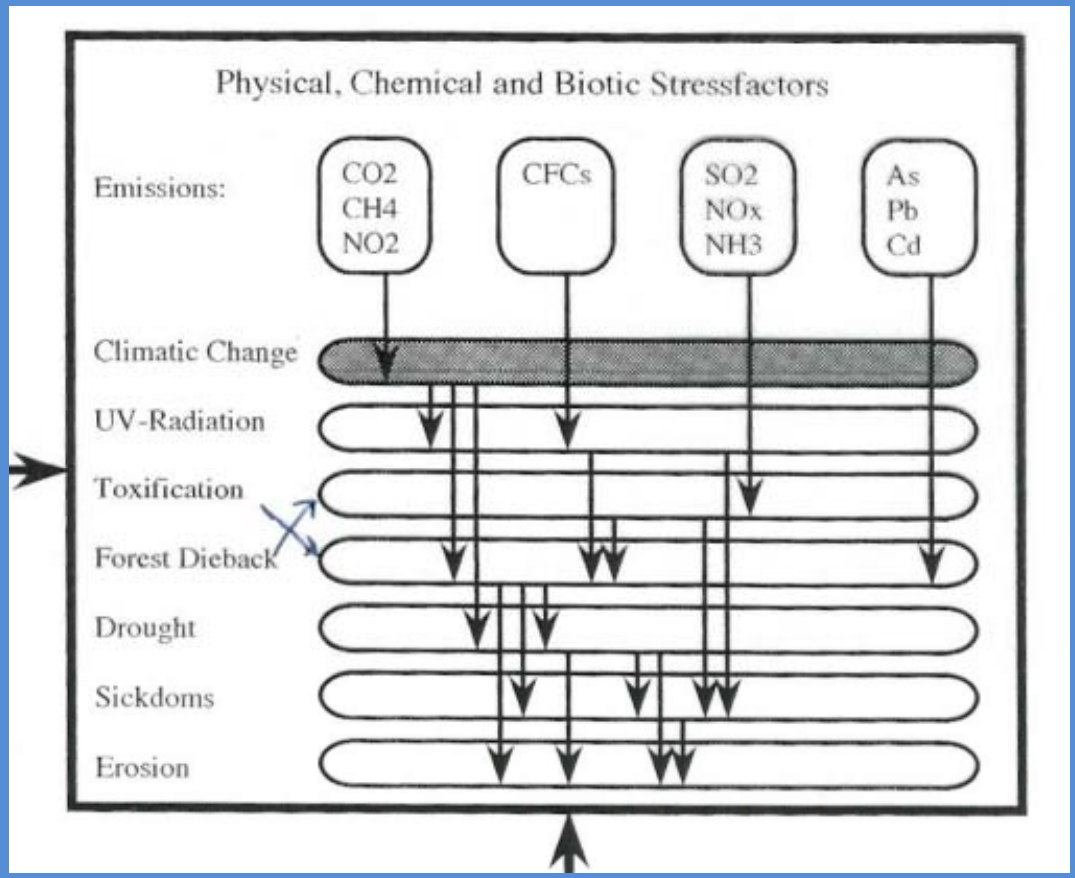
# A conceptual model of challenges



# Not one but many exogenous change factors

- Climate change was only considered as one out of many environmental challenges
  - Today climate change seems the most relevant environmental threat in the public debate
  - Cannot be mitigated locally
  - But adaptation is by definition local
- Any local area is specific and would need a specific assessment according to
  - altitude classes
  - climate, hydrology, vegetation, soil,
  - Socio-economic conditions
- Vulnerability to climate change is different
  - At least in well developed countries
    - With more people easier to adapt
    - A richer place can adapt more easily

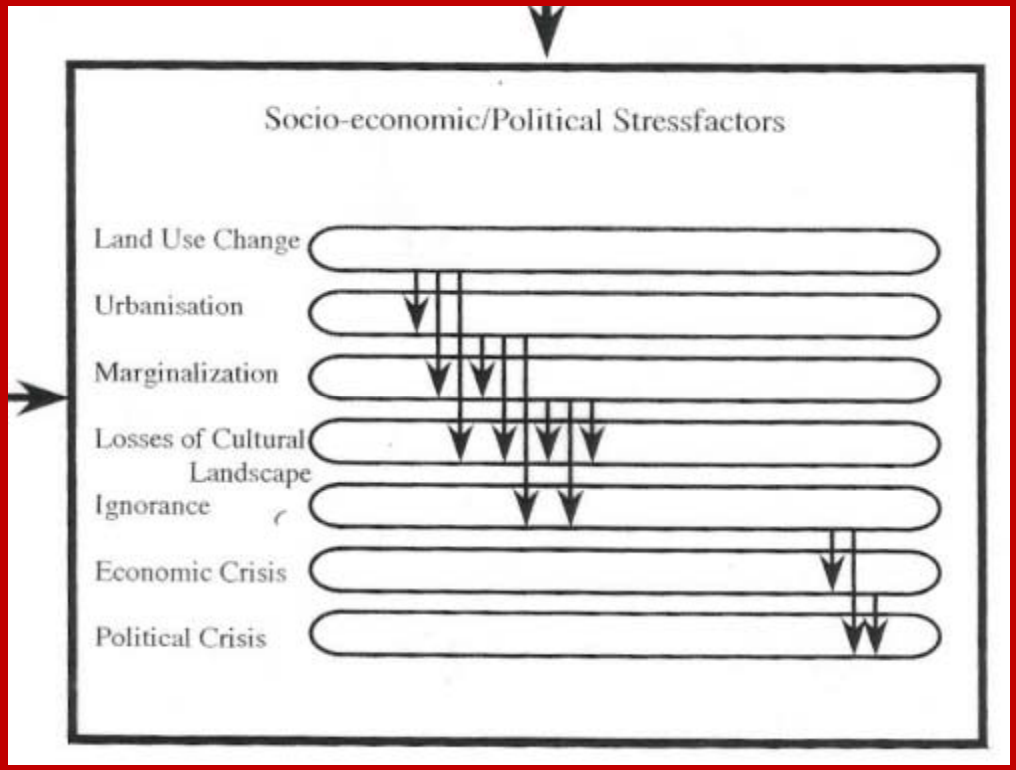
# Physical challenges



# Several physical change factors

- Pollutants NOx, SOx, NH3, CFCs, heavy metals,
  - could be significantly reduced in developed countries since this chart was drawn in 1992
  - Only pollutant that increased were greenhouse gases (previously not considered as pollutants)
- Major problem categories of 1992 do not longer exist
  - Forest die back
  - Other categories like erosion, drought, sickdoms are currently more connected to social change factors

# Social challenges



# Increase in number of social change factors over the last 20 years

- In particular rural areas were adversely affected by social phenomena
  - Ignorance to “silent” changes
    - Marginalization
    - Land use changes
    - Urbanization
    - Losses in cultural landscape
  - Accumulations to larger regional phenomena possible
    - Economic crisis
    - Political crisis

# CCA is Economically Important

- CC is driving change in long term
  - If we can wait for climate change impacts as anticipated by many (inclusive mine) studies
    - Then socio-economic circumstances are fairly good
    - We have an ongoing of peaceful post WWII development
  - In particular relevant when there are no people
    - To maintain landscapes locally and to repair damage
  - Disaster prevention is one most important task
    - Likelihood of disasters expected to increase
    - A stable level of safety needs more investment
    - Perhaps 1% to 5% of local GDP over a span of 20 years or more
    - Damage in Hermagor district over 40 years was comparatively cheaper than to built out safety constructions
  - Adaptation in winter tourism is another major task
    - To be discussed in next lecture

# Quantitative models to get better understanding

- Population model
  - Crisis in winter tourism
    - Could lead to a renaissance of agriculture if urban growth is modest
    - With economic growth more people will work in services
- Land Use Model
  - Assumption that 400ha safety construction are necessary with increase in temperature
    - To counter major risks related to flooding, extreme events, hang gliding and avalanches
- Hydrological model
  - Comparison of precipitation and run off situation
    - 40 years of observation were to little to show significant differences or a change in pattern

# Summary CCA Europe

- Europe established a climate change adaptation policy
  - Policy is distributed to the public
  - Public shall participate
  - Cooperation with other countries is promoted
- Currently efforts are made to develop concrete climate adaptation plans with measures
  - For member states
  - For priority sectors
  - For particular vulnerable areas
- The actual adaptation is highly diverse
  - Must be region specific
  - Has to consider considerable more warming than what is experienced today

# Summary CCA Austria

- Climate adaptation is going since two decades in Austria
  - In particular in rural areas and in winter tourism
    - New infrastructure ski lifts and snow making machines
    - However, large public subsidies are necessary to maintain the system
  - Natural buffering systems exist,
    - the melting glaciers provide cool water
    - For decades the situation may stay the same, but suddenly there is a change
  - Forest work is neglected
    - Appropirate management action will increase the resilience and reduce vulnerability
    - This is a silent problem, climate is just one driving factor, should neither be over- nor underevaluated
  - Agriculture can more easy adapt to new situation
    - Primarilly with annual crops the adaptation seems more easy
    - A change in precipitation
  - Precondition for CCA in future
    - Enough people have to be in place to counter adverse CC impacts
    - Differences in income should not be too high


Thank you for your attention