# VALUING NATURAL RESOURCE MANAGEMENT IN THE CONTEXT OF CLIMATE CHANGE ADAPTATION FRAMEWORKS IN AUSTRIA

*Meinhard Breiling*

## 1. INTRODUCTION

The majority of Europeans became aware of climate change in 2007 when the fourth assessment report of the International Panel of Climate Change was published (IPCC 2007, Alcamo 2007). Two things were obvious. Climate change is real and the EU will not succeed in successfully completing the Kyoto Protocol. There is a broad support by parties for a science-based indicative goal for the reduction of greenhouse gases including halving greenhouse gas emissions by 2050 to limit a rise in temperature by 2°C Celsius above pre-industrial levels and setting a low personal emissions quota for everyone. Importantly, this recognition has led to the political realization that urgent action is needed, not only for climate change mitigation, but also adaptation. Wilby et al. (2009) assert that climate change scenarios can meet some, but not all, of the needs of adaptation planning.

Over recent decades, climate change research has focused primarily on the climate system impacts in general terms, and on mitigation. In the future, new challenges will be posed by the emergence of climate change adaptation policies across Europe. Climate policy integration and coherence will be essential in order to bring together the environmental, economic and social impacts of both adaptation and mitigation policies. In this context natural resource management will gain increased importance.

Natural resource management includes the two aspects constituting human life: environment and culture. Environment is the entity of all natural resources - like soil, water, energy and materials - and culture – which manifests physically in agriculture, industry, tourism, settlement patterns and all other land uses - is the way how humans use these natural resources to make a living. For millions of years the use of natural resources was modest and the possibilities of humans limited. During a 250 years industrialization period and in particular during the last 50 years, the natural resource use increased tremendously. We consume huge quantities of groundwater, soil and energy resources for a continuous modernization of our life styles. Some sources argue that only on one day, the energy resources collected globally for more than 1000 years are consumed (www.klimabuendnis.at, 2010). As a consequence we experience global and climate change today as a challenge to sustainable development on regional and local scales.

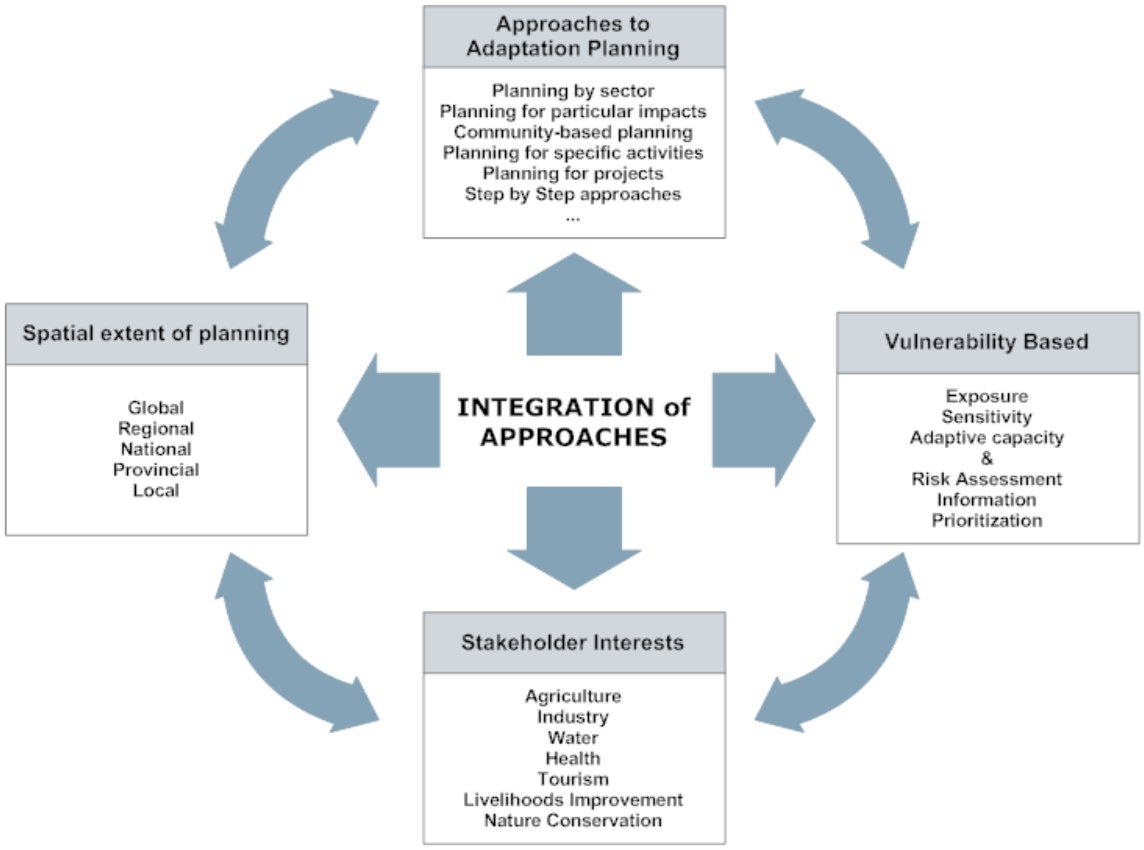
It might take decades to stabilize resource consumption globally and perhaps hundreds of years to significantly reduce greenhouse gas concentrations in the atmosphere. As a consequence we have to consider different scenarios of climate change and various climate change impacts in our future planning. However, under the ongoing of gradual climate change with warming and related change of other climate parameters and an expected increase in vulnerability to climate extreme events such as floods and droughts, climate change adaptation becomes a necessity everywhere, even in regions that did not considerably contribute to global resource consumption. The possibilities and readiness to adapt are different in the countries around the globe. Often, but not always, this is related to financial resources. Additionally the knowledge of what could be done precisely and how to use available financial resources in an optimal way is missing.

## 2. THE UNFCCC FRAMEWORK TO EVALUATE POSSIBILITIES AND READINESS FOR CLIMATE ADAPTATION MEASURES

The United Nations Framework Convention on Climate Change Secretariat elaborated a report based on a workshop using the experiences of several countries, sectors and related impacts (UNFCCC 2010). A wide range of climate change impacts was addressed and a variety of approaches to adaptation planning have been developed, related to different sectors (i.e. agriculture, tourism), coping with particular impacts such as droughts and storms, tackling the vulnerability of certain groups such as farming communities (i.e. a community-based approach), climate-resilient development projects (i.e. a project-based approach) and taking a step-by-step approach. Each of these approaches facilitates adaptation planning in particular ways within specific contexts, involving different stakeholders and with different requirements for technical, institutional and financial resources.

Consequently, efforts have begun to consider how to integrate these approaches, since no single adaptation planning approach is sufficient to address the array of complex situations where adaptation takes place. There is also a concern to avoid isolated adaptation planning. Integration of adaptation planning approaches could be achieved through close coordination and cooperation across administrative levels (i.e. vertical integration), across economic sectors (i.e. horizontal integration) or through the consideration and reduction of vulnerability of a particular group or system (i.e. vulnerability-based integration). Stakeholder engagement, vulnerability and risk assessment, advanced local, regional and specialist information, and prioritization of adaptive measures are equally important in this process.

**Figure 1: Conceptual framework of approaches to climate adaptation planning and their integration**




*Source: Modified based on UNFCCC 2010 http://unfccc.int/resource/docs/2010/sbsta/eng/02.pdf, p. 5*

The approaches to climate adaptation either refer to social, technical or physical measures.

Social climate change adaptation is related to institutional and financial means or so called non structural measures with the aim to raise awareness and to prepare people for adverse impacts in climate conditions. It multiplies the number of informed people by giving orientation to local residents about what is likely to happen in the near, medium and long term future and to enable them to plan for their future and to avoid risks.

Technical climate change adaptation means concrete actions in the landscape and requires some knowledge. To dig holes to store water and to provide retention areas, to plant tree lines or even forests to hold soil and water even in the case of strong rains. To build walls and dams against flooding is another technical measure. Often these measures are beneficial even without climate change as fast development in many places around the world is requiring for adjustments.

Physical climate change adaptation means to switch places of activities. On a local scale this is to choose wind protected, cooler or shadow places in the neighborhood and avoid the most risk prune hot spots. On the regional scale the inhabitants may climb higher up if they live in mountains or move away from coastal areas to escape coastal risks like hurricanes. In some cases – e.g. the densely populated or flat areas (e.g. Bangladesh or island states like

Maldives) even regional moving will not be possible and other regions may be confronted with climate refugees. Climate change aggravated or induced tensions between regions will not be unlikely in future.

Most countries in the Asia Pacific Region have already developed climate change adaptation plans as a short term measure, under them Cambodia (2007), People's Republic of China (PRC) (2009), Pakistan (2010) and Phillipines (2010) just to mention some examples. The appropriate spatial scale and time frame have to be adjusted to the needs of the region of concern. A principal overview is given in Table 1.

**Table 1. Spatial Assessment for Climate Change Adaptation**

| *Climate Change Adaptation (CCA)for a particular area* | *Possibilities (Social, technical, physical measures)* | *Readiness (Financial, legal, institutional provisions)* |
|---|---|---|
| Social CCA | Awareness rising to particular problems<br>Emergency action plans | Non structural measures.<br>Relatively cheap and fast to implement. |
| Technical CCA | Modify Use: Improved soil tillage, water management for agricultural crops<br>Conversion: Convert to uses with less climate risk | Structural measures.<br>Local provision of CCA measures.<br>Cheap to expensive. |
| Physical CCA | Give up Territory or Use<br>Migration to better places with less climate risk. Local, regional, national, international refuges for climate victims. | Do we have places to shift/migrate? How many victims can be taken up?<br>Expensive measures. Source of conflicts. |

Some measures can be implemented immediately like avoiding deforestation, others will take different time spans, from up to two years to develop risk management and emergency action plans, or up to five years to come up with legal provisions for climate change adaptation and particular educational programs to train target groups, or more than five years in case of tree planting and forestation measures. At the beginning only a few tasks will be part of a national climate adaptation program. With the time it will become more comprehensive. It is important to link climate change adaptation measures to programs and actions already in place and from there to develop particular tasks not sufficiently well covered by other programs.

**Table 2. Timing of Climate Change Adaptation related to selected measures**

| Measure | Social CCA | Technical CCA | Physical CCA |
|---|---|---|---|
| Immediate | Awareness rising to CC and CCA | Avoided deforestation | Emergency shelters after catastrophes |
| Short term<br>< 2 years | Risk management plans, Emergency action plan | Avoided soil erosion, | Avoid management of high risk areas |
| Medium term<br>< 5 years | Educational programs, legal provisions | Improvement of territory with regard to water storage capacity and top soil | National climate refugee centers |
| Long term<br>> 5 years | | Forestation, green belts, green nets | |

## 3. EU PROVISIONS FOR VALUING CLIMATE CHANGE ADAPTATION IN NATURAL RESOURCE MANAGEMENT

In European countries climate change adaptation measures were not on the agenda until the fourth IPCC impact assessment report was published in 2007. Many of the established frameworks did not explicitly consider climate change adaptation until then. This widely changed within the last three years. The EU published a white paper on climate change (EU 2009) and for Austria a climate change adaptation strategy is in place since late 2009 (Umweltbundesamt 2009). While the majority of changes are perceived adversely, some climate changes might provide new opportunities and are also considered within the strategy. Instead of developing a new and particular climate change adaptation instrument it was preferred to integrate needed measures into frameworks that already do exist. The work is now in progress.


Legend: The pink red countries are part of EU. The blue countries are non EU countries. Austria (red) is in the center of Europe with 8 million people and 84,000 km² with approx. two thirds of its area as mountains. The EU has 27 member states and 400 million inhabitants. The European Council includes all 47 European countries with 700 million people.

**Figure 2. Europe with EU and non EU countries and position of Austria and Vienna in Europe**

With regard to global problems like climate change the EU acts as one single player and the national policies within the EU are adjusted to each other. The individual countries from within can always make more strict regulations, but the outlined frameworks are a minimum consensus often negotiated over many years. Natural resource management is widely covered by sector directives and guidelines. Standards are the same, but not all countries in EU have them for the same period. In particular the new EU countries, Bulgaria and Rumania have only adopted them in 2007 when they entered EU.

Sector programs are provided on national levels in conformity with EU regulations/directives. Intra-national comparison and control became a main policy in EU. Final aim is to harmonize the development in all EU countries with regard to natural resource management and to balance out the given differences. Agreed reporting systems, procedures and measures are resulting from this. I will restrict myself to describe some important directives that have relevance here.

Water issues are regulated by the water framework directive (WFD, EC 2000), and supporting daughter directives namely the Flooding Directive (EU 2007) and Groundwater Directive (EU 2003). Management plans had to be developed until 2010 and implemented until 2015 or in particular cases until 2027. The aim is to achieve everywhere in Europe a good chemical and ecological status of water bodies. Member states have additionally to

produce flood hazard and risk maps. Recently the EU included a technical note with regard to climate change adaptation (EU 2009) which was not considered before.

Soil and soil management is not yet covered by any EU directive. Currently there are discussions going on to introduce a soil directive. As the topic is closely linked to the water issues a combination with the water framework directive is also possible. An important issue in relation to climate change adaptation is the increase of soil organic matter and the fight against soil erosion. A high content of soil organic matter increases the water storage capacity and avoids soil erosion. Agricultural practices can support this process. New practices, not directed to maximum yield, but to best ecological performance our nowadays (re-) introduced. No tillage and low level ploughing are two methods in this line. The digging of retention tunnels and retention areas provide safety in case of flooding. A major problem is also land converted from biological active to biological inactive sealed area. Nowadays there are new methods to improve sealed areas to semi-sealed areas, avoiding access run off.

Biodiversity issues or qualitative aspects of natural resource management are covered by the EU habitat directive (HD, EU 1992) and regulates protected areas within the EU. As a region EU has with 17% the highest share in protected areas worldwide. Wetlands are a direct link to the previously mentioned water framework directive and treated within the Ramsar convention. Invasive Species are a major threat. Within 2°C temperature rise so called pioneer plants are advancing and pushing out the specialized and established species out. Extinction of endangered species is the consequence.

Biomass as a quantitative aspect of natural resource management is one of the topics of the recent Renewable Energy Directive (EU 2009b) where the use of biomass is promoted. Quite in contrast to other world regions, the use of biomass decreased in recent decades along with a neglect of forest management. Renewable energy systems create a higher demand in biomass and values forest management higher than before. This is certainly good for climate change adaptation as well managed forest store a lot of CO2. There is no particular directive for forest land and to counter deforestation as in many European countries there is a century established national law to afforest land after timber cutting.

There are no particular directives for major types of sensitive ecological regions, like mountains, arctic areas, coastal zones or urban settings. These differences are incorporated within each directive. However, climate change and climate change adaptation can be very particular in each ecological region. Mountains and arctic regions are changing faster than other regions and the degree of warming was twice as fast as the global average. This is due to the retreat of snow and ice. The snow line moves up in altitude and latitude and less water is stored as snow and ice (EEA 2010). Thawing and melting patterns are changing with a significant impact on agriculture and tourism. Urban areas experience an additional heat effect that is not caused by climate change, but by the particular situation in urban areas. Here in particular it is necessary to provide more trees and water areas to cool the places naturally during the hot season. Green belts around and green nets within the city are a major mean to adapt to more heat and storms coming along with climate change (Amati 2008).

## 4. THE LACK OF COMPREHENSIVE LOCAL MANAGEMENT TOOLS WITHIN EU LEGAL PROVISION

All EU directives are sector oriented and implemented on a larger scale with medium term goals. It is hard to know all factors of influence dealing with areas over several thousands of square kilometers. To counter this situation, the European Council proposed a European Landscape Convention (EC 2000), an initiative related to comprehensive landscape planning

on the community scale, usually covering territories between tens to hundreds of square kilometers or 10 to 100 times smaller than the smallest scales of the sector approach by the EU directives. Only at the smallest administrative unit all local problems are perceivable and can be combined in a holistic approach. Cultural aspects are equally relevant to natural resource management aspects. While the landscape convention is ideally from its principles, it was not signed by all member countries due to practical hinders. The smaller scale approach of the landscape convention relates to considerable organizational work. The related costs for necessary inventories seem to be a problem for many municipalities.

Alike the landscape convention, municipal efforts to combine sectors are currently working on a voluntary base, carried out by NGO workers who receive limited funding and are not everywhere present in Europe. Because of the voluntary character and the enthusiasm of the people involved, these initiatives work well, but do not necessarily share the same methods of implementation. The climate Alliance is perhaps the best known NGO in Europe dealing with climate change (Climate Alliance 2006) and climate change adaptation (Climate Alliance 2007) at the local level and grew gradually since 1997. Recently a coalition to the European soil alliance another European NGO working on the same scale was undertaken (ELSA 2010). As a consequence a set of best practice approach for both NGOs was worked out jointly and is promoted by both organizations in their member countries. In some but not all European states and municipalities there exist Agenda 21 plans aiming for sustainable development. These plans can particularly be updated for climate change adaptation (ICLEI 2009).

## 5. CLIMATE ADAPTATION AND NATURAL RESOURCE MANAGEMENT IN AUSTRIA

In the following part local approaches as they show concrete – often inexpensive - measures of climate change adaptation. Local measures from Austria are limited in scale, but if they are practiced by many people. The multiple effects contribute considerably to adapt regionally to the increased climate risk. A difference of adaptation measures in less populated rural areas and densely populated urban areas can be made.

In agriculture projected climatic changes will affect crop yields, livestock management and the location of production. The increasing likelihood and severity of extreme weather events – like hail in certain Austrian regions - will considerably increase the risk of crop failure. Climate change will also affect by depleting soil organic matter (SOM) – a major contributor to soil fertility. No tillage and minimum tillage practices including ploughing less deep can protect and alter SOM. Austria has the highest share of organic farm units in the EU. This fact is considered very benign, both for soil conservation and for protecting rural biodiversity. Concerned farmers can even profit from climate changes. In some parts of Austria – alike some regions in England and Sweden where it was previously too cold - wine is planted now. Fruit trees like apricots, figs and kiwis, previously rarely or not present favor from decreasing spring frosts and represent interesting alternatives. The effects of climate change on forests are likely to include changes in forest health and productivity. Certain trees are more robust to changes and will increase their populations while others will become less frequent. Water management aims very much in keeping the water in the landscape or even to create new water bodies or restore former wetlands converted to agriculture. However, the rural economy might become adversely affected by climate change impacts. Mountain based winter tourism the main contributor to rural economic growth is depending on snow. Snow is less frequent in important winter sports resorts (Breiling 2008). Technical climate change adaptation in relation to artificial snow making is going on since the 1980ies, long before any European or Austrian climate change strategy was developed. In case climate change adaptation gets too expensive in particular low laying places are given up for winter tourism

or have to look for less profitable alternatives. If higher up places will become more severely affected few or no alternatives are currently available.

In urban dwellings future problems can be anticipated. The Vienna water comes directly from the Alps collected over an area that is several times the size of the city and is transported over 100km in aqueducts. The water quality is considered to be excellent and not usual for a city of this size. Good forest management and wise land use has therefore a direct impact on the health people that never leave the city and do not see the place of origin of their water (Kuschnig 2006). Drought does not yet lead to water scarcity, but makes an impact on water quality. Recent storms damaged parts of the forest and reduced the cleaning potential. Forest pests are anticipated to increase with climate change. The combined impact of many stress factors means a good level of uncertainty. Human health in urban region will be favored by improving the urban climate. Vienna - probably the first town to establish a water school for school children – was very early out in explaining the connections between water management, land use and climate change impacts. For this reason the public developed a good understanding for funding appropriate measures in climate change adaptation. Caring for the urban green structure urban areas is essential. Since more than 100 years, Vienna is developing and enlarging its green belt continuously (Breiling, Ruland 2008). The restitution of water bodies that were overbuilt in former decades are planned to be restituted by Vienna city (Goldschlag 2006). Vienna was the first town to plan a biomass electricity plant (Wienenergie 2009) that supplies energy to 100,000 people. While this can be criticized from a simple economic view – the costs of electricity generation are three times higher than conventional energy production – the co-benefits are numerous. The surrounding forest received many incentives to be better managed and the plant itself became a tourist attraction as many groups from all over the world come every day for a guided tour, eventually planning to introduce a similar plant at home.

## 6. FINAL REMARKS

Natural resources can be used, harvested, overbuild, overused, polluted or destroyed. Depending on the impact we classify the natural resource management into sustainable and non sustainable activities. However, this borderline between sustainable and unsustainable will change over time due to climate change impacts. More uses will become unsustainable than before if states and local communities do not react and more uses will again become sustainable if they are accompanied with appropriate actions. The awareness of local people is the first important step in this context. Taking technical adaptation measures is the next important step and will improve the situation for many places. Physical adaptation is the last option. Giving up spots and places that cannot be sustained within acceptable risks is sad, but probably unavoidable in some cases. Alternatives have to be provided for the people affected. The examples from Europe and Austria exhibit that concerned people can do a valuable job in natural resource management postponing or even avoiding climate change impacts on local scales.

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