Chapter 5

Valuing Natural Resource Management: Climate Change Adaptation in the European Union

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5.1 Introduction

We are experiencing global climate change and adverse impacts as a challenge to sustainable development on regional and local scales. The majority of Europeans became aware of climate change in 2007 when the International Panel of Climate Change (IPCC) published its fourth assessment report (Alcamo et al. 2007; IPCC 2007). Two things are obvious: climate change is real and the European Union (EU) will not succeed in completing the Kyoto Protocol. There is broad support by government agencies and the EU institutions for science-based indicative goals for the reduction of greenhouse gases (GHGs) to limit the rise in temperature by 2°C above preindustrial levels. These goals include halving GHG emissions by 2050 and setting a low personal emissions quota for everyone. This has led to the political realization that urgent action is needed, not only for climate change mitigation, but also for adaptation.

Before 2007 climate change research focused primarily on the climate system impacts in general terms, and on mitigation. New challenges are being posed by the emergence of climate change adaptation policies across Europe. Climate policy integration and coherence will be essential 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—soil, water, energy, and materials. Culture—which manifests physically in agriculture, industry, tourism, settlement patterns, and all other land uses—is the way humans use these natural resources to make a living. For millions of years the intensity of natural resources use was modest and the possibilities of humans limited. During a 250-year industrialization period and in particular during the last 50 years, natural resource use has increased tremendously. It might take decades to stabilize resource consumption globally and perhaps hundreds of years to significantly reduce GHG 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. Under the ongoing

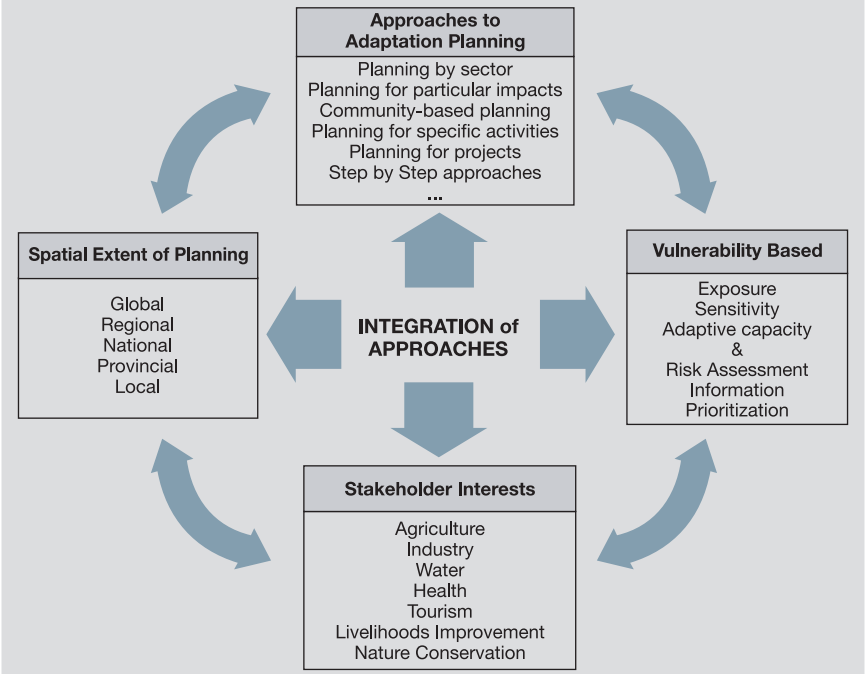
gradual climate change and an expected increase in vulnerability to extreme climate events such as floods and droughts, climate change adaptation has become a necessity, even in regions that have not considerably contributed to global resource consumption.

5.2 Conceptual Framework to Evaluate Possibilities and Readiness for Climate Adaptation Measures

In a recent review Wilby et al. (2009) asserted that climate change scenarios can meet some, but not all, of the needs of adaptation planning. The possibilities and readiness to adapt are different around the globe. Often, but not always, these are related to financial resources. In addition, the knowledge of what could be done precisely and how to use available financial resources in an optimal way is missing. More guidance on adapting to the risks of climate variability and change over nearer time horizons, that is, the 2020s, is required. The United Nations Framework Convention on Climate Change (UNFCCC) secretariat published a report based on a workshop using the experience of several countries, sectors, and related impacts (UNFCCC 2010). The report addressed a wide range of climate change impacts and set out main approaches to adaptation planning. These approaches relate to the way different sectors (such as agriculture and tourism) could cope with impacts such as droughts and storms. The vulnerability of certain groups such as farming communities is targeted by community-based approaches that are combined with climate-resilient development projects. Climate-resilient development projects include a step-by-step approach and facilitate adaptation planning in particular ways within specific contexts, involving different stakeholders and with different requirements for technical, institutional, and financial resources. Several steps can be distinguished: provide climate information, screen vulnerability, identify adaptations, conduct analysis, select course of action, implement adaptations, and evaluate adaptations (GIZ 2010; USAID 2007). Several countries in the Asia and Pacific region have developed national climate change adaptation plans considering the range of possible adaptations in a country context: examples are the Kingdom of Cambodia (2006), the People's Republic of China (PRC) (2009), Pakistan Government (2010), and the Philippines Office of the President (2010).

Consequently, efforts of various regional and local government agencies 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 need to avoid isolated adaptation planning. Figure 5.1 is based on the workshop of the UNFCCC (2010) and proposes a conceptual framework to climate adaptation planning. The integration of adaptation planning approaches could be achieved through close coordination and cooperation across administrative levels (that is, vertical integration), across economic sectors (that is, horizontal integration) or through the consideration and reduction of the

Figure 5.1 **Conceptual Framework of Approaches to Climate Adaptation Planning and Their Integration**



Source: Modified based on UNFCCC (2010)

vulnerability of a particular group or system (that is, 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.

The approaches to climate change adaptation refer to social, technical, and physical measures. Social measures are related to institutional and financial means or so called nonstructural measures with the aim of raising awareness and preparing people for adverse impacts in climate conditions. More people are informed through orientations to local residents about what is likely to happen in the short, medium, and long term, and to enable them to plan for their future and to avoid risks.

Appropriate spatial scales (Table 5.1) and time frames (Table 5.2) have to be adjusted to the needs of the region of concern.

Technical measures refer to concrete actions in the landscape and require engineering knowledge. Measures include digging holes to store water and to provide retention areas, planting tree lines or forests to hold soil and water even in the case of strong rains, and building walls and dams against flooding.

Table 5.1 **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	Raising awareness: Emergency |action plans related to particular problems and risks.	Nonstructural measures. Relatively cheap and fast to implement.
Technical CCA	Modify use: Improved soil tillage, water management for agricultural crops. Conversion: Convert to uses with less climate risk.	Structural measures. Local provision of CCA measures. Cheap to expensive.
Physical CCA	Give up hazard zones or use: 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? Expensive measures. Source of conflicts.

Source: Author's compilation.

Table 5.2 **Timing of Climate Change Adaptation Related to Selected Measures**

Measure	Social Climate Change Adaptation (CCA)	Technical CCA	Physical CCA
Immediate	Awareness raising to climate change and CCA	Avoided deforestation	Emergency shelters after catastrophes
Short term <2 years	Risk-management plans, emergency-action plans	Avoided soil erosion by building terraces, water-storage facilities	Avoid management of high-risk areas
Medium term <5 years	Educational programs, legal provisions	Improvement of territory with regard to water storage capacity and top soil	National climate refugee centers
Long term >5 years		Forestation, green belts, green nets	

Source: Author's compilation.

Physical climate change adaptation means to switch the location of activities. On a local scale these include choosing wind protected, cooler, or shaded places in the neighborhood and avoiding the most risk-prone hazard zones. On a regional scale, inhabitants may move away from coastal areas to escape risks like hurricanes or move higher up if they live in the mountains to have better access to water. In some cases—in densely populated or flat areas (for example, in Bangladesh or island states like Maldives) even regional movement 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.

Some measures such as avoiding deforestation can be implemented immediately. Other measures will take different time spans: up to two years to develop risk-management and emergency-action plans, up to five years to develop legal provisions for climate change adaptation and particular educational programs to train target groups, or more than five years for tree planting and forestation measures.

5.3 EU Provisions for Valuing Climate Change Adaptation in Natural Resource Management

It is important to link climate change adaptation measures to programs already in place and then develop particular actions not sufficiently well covered by other programs. 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 had not explicitly considered climate change adaptation until then. This has widely changed in the last years. The European Commission (EC) of the EU published a white paper on climate change (EC 2009a) and for Austria a climate change adaptation strategy has been in place since late 2009 (Umweltbundesamt 2009). Austria is a small and rich EU country with 8.4 million people and 84,000 km² and represents 1.7% of the EU population and 1.9% of the EU territory. Two thirds of its area is mountains. While the majority of climate induced 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, European and Austrian authorities preferred to integrate needed measures into frameworks that already existed. This work is now in progress.

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. Individual countries can always make more strict regulations, but the 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 the EU have had them for the same period. For example, the new EU members—Bulgaria and Romania—only adopted them in 2007 when they entered EU.

Sector programs are provided on national levels in conformity with EU regulations and/or directives. Intra-national comparison and control became a main policy in the EU. The final aim is to harmonize the development in all EU countries with regard to natural resource management and to balance out the differences. Agreed reporting systems, procedures, and measures are resulting from this. This chapter describes some important relevant EU directives.

Water issues are regulated by the water framework directive (EC 2000) and supporting directives: the flooding directive (EC 2007), and the groundwater directive

(EC 2006). River basin management plans covering the entire EU territory had to be developed by 2010 and will be implemented by 2015, and in particular cases by 2027. The aim is to achieve in EU countries a good status of water bodies with regard to identified ecological and chemical parameters. In addition, member states have to produce flood hazard and risk maps. Recently the EU included a technical note with regard to climate change adaptation (EC 2009b) that had not been previously considered. This guidance document describes 62 guiding principles for adaptation, and relates each to steps in the river basin management plans. The principles are purposely broad to be applicable across all member states not considering regional variations in potential impacts. Examples demonstrate how the principles work in practice.

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 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 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 now being introduced. No tillage and low-level plowing are two methods in this line. Retention tunnels and retention areas provide safety in case of flooding. A major problem is also land converted from biologically active to biologically inactive sealed areas. This is primarily the conversion of unsealed agricultural land to sealed urban land with settlement and road areas. Now there are new methods to improve sealed areas to semi-sealed areas, avoiding excessive runoff.

Biodiversity issues or qualitative aspects of natural resource management are covered by the EU habitat directive (EC 1992) that regulates protected areas within the EU. The EU region has 17% of its land area protected as Natura 2000 areas (EEA 2010a). Wetlands are a direct link to the water framework directive and treated within the international Ramsar convention. This is an intergovernmental treaty of 1971—worldwide the only one dealing with a particular ecosystem—that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources (Ramsar Secretariat 2010). The EU is committed to halting the loss of biodiversity and thereby adaptation to climate change is one of the target areas. Invasive species are a major threat. Within a 2°C temperature rise, the so-called pioneer plants are advancing and pushing out the specialized and established species, with the consequence of possible extinction of endangered species.

Biomass as a quantitative aspect of natural resource management is one of the topics of the recent renewable energy directive (EC 2009c). In contrast to other world regions, the use of biomass has decreased in recent decades along with a

neglect of forest management in periphery and mountainous regions. Renewable energy systems again increase the demand in biomass and forest use. Additionally a promotion of biomass use is also good for climate change mitigation as a sink for CO_2.

There are no particular directives for major types of sensitive ecological regions, like mountains, arctic areas, coastal zones or urban settings. These areas are incorporated within each directive. However, climate change and climate change adaptation can be very particular in different ecological regions. Mountains and arctic regions are changing faster than other regions and the degree of warming is twice as fast as the global average. This is due to the retreat of snow and ice. The snow line has moved up in altitude and latitude and less water is stored as snow and ice (EEA 2010b). 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 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 in cities are major ways to adapt to more heat and more frequent storms associated with climate change (Amati 2008).

5.4. European Local-scale Climate Adaptation

All EU directives are sector oriented and implemented on a larger scale with medium-term goals. It is hard to know all the factors of influence dealing with areas over several thousands of square kilometers. To counter this situation, the Council of Europe proposed a European Landscape Convention (Council of Europe 2000), an initiative related to comprehensive landscape planning on a community scale, usually covering areas between tens to hundreds of square kilometers or 10-to-100 times smaller than the smallest scales of the sector approach under the EU directives. Like the European landscape convention, other municipal efforts to combine sectors are currently on a voluntary basis, carried out by nongovernment organization (NGO) workers who receive limited funding and are not present everywhere 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 an NGO in Europe dealing with climate change and climate change adaptation (Climate Alliance 2007) at the local level and has grown gradually since 1997. Currently 1600 municipalities in 17 countries are members. Recently a coalition with the European soil alliance—another European NGO working on the same scale—was undertaken (ELSA 2010). The two NGOs have since jointly developed a set of best practices that they have promoted in their member countries. In some European states and municipalities there exist Agenda

21 plans aimed at sustainable development. These plans were developed after the UN conference in Rio in 1992 with the motivation to stimulate environmental benign actions. These actions include saving water, energy, and other resources or to avoid waste on the local scale and target neighborhoods with smaller groups, households or individuals. These plans can be additionally highlighted for climate change adaptation (ICLEI 2009).

5.5 Climate Adaptation and Natural Resource Management in Austria

The following section describes local approaches of actual—and often inexpensive—measures of climate change adaptation in Austria. Local measures are limited in scale, but are practiced by many people. Adaptation measures are different in less populated rural areas than in densely populated urban areas.

In agriculture, climatic changes will affect crop yields, livestock management, and the location of production. The increased likelihood and severity of extreme weather events—like hail in certain regions—will considerably increase the risk of crop failure. Climate change will also deplete soil organic matter—a major contributor to soil fertility. No tillage and minimum tillage practices including plowing less deep can protect and alter soil organic matter. 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 change. In some parts of Austria—like some regions in England and Sweden where it was previously too cold—vineyards are planted now. Fruit trees like apricots, figs, and kiwis, previously rarely available, can offer interesting alternatives in areas when spring frosts disappear. The effects of climate change on forests are likely to include changes in forest health and productivity. Certain trees are more robust to change and will increase their populations while others will become less common. Water management aims to keep water in the landscape and even to create new water bodies or restore former wetlands converted to agriculture. However, the rural economy might be adversely affected by climate change impacts. Mountain-based winter tourism, the main contributor to rural economic growth, depends on snow. Snow is less frequent in important winter sports resorts (Breiling 2008). Technical climate change adaptation in relation to artificial snowmaking has been going on since the 1980s; long before any European or Austrian climate change strategy was developed. In cases where climate change adaptation gets too expensive, low lying places are given up for winter tourism or have to look for less profitable alternatives. If higher altitude places become more severely affected, few or no alternatives are currently available.

In urban dwellings future problems can be anticipated. The Vienna water supply comes directly from the Alpine mountains nearby collected over an area

that is several times the size of the city and is transported over 100 km 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 of people that in their majority do not see the place of origin of their water (Kuschnig 2006). Drought has not yet led to water scarcity, but it has made 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 higher vulnerability. Human health in urban regions will be favored by improving the urban climate. Vienna—probably the first town in EU to establish a water school for primary school children—very early on explained 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 areas is essential. For more than 100 years, Vienna has been developing and enlarging its green belt continuously (Breiling and Ruland 2008). Vienna city plans to restore the water bodies that were overbuilt in former decades (Goldschmied 2006). It was the first town to plan a biomass electricity plant (Wien Energie 2011) 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 benefits are numerous. The surrounding forest received many incentives to be better managed and the plant itself has become a tourist attraction.

5.6 Conclusion

Natural resources can be used, harvested, overbuilt, overused, polluted, or destroyed. Depending on the impact we classify natural resource management into sustainable and non-sustainable activities. More uses will become unsustainable than before if states and local communities do not react to climate change and more uses will again become sustainable if they are accompanied with appropriate actions. The awareness of local people is the first significant 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 in places that cannot be sustained within acceptable risks. 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 postponing or even avoiding climate change impacts on local scales.

References

Alcamo, J. et al. 2007. 'Europe: Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. In M. L. Parry et al., eds.

Climate Change 2007: Impacts, Adaptation and Vulnerability, pp. 541–580. Cambridge, UK: Cambridge University Press.

Amati, M. 2008. *Urban Green Belts in the Twenty-first Century*. London: Ashgate.

Breiling, M. 2008. *Snow in Kitzbühel: How Winter Tourism Is Adapting to Climate Change*. On Snow. Catalogue to Exhibition Snow Affairs, Museum Kitzbühel, November 28, 2008–April,11 2009.

Breiling, M. and G. Ruland. 2008. The Vienna Green Belt: From Local Protection to a Regional Concept. In M. Armati, ed. *Urban Green Belts in the Twenty-first Century*. London: Ashgate.

Climate Alliance. 2007. *Adaptation and Mitigation: An Integrated Climate Policy Approach*. Frankfurt, Germany: European Secretariat.

Council of Europe. 2000. European Landscape Convention. *European Treaty Series*. No. 176. Strasbourg, France: Council of Europe.

European Commission (EC). 1992. *Council Directive 92/43/European Commission EC on the Conservation of Natural Habitats and of Wild Fauna and Flora*. Brussels: European Union.

———. 2000. *Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 Establishing a Framework for Community Action in the Field of Water Policy*. Brussels: European Union.

———. 2006. *Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the Protection of Groundwater against Pollution and Deterioration*. Brussels: European Union.

———. 2007. *Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the Assessment and Management of Flood Risks*. Brussels: European Union.

———. 2009a. *Adapting to Climate Change: Towards a European Framework for Action*. EU White Paper. Brussels: European Union.

———. 2009b. *River Basin Management in a Changing Climate*. Guidance Document No. 24. Common Implementation Strategy for the Water Framework Directive (2000/60/EC). Technical Report-2009-040. Brussels: European Union.

———. 2009c. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the Promotion of the Use of Energy from Renewable Sources and Amending and Subsequently Repealing Directives 2001/77/EC and 2003/30/EC. Brussels: European Union.

European Environment Agency (EEA). 2010a. *The European Environment: State and Outlook 2010—Synthesis*. Copenhagen: EEA.

———. 2010b. *Signals: People and Their Environment*. Copenhagen: EEA.

European Land and Soil Alliance (ELSA). 2010. *Local Land and Soil News*. 32–33. April.

GIZ. 2011. *Adaptation to Climate Change: New Findings, Methods and Solutions*. Bonn, Germany: Deutsche Gesellschaft für Internationale Zusammenarbeit.

Goldschmied, U., 2006. Living River Liesing: A LIFE-project on Rehabilitation of a Heavily Modified Waterbody in Vienna's Urban Environment. In M. Breiling, ed. *The Implementation of the EU Water Framework Directive from International, National and Local Perspectives*. Vienna: Department for Urban Planning and Landscape Architecture, Vienna University of Technology.

Intergovernmental Panel on Climate Change (IPCC). 2007. *Fourth Assessment Report (AR4) Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Geneva: IPCC.

Kingdom of Cambodia, National Government. 2006. *National Adaptation Programme of Action to Climate Change*. Phnom Penh.

Kuschnig, G. 2006. The Interreg IIIB CADSES Project KATER II (Karst Water Research Program). In M. Breiling, ed. *The Implementation of the EU Water Framework Directive from International, National and Local Perspectives*. Vienna: Department for Urban Planning and Landscape Architecture, Vienna University of Technology.

Local Governments for Sustainability (ICLEI). 2009. *Changing Climate, Changing Communities: Guide and Workbook for Municipal Climate Adaptation.* Toronto, Canada.

Pakistan Government, Planning Commission. 2010. *Final Report: Task Force on Climate Change.* Islamabad.

People's Republic of China, National Development and Reform Commission. 2009. *China's Policies and Actions for Addressing Climate Change*. Beijing.

Philippines Office of the President, Climate Change Commission. 2010. *National Framework Strategy on Climate Change, 2010–2022*, Manila.

Ramsar Secretariat. 2010. *The Ramsar Handbooks for the Wise Use of Wetlands, 4th edition,* Gland, Switzerland: Ramsar Secretariat.

Umweltbundesamt (Austrian Environment Agency). 2009. *Die Anpassung als zweite Säule der Klimapolitik*. http://www.klimawandelanpassung.at/nationale-anpassungsstrategie/ (accessed 12 February 2012).

United Nations Framework Convention on Climate Change (UNFCCC). 2010. Report on the Technical Workshop on Advancing the Integration of Approaches to Adaptation Planning. Item 3 of the Provisional Agenda Nairobi Work Programme on Impacts, Vulnerability, and Adaptation to Climate Change. Bangkok. October 2009. http://unfccc.int/resource/docs/2010/sbsta/eng/02.pdf

US Agency for International Development (USAID). 2007. *Adapting to Climate Variability and Change: a Guidance Manual for Development Planning.* Washington DC: USAID.

Wien Energie. 2011. *Europe's Largest Forest Biomass Power Station*. http://www.wienenergie.at/we/ep/programView.do/contentTypeId/1001/channelId/-27957/programId/19444/pageTypeId/19114 (accessed 12 February 2012).

Wilby, R. L. et al. 2009. A Review of Climate Risk Information for Adaptation and Development Planning. *International Journal of Climatology*. 29 (9). pp. 1193–1215.