# Appraising long-term regional climate policies in Inner Mongolia, the Tisza floodplain and the Guadiana river basin.

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## ABSTRACT:

This paper looks at the social and ecological commonalities and contrasts encountered in the development of measures and strategies to mitigate and adapt to climate change in three distinct regions of the world: the Alxa league, located in Inner Mongolia (China), the Tisza floodplain (Hungary), and the Guadiana river basin (Iberian Peninsula). Populations living in these areas share in common that they are increasingly vulnerable to climate related pressures, including mounting desertification, water stress, and risks of occurrence of extreme events such as floods and heat waves. However, the institutional contexts and the governance traditions upon societal responses and long-term policies are developed greatly differ in these three cases. Our research examines the impacts and the triggers of adaptive and mitigation responses, including the making of climate appraisals at the regional level from a comparative, empirical and analytical perspective. A methodology, called *Policy Appraisal Framework* (PAF), has been developed to support and assess in an integrated and social-ecological robust way the appraisal processes in each region. We look at how local, meso or global social and ecological processes enhance or impede climate actions and how distinct institutional capacities and modes of agent engagement, collaboration and transformation affect the implementation of long-term climate policies in these regions. In particular, we argue that in the long-term, enhancing, protecting and integrating cultural and institutional diversity may be one of the best strategies to mitigate and adapt to climate change. This research is part of the EU project ADAM - *Adaptation and Mitigation Strategies: Supporting European Climate Policy* (2006-2009).

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## 1. INTRODUCTION.

Human societies are increasingly becoming aware of the need to adapt and to prevent the negative side effects of changes occurring to a new environment created by themselves. The making of robust long-term climate policies at local and regional levels requires the development of tools and methods capable, on the one hand, to provide an accurate representation and understanding of the system of concern, and on the other, that contribute to empower agents and organisations in a way that improve their opportunities for collaboration, engagement, and social-ecological transformation. In this paper, we refer to these processes as contributing to *agent reconfiguration*.

The main objective of the present research is to obtain first-hand empirical insights regarding the processes of formulation and implementation of long-term climate measures and policies in three regions of the World. This research uses a comparative analysis coupled with the development of an Integrated Assessment (IA) methodology called Policy Appraisal Framework (PAF) which is used as a heuristic devise to examine the factors that influence the way regional climate appraising processes are carried and how they can be improved. Such method is intended to constitute a general and flexible guidance –and not a rigid yardstick- for climate researchers and practitioners who want to evaluate and reflect onto what extent the existing climate appraising processes yield socially and ecologically robust climate options in specific contexts of action. For 'socially and ecologically robust' we understand that the processes and outcomes of the appraisals need to take into account the particularities and conditions of the social and ecological system in which the assessment takes place. In quest for producing 'climate assessments in context', our research looks at issues such as how multiple sources of knowledge and for what purposes are integrated in particular regions and to what extent the existing processes climate appraisal contribute agent engagement, collaboration and transformation.

## 2. A REGIONAL APPROACH WITHIN THE ADAM PROJECT AND THE POLICY APPRAISAL FRAMEWORK.

### 2. 1. Research questions and approach.

The EU funded ADAM project (2006-2009; *Adaptation and Mitigation Strategies*) aims at generating interdisciplinary knowledge capable to support current EU climate policies and international policymaking in this domain. Within the structure of the project, one particular work package looks at the methodological and fundamental aspects of knowledge integration, agent engagement and empowerment and at the potential interfaces between science, policy making and the public in the development and implementation of climate strategies. Another work package concentrates in gaining empirical insights from the actual making of climate appraisals in three selected regions: 1. The Alxa league, located in Inner Mongolia, China, 2. The Tisza floodplain in Hungary, and 3. the Guadiana river basin, shared between Spain and Portugal. While the first work package used a deductive and normative approach, the second took a more inductive strand, based on the application of specific tools and methods such as stakeholder workshops and modelling. The present paper draws insights from the interactions between the two work packages.

Therefore, these three regions are examined both from a descriptive and analytical way. Populations living in these areas share in common that they are increasingly vulnerable to climate pressures, including mounting desertification, water stress, and risks of occurrence of extreme events such as floods and heat waves. However, the institutional contexts and their governance traditions upon societal responses and long-term policies are developed greatly differ. In this research, the comparative analysis of these regions intends to contribute to answer the following questions:

1. What are the main impacts, opportunities and responses to climate risks in the selected regions? What type of transformations can be observed by specific agents and regional institutional arrangements to cope with climate change?
2. What are the main triggers and driving forces that lead to the development and implementation of regional climate policies and actions? To what extent these actions actually relate to a conscious and explicit regional and national strategy that aims at dealing with climate change?

Beyond these questions, ADAM also worked in the development of an Integrated Assessment methodology called *Policy Appraisal Framework* (PAF). In particular, the PAF (for a further description s. Weaver et al. 2006) it can be seen: (a) as an heuristic tool or ideal type to think about and analyze and categorize the diversity of possible appraisal processes that can be relevant to design climate policies for a particular system of reference; and (b) as a mechanism to help understanding how specific climate appraisals can be improved. With regard to scale and multi-level issues, the PAF can also be regarded as way to help connecting global policy processes, diverse sources of knowledge and concerns with local and regional contexts of action. Thus this approach looks at interactions between different levels of action and social-ecological system changes. It aims at integrating different disciplines and sources of knowledge, expert and non-expert, from policy circles, academia and NGOs. The main ambition of the PAF was to produce a structured procedure that can be replicated and adapted according to peculiar social-ecological conditions in a way that can contribute to agent reconfiguration and system transformation, and to build social learning processes and capacities that go beyond simply producing expert 'results'.

The PAF has been used within the three regions, e.g., either to orient the research process or simply to analyse the existing policy practices. Stakeholders' workshops have been conducted in the three regions and consulted actors include people from the scientific community, policy-makers and local stakeholders affected by increasing climate risks. Some particular concerns have been the examination of how different agents contribute to deciding the different climate interventions, how uncertainties are dealt in the process of assessing climate change processes and options for adaptation and mitigation and how the international and national climate policy developments affect regional actors. Our focus lays both in the description of the specific policies and measures which are actually developed and implemented in each context, together with the analysis of the specific tools and methods which are used to do so and how this process can be strengthened.

With these questions and framework in mind, we now proceed to examine the particular impacts, responses and triggers of existing regional policies and climate-related actions in these three regions and the role played by climate appraising procedures.

### 2. 2. The Alxa and the Inner Mongolia, China

The Alxa sub-region constitutes a vast expanse of arid and semi-arid land of 270.000 Km2 situated in the Autonomous Region of Inner Mongolia, Northern China. With a population of only 20.000 people, it is crossed by three of the largest deserts within Inner Mongolia. This area is the origin of sandstorms, and given its intensity and scale of which they can even be felt in city of Beijing and Japan (although there are accounts of sands having arrived to North America). Desertification is a growing concern in China, where one third of its territory is already affected by land degradation. Being deserts very fragile environments, and very sensitive to perturbations, climate has become an additional stress factor to these already degraded environments, which already have suffered from decades of overgrazing and terracing (Shapiro 2001). A three-day workshop in the city of Erdous, and field trip that included several locations of Inner Mongolia in May-June 2006 which included

consultation with local stakeholders, researchers, and politicians helped to identify the main options regarding climate adaptation and mitigation in the regions (ADAMa)

From the adaptation side, it has been claimed that some policy measures taken to cope with the new climate situation in the area include the following (ADAM 2007b): fencing off desert grazing areas (Rogers et el 2006, Yonghuan et. al 2006, Jiang, et al. 2006) and forest, aerial seeding and afforestation, changing in the composition of livestock, rainwater harvesting (by means of collecting water in underground pools), and developing new forms of sand tourism to compensate for the reduced income from traditional farming activities. In the unique, forested and isolated mountain range of the Hellan Mountains, surrounded by three deserts, besides enclosure of grazing areas, artificial rainwater has been tested and argued as one of the best options to save this shrinking ecosystem threatened by lowering precipitation. Given the mounting *aridification* of the area, there are growing conflicts for the use of water resources, mainly along the Heine river. In this regard, as in many parts of the world like in the Guadiana river basin (see below), some of the 'adaptation measures' are now directed to extending the building of water infrastructures, such as reservoirs and water transfers, in an attempt to bring water and new development opportunities to areas where water resources are becoming increasingly precious and scarce.

As part of a massive reforestation programme, there are ongoing activities to lay down a 'green wall' of trees and plants stretching from Beijing to Inner Mongolia (Three North Forest Shelterbelt Program), and in Inner Mongolia itself there is a grain for green program subsidising tree and grass planting. Tree planting is seen as a major focus of addressing the desertification problem and can even involve other neighbouring countries (for instance, Japan sends volunteers each year to help with this restoration activity). Haloxylon woodlands in particular have been identified as one of the best windbreak and sand-fixing types of vegetation (Dai et al, 2007), however evidence shows that the coverage of this tree in the Alxa Banner has reduced from 1,133,000 hectares to 384,500 hectares since the 1960s. This is clearly a significant issue that needs to be addressed. That said, the effectiveness of ongoing tree planting campaigns is not clear, as evidence from the ADAM fieldtrip suggested that in some cases trees were dying after being planted too close together (and hence competing for limited water resource) or alternatively were the wrong species for the arid conditions (water thirsty). As part of the ADAM fieldtrip, EU researchers and scientists were shown a forest strip demonstration area in the Tengger desert area. This was highlighted as a successful example of reversing the current trends of desert expansion, due to a drop in the level of groundwater from 2m to 4m within 50 years (ADAM, 2007). Although obviously seen as a successful anti-desertification initiative by local people, even here there was evidence of trees dying.

From the mitigation side, and more generally within the whole Inner Mongolia region, the potential for reducing GHG emissions is enormous, given the number of large coal power stations now in operation and planned (Aden 2006). Large international energy investors, mostly in the field of the development of Carbon Capture and Storage (CCS) and Integrated Gasification Combined Cycle (IGCC) technologies are now turning their attention into China. However, although local and regional agents can play an important role in mitigation strategies in this sector, the goals and the means to achieve these goals are not so much dependent of local purposes or actions, but much more related to the wider national and international strategies on development and climate change. It is still uncertain what is going to be the eventual role of China in the international strategy to cut CO2 emissions (especially after Bali), although whatever it will be, it will have to be a very important one as it can affect the global environment (Congjie & Dongping 2007, Day 2004, Economy 2004, Ho 2006). Therefore, how the Chinese national policy is to be translated at the regional level and how regional actors, such as in Inner Mongolia, will be given a decisive role in this respect is still a question to be answered. Of particular note in the Chinese context was the launch of the first national climate change plan in June 2007 (National Development and Reform

Commission, People's Republic of China, 2007). This new legislation puts forward three major targets to be achieved by 2010 - reducing energy consumption by 20%, increasing renewable energy to 10% of primary energy supply, and increasing reforestation by 20%. It also highlights some of the key sectors and thematic areas for adaptation (agriculture, forestry and water in particular), with a stated goal of restoring 52 million hectares of grassland previously subject to desertification by 2010. The National Coordination Committee on Climate Change will oversee activity, formulating policies and measures and providing guidance for local responses to climate change.

This notwithstanding, the rising awareness of climate impacts and of its opportunities for development and institutional reform, as well as new internal and external political and civic pressures are beginning to produce some changes both in the Chinese environmental science and policy contexts (Heggelund & Backer, 2007). China counts with a notable tradition of atmospheric, terrestrial and climate monitoring, and the participation of Chinese scientists has been crucial in many international research programmes regarding global change (NRC, 1992). In the present situation, scientists seem particularly to be benefiting from the current wave of interest in the development of new climate international research networks and cooperation. In particular, the role played by transnational epistemic communities, more than NGOs, has been underlined as a key factor giving salience to the climate politics in China (Schroeder 2007). Thus, new scientific concepts and insights coming from environmental science and knowledge from ecology seem to start informing policy in this domain. It is likely that concepts such as desert management following an integrated ecosystems approach and others, will gradually be used to reorient current land use and natural resource practices, in a way some authors on ecological modernisation, not without criticism, argue to have begin to penetrate in China in other domains (Huan 2007, Carter & Mol 2007, Zhang et al. 2007).

Therefore, and with regard to key drivers of change, it is important to remark that beyond direct exposure to climate effects, in China non-biophysical triggers may play an specially important role in mobilising resources towards climate adaptation and mitigation. In a society explicitly committed to alleviating poverty (Wang and Fang 2007) and dominated by the quest of economic growth (Harris 2004), this new cultural mood can not be neglected. Indeed, it is likely that the most important drivers for mitigation and adaptation actions, at least in the short and mid term in China, not only in particular regions but also nationwide, will be motivated more for the prospects of economic development and growth than the direct experience of the effects of climate change.

The implementation of measures such as the grassland enclosure and resettlement have not free of questioning both on social and ecological grounds. For instance, some authors argue that some of these policies do not necessary guarantee that all resettled people are now better off than before (Jiang 2006, Rogers & Wang, 2006, Webber and McDonald 2004). Furthermore, herdsmen who have been moved to different areas now follow modernisation processes that entail following lifestyles radically different from their original or traditional practices and identities and there are risks of social disarticulation; and where grazing has been completely eradicated, new environmental problems may emerge such grass overgrowth which may lead to greater fire risks. In this line, Williams (1996, 2002) has argued that in Inner Mongolia that fencing has been an expression of the current move towards increasing land privatisation and more a catalyst of land degradation than its solution. For him, such measures have not created increased trust of local communities or reduced the political fear to existing political institutions and in this guise local people have not more consulted in this move towards privatisation than when collectivization was imposed. Therefore, and in line to those lines of thought that distinguish between development as a outcome and development as process (Dickinson & Weber 2007), we understand that the main political climate challenge goes beyond determining what particular measures need to be implemented that accommodate to the short term goals of property regime reform and economic

growth. Rather, the main questions to be tackled relate to deciding what appropriate appraising and decision-making *processes* can be developed, suitable for Inner Mongolia and Alxa in particular, so as to produce equitable, and socially and ecologically robust adaptation and mitigation results compatible with the long-term quest of sustainable development (Lemos et al. 2007). This necessarily entails processes that explicitly aim at protecting not only grasslands, but also enhancing the whole social conditions and traditional knowledges and communities that can potentially contribute to a sustainable use of those resources, which are embedded and expressed in cultural and institutional diversity (Becker & Ostrom 1995, Ostrom, 2005, Tàbara et al. 2004). While many current policies aimed at alleviating poverty and restore grassland translate in an augment in the number of populations being dependent on or participating in larger economic markets -thus with a higher contribution GHG emissions-, it is also important to consider to what extent how the (often more adapted) traditional cultures and lifestyles can also contribute to mitigate or reduce the need of adopting new carbon-intensive lifestyles.

### 2.2. The Tisza flood plain, Hungary.

The Tisza River is the largest tributary of the Danube, receiving water from the Carpathian Mountains in Romania, Slovakia and Ukraine. Within Europe, the Tisza is unique in terms of wetlands and conservation areas, albeit its much regulated river bed and frequent floods. Until the 18th century the Tisza floodplain area was utilized in a complex way providing secure income for the communities along the river. Activities were mainly organized around the operation of a system of small streams and channels between the river main bed and the floodplain, cutting through the natural levee (Balogh el al. 2000). Since then the Tisza River has been heavily modified. To cater for large-scale mono-agriculture and river transport, the river was canalised and straightened and the floodplains drained. The major changes of the Tisza River were introduced by the Vásárhelyi Plan initiated in the 19th century. These changes meant the destruction of the traditional water management system and the decline of the region. Next to the flooding there are other environmental problems such as draught, water stagnation and the degradation of peat lands and wetlands. The area also suffers from socio-economic deprivation, with high unemployment rate, ageing, migration and minority rights problems (Sendzimir et al. 2004, Linnerooth-Bayer et al. 2006).

The main observed signs of climate change are variation of precipitation and temperature. In the Tisza region, these result in a higher frequency and intensity of extreme floods and droughts. Between 1998 and 2006 there has been at least one severe flood each year, of a magnitude that previously happened once per 100 years. At the same time, the plains between Danube and Tisza are especially drought prone. The predictions suggest more irregular rainfall and a warmer climate in the Carpathian basin (Lang, 2006). Climate change is connected to the three main water related problems of the Tisza regions 1) floods; 2) in-land water stagnation; 3) droughts.

The recurring flooding events and the recent predictions of an increased incidence of floods and droughts have been triggered force behind a new water management plan for the Hungarian Upper Tisza river: the New Vásárhelyi Plan. This plan is the main mechanism for mainstreaming adaptation in the Hungarian Tisza region. The plan's main aims are to reduce flood risk in combination with nature conservation and rural development. It identifies micro regions for water retention (flood polders and formerly used small water bodies) and enacts the revitalization of floodplains as the preferred adaptation strategy in integrated floodplain management and rural development (Adam 2007c, Matczak, et al. 2007, Werners, et al. 2007.).

Following the PAF, the Tisza regional case identified various responses to increasing climate pressures. These can be summarised as: 1. Re-evaluate and modify the institutional and legislative

framework to support adaptation and mitigation through climate proof floodplain management as proposed in the new water management plan, 2. Support land use and water management that increases the buffering capacity of the region and the adaptive capacity of its inhabitants, iii) Encourage local markets, investment and awareness raising.

As part of the evaluation of the institutional framework, actors in the Tisza called for clarifying the roles of non-state actors. Actors expressed a particularly strong interest in establishing agencies beyond the state. To prepare for climate change, actors suggested an informed multi-stakeholder approach (e.g. dialogues) at national, basin and regional level to prepare action plans for adaptation and to strengthen regional and local representation (e.g. after the Bokartisz Public Utility). It was proposed that an "Hungarian Water and Climate Alliance" could be established as a national umbrella to continue building bridges between the climate and water sector, to encourage capacity development to better cope with climate impacts and facilitate obtaining financial support for national, basin and regional level adaptation plans. An alternative to national coordination of the new water plan is to establish a multi-stakeholder implementing agency with half political representation, half other stakeholders. The Tisza Alliance (elotisza.hu) that was established in June 2006 could play a role in representing regional and local actors.

Next to redefining formal relationships, institutions and participation, actors identified options to strengthen informal relations and cooperation with agencies beyond the government (Matczak et al. 2007). This includes awareness raising about a.o. impacts of climate change, flood risks and saving energy. Actors also stressed the importance of local and regional markets and private sector initiatives. One option is to find new partners and encourage local investment in flood protection and river revitalisation. Another to interest urban areas to support the development of rural regions, taking local interests and unique local practices into account to make the system of agricultural land-use more sustainable. Some actors stressed the promotion of local markets and a fair economic relationship between urban and rural areas. Local markets can also have a role in enabling land use change by supporting the full chain of land use related products. For example if grazing increase, milk and meat production will also increase and markets are needed for these products. Finally biomass from floodplain management and local waste could be reserved for household heating systems. New bio energy production facilities are competing for biomass with households, food crop production and nature conservation.

Given the shortage of resources, actors suggested integrating adaptation, the new water plan and the Hungarian regional development programs. The allocation of resources is closely connected to the land consolidation challenge that the Tisza region is facing. The costs and benefits of adaptation and floodplain management have to be shared between many parties at different scales. A re-evaluation of resource allocation is crucial and should include i) Subsidies for sustainable agriculture and land-use management, ii) Subsidies for renewable energy, levelling the price difference between renewable energy & average energy price, iii) Agro environmental schemes and removing damaging current subsidies like compensation schemes for farmers in areas at risk of inundation, iv) Property rights, and v) regulation of the use of EU funds in several sectors of the Hungarian economy (e.g. CAP, EU cohesion funds and Natura 2000).

**4. 3. Guadiana river basin.**

The Guadiana river basin lies between Spain and Portugal and constitutes one of the three main drainage units of the Iberian Peninsula, with a total drainage area of 66,800 km2. Its climate is semi-arid with low irregular precipitation (440mm/year; CHG, 2000). The Guadiana river basin constitutes a natural unit but not an administrative one. Administratively, in Spain, the Guadiana crosses various Autonomous Communities (CCAA) -Extremadura, Castilla-La Mancha and Andalucía- being specially represented the provinces of Badajoz, Ciudad Real and Huelva. In Portugal, the Plano de Bacia Hidrográfica do Rio Guadiana (PBHG) is administratively divided between the Alentejo region and the Algarve region. Strong modification of the natural hydrological regime, in the form of dams, illegal dwells and increasing urbanization pressures in the last four decades have caused increased water scarcity along the Portuguese-Spanish border. The main problems within the river basin are the overexploitation of the aquifers through the large extractions for agricultural use, agricultural contamination river fragmentation by dams (Cosme, Sousa et al. 2003; WWF 2003b). The Portuguese part of the basin shows a less a structured economy and includes some of the poorest municipalities in the country, with an ageing population and unemployment. Portuguese authorities often associate the deprived economic indicators to the lack of water availability (WWF, 2003). This is perceived so given that in the Spanish Upper Guadiana basin the use of groundwater resources seem to have increased substantially the (short-term) livelihoods of the people in that area. However, this relative wealth has not come with an important ecological cost that a large part of population seem not realise (Costejà and Maestu, 2005). Other processes altering the river basin include the building of large urban and leisure developments for tourism, which originally used only to be located near coastal areas, now also spread inland.

An ADAM workshop carried out with stakeholders in the Lower Guadiana, in Portugal in December 2006 helped to identify some of the main impacts, responses and drivers of climate related actions (ADAMe, see also Moreno Rodríguez, 2005, Santos et al. 2002, Tàbara, 2007). Among the main possible responses to adapt to climate pressures the following were mentioned: increase agricultural and economic diversification as well as the scale of farm organisations (e.g. by concentrating on certain more productive varieties, although this has a negative effect on agricultural biodiversity and perhaps on the long-term system adaptability), reuse of grey waters, promotion of rural tourism, and local produce, protecting but also modernising the 'dehesa' multifunctional ecosystem, which is formed by well adapted extensive farming tree varieties such as acorn and cork trees, the use new varieties of draught and heat resistant crops and the implementation of new management systems. Reforestation measures, mainly with pine (pyrhofic) species have been also implemented, not without criticism.

Therefore, having sufficient quantity of water is of major concern in the Guadiana basin. The semi-arid climatic conditions of the basin affect availability of adequate quantities of water. Climate change potentially increases the pressure on the available water resources and thus the potential conflicts between agriculture/irrigation, tourism, the construction of large urbanisations and the environment. Current groundwater reserves are already threatened by salinisation and overexploitation, due to an increase in the demand of water and a decrease of the supply. Water shortages, summer droughts and desertification are thus very likely to increase. All this reinforces the need for adequate and holistic water management, integrated in wider concerns and strategies that include actions dealing with erosion and desertification prevention policies, although only recently is being politically recognised (ADAM. 2007d).

One of the main drivers of change and transformation of the governance structure of the Guadiana basin needs to be found in the need to adapt the European directives to national and regional legislations. Pasquier (2005) argues that the introduction of concepts and ideas from the European level to the national and regional ones constitutes a learning process based on the transmission of

cognitive resources in terms of public policies, administrative agreements and institutional designs. These cognitive resources provide to national and regional actors new elements to apply their territorial policies. With regard to climate change mitigation and adaptation related policies and strategies in the Guadiana river basin, this process has be observed on several grounds. First, in the elaboration and implementation of national and regional climate change strategies; second, as a result of the requirements established by the Water Framework Directive (WFD); third, as an effect of the formulation of national and regional rural development programmes; and fourth, because of the transformation provoked on the socio-economic structure and environmental conditions of the river by the EU Structural Funds. Although with limited success, these regulations do promote the participation of all public and private actors in the policy making process at all scales and the inclusion of "good governance" criteria and principles in the daily management of public institutions.

The European Climate Change Programme (ECCP) I and II are the origin of the main national climate change programmes and strategies adopted in Portugal and Spain: the Portuguese National Climate Change Programme (2001), the Portuguese Strategy on Climate Change (2001), the Spanish Strategy on Climate Change and New Energies (2007) and the Spanish National Adaptation Plan (2006). Several national bodies have been created in both countries to execute and inform on climate change policies. This is the case of the Portuguese Climate Change Commission, the Spanish Inter-ministerial Group in Climate Change (GICC in its Spanish initials), the Climate Change Policies Coordination Commission (CCPCC in its Spanish initials), the Spanish Bureau of Climate Change or the National Council on Climate Change. Among their duties are to promote and facilitate the climate change policy across the Government bodies with relevant competences and ensure that these issues are considered in the full range of sectoral policies. Changes regarding climate institutional arrangements capacities in both countries and in particular at river basin scale can be observed although still in a rather underdeveloped stage (McEvoy et al. 2007).

In many regions of Portugal and Spain, important changes in the current institutional designs are motivated by the influence of European policies as well as the growing involvement of actors that traditionally were excluded from the regional policy-making processes. Rural and EU development policies have created new opportunities for collaboration between adjacent regions of different countries. Due to the wide range of policies and actors that directly or indirectly influence climate change mitigation and adaptation policies in the Guadiana River Basin, the need for an adequate coordination at different levels of government and between different programmes and sectoral policies is a matter of concern. In this regard, several transboundary institutional arrangements for the use of shared water resources exists between Spain and Portugal (Maia, 2000). The current *Convention on Cooperation for the Protection and Sustainable Use of the Portuguese-Spanish River Basins*, formed the Commission for the Convention Development and Application (CDAC). The Convention defines the framework for cooperation between the two countries to protect inland waters (surface waters and groundwater) and their dependent ecosystems and to use the shared basins waters in a sustainable fashion. However, the agreement and the CDAC are almost unknown to the general public and even to the local administrative bodies in the Guadiana basin (Newater, 2005) and climate change were not mentioned.

The EU Structural Funds policy have also impacted on the governance structure of the Guadiana river Basin. The European Commission has used successive reforms of Structural Funds to condition the activity of sub-estate actors and they have responded taken on a more active role. By means of initiatives such as INTERREG, the European Commission has promoted the setting up of transnational networks focusing on the definition of common interests and the intensification of horizontal co-operation among the substate actors belonging to different Member-States. Thanks to this type of initiatives, the regions have gradually developed a more important role both in the European arena and in national decision-making and policy-implementing spheres (Jones and

Keating 1995). Today, regions interact directly with the EU bodies to obtain resources from the distributive policies and further their interests. Due to the transboundary nature of the Guadiana river Basin, important parts of it constitute eligible zones for cross border initiatives and projects under INTERREG. In order to promote cross border cooperation in the area, the following institutional agreements have been adopted:

1. Agreement between CCR Alentejo and Junta de Extremadura (1992);
2. Agreement between CCR Algarbe and Junta de Andalucia (1995);
3. Agreement between CCR Algarbe and Junta de Extremadura (1995);

These agreements have created three Working Communities for their respective geographical scopes, which are new structures of governance that are not a new tier of local or regional government, but a space for exchanges and cooperation between public- and private-sector actors. Institutions operating across boundaries can have responsibility for a portfolio of topics (for instance, economic and regional development, energy, environmental protection, tourism and leisure, agriculture, to name a few). Decisions in these policy arenas are likely to have a significant impact on climate change. The Operational Programme on Cross Border Cooperation Portugal-Spain 2007-2013, which was formally approved by the European Commission on October 2007, seeks to foster cross border cooperation on four main aspects: cooperation and joint management for the promotion of competitiveness and employment support; cooperation and joint management for the conservation of the environment, patrimonial and natural resources and risks management; cooperation and joint management in land use planning and accessibilities; promotion of cooperation and institutional and social integration.

In short, we can say that within the Guadiana river basin, but also in other EU countries, some regions are acquiring greater decisional powers in the recent years and new regions are emerging (Cots, et al. 2007). However, the 'new regions' do not longer correspond to the divisions that once were useful to the particular goals of the old nation-states, but are now created upon other new cooperation goals, including environmental quality procurement and sustainability, that transcend country borders. The mainstreaming of climate change into regional development goals and processes, including the adoption of new forms of governance and resource management related to adaptive management of shared resources such as transboundary river basins, translates into new ways of cooperation and collaboration, some capable to erode existing (and dysfunctional) regional or national divisions while at the same time developing new ones. Climate change poses specific risks to geographical regions which do not fit with the existing administrative and political arrangements. New tools and methods are necessary to know how the 'new regions' can be best rearranged and what new political institutions can best be compatible with the long-term setting of climate goals. The new situation is likely to demand some flexibility and innovation of the existing national settings, given that originally they were developed in completely social-ecological conditions and for completely different purposes than mitigating and adapting to global environmental change.

## SUMMARY OF RESULTS AND CONCLUSION:

Table 1 summarises the main impacts, responses as well as triggers and driving forces that have led to adaptation and mitigation actions that have been identified in the three regions.

**Table 1. Climate trends, impacts, responses and drivers in Alxa, the Tizsa floodplain, and the Guadiana river basin.**

| Region | Climate change | | Adaptation domain | | Mitigation domain | |
|---|---|---|---|---|---|---|
| | Recent trends and signals | Main impacts | Some responses | Triggers and driving forces | Some responses | Triggers and driving forces |
| **Alxa league, Inner Mongolia, China** | Increased temperature: about 1°C from 1970s to 1990s. Increased aridification (desertification). General environmental deterioration and biodiversity loss. | Reduced agriculture and livestock productivity and water availability; Impact on human settlements leading to migration. | Desert enclosure and fencing; changes in livestock; State-organised ecological emigration; conversion of farmland into forestland or grassland, aerial seeding, artificial precipitation, Heihe River water redistribution; promotion of sustainable tourism activities in the desert. Water harvesting (underground pools). Artificial rainwater in the Hellan mountains. Reforestation to stop the expansion of the desert ('the green wall'), | Sand storms and increased water stress. Political reorganisation. Institutional changes regarding land privatisation and land ownership regimes. Poverty alleviation policies linked to new development opportunities elsewhere. New scientific findings and concepts now informing local and regional policies. Opportunities for international cooperation in the form of research and development projects. Increased participation of local and private agents. | Still not developed at the regional level, but huge potential within the coal power generation and electricity sector. Post-Bali climate commitments may impact Alxa's coal industry. | New opportunities and potential for large international investments, e.g. in Carbon Capture and Storage (CCS) and Integrated Gasification Combined Cycle (IGCC) technologies. Increased participation of local and private agents. Increasing role of transnational epistemic communities (Schroeder). |
| **Tisza floodplain, Hungary** | Increased temperature; changes in precipitations regime e.g. heavy rainfalls; increased risks of droughts; increasing frequency and magnitude of floods and in-land water stagnation; biodiversity loss. | Physical damage for agriculture and infrastructure; water availability and water quality problems; (indirect) migration of the population from the declining areas.<br><br>Highly transformed ecosystem has lower buffering capacity; unstable social and economic conditions increase the risk for population and economy. | Complex program of land rehabilitation based on traditional techniques of shallow flooding, water retention areas, diversification of land use (VTT plan);<br><br>Traditional adaptation measures - dike construction, relocation of settlements, | Disastrous floods; increasing social awareness and pressure (NGO, etc.); scientific research at national level (VAHAVA plan); Policy debates at the national level (Hungarian National Climate Policy). EU accession: need to comply with EU standards for water management and rural development (WFD, CAP, Natura 2000, etc.); EU funding (Regional Development Fund, Cohesion Fund, CAP). | Potential for energy crop production (scientific research and interest from commercial companies); promoting the idea of biodiversity conservation (wetlands) as carbon storage; promoting local market and small-scale production to reduce energy and fuel consumption. | EU and national climate change programmes and strategies; opportunity for investments in bio-energy production;<br><br>cross-compliance of the adaptation and mitigation goals - biodiversity conservation might also support adaptation and economy (tourism) in the region. |
| **Guadiana river basin, Iberian Peninsula** | Increased temperature. Increased desertification. Erratic rainfall. Impact on local biodiversity. Impact on traditional landscapes such as the 'dehesa' (formed out of cork oaks, and other adapted species). Depopulation. Increase of forest fires. | Agriculture; Tourism ; Water availability; water quality problems: oak tree disease, increased risk of forest fires, migration of endemic species, sea level rise (impacts on tourism, erosion of the coast, etc.) | Agricultural and economic diversi-fication,; increase scale of farm markets, by concentrating on certain products. Dry crop irrigation and water reuse; promotion of rural tourism, local handcrafts and pro-ducts; promoting and modernising the traditional dehesa ecosystem. Identify and plant drought and heat tolerant crops & management systems ; New transboundary institutional arrangements, linked to regional and rural development policies. | Economic globalisation of local farm products (e.g. olive oil). European, national and regional climate change, water management and rural development policies, European funds. Pressure of NGO s and civil society movements. Some new transboundary institutional regional arrangements triggered and supported by EU regional and rural development policies, such as INTERREG, leading to 're-regionalisation'. | Production of renewable energies, mainly sun, and others like bioenergy crops –although now questioned on other environmental grounds. Conservation and promotion of Dehesa, reforestation and soil conservation. | European, national and regional climate change programmes and strategies, local mobility plans. New opportunities for technological innovation in renewable (sun) energy. Beginning of the implementation of national climate and clean energy policy. |

The main conclusions of this still on-going research can be summarised in the following points:

- In the selected regions, the identified actions and measures that apparently have been adopted to mitigate or adapt to climate change have not been triggered by direct exposure to climatic risks or as part of an explicit, conscious and structured climate policy but for other reasons. This does not mean that these *other reasons* –including policies related to privatisation and political reform, consolidation of new agricultural markets, new opportunities for regional development and transboundary cooperation, or possibilities for new scientific and epistemic communities have nothing to do with climate change. On the contrary, a careful consideration and integration of these institutional, economic and social factors is fundamental for the success of long-term climate strategies.

- This does not mean either that climate change has not played a role in the eventual implementation or justification of current regional measures to deal with climate change. In the case of the Tizsa flood plain, for instance, it was the recurring risks of floods and droughts that triggered the attendant preventative actions to cope with floods, in a similar guise that in Inner Mongolia the increasing desertification also motivated a number of policy measures to deal with aridification. However, those impacts originally were not framed as climate change problems, given that such peculiar science and policy framing is very recent at the regional level, a fact which is specially clear in the case of the Guadiana river basin.

More generally, and taking into account a long-term and global perspective we can say that:

- The main challenge remains not in producing end-of-pipe lists of possible 'fit-all' measures to abate climate changes but to develop long-term durable *processes* that are able to integrate local and regional concerns, experiences and conditions, as well as long and short term goals and mitigation and adaptation responses and action in way that is consistent with the total social-ecological resilience of the planet. We argue that a structured and regionalised procedure such as a Policy Appraisal Framework can contribute to this goal.

- The conservation and promotion of cultural and institutional diversity may be one of the best strategies to radically mitigate and adapt to climate change, thanks to the preservation of lifestyles and communities that are already know how to adapt or cope to climatic changes and which require less greenhouse gases to define and practice their happiness and identities.

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