

Public perception and policy of climate change in Catalonia

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Summary

Foreword	7
Introduction J. David Tàbara	9
1. Public perception of climate change in Catalonia. A quantitative approach Roser Solà, Christian Oltra and Roser Sala	13
1.1. Introduction	15
1.2. The study of the public perception of climate change	16
1.3. Results of the survey	19
1.3.1. Affective aspects: concern and seriousness awareness	19
1.3.2. Cognitive aspects: information, knowledge and perception of agreement on climate change	21
1.3.3. Willingness to pay. Action to be taken	22
1.3.4. Opinion on the policy of climate change	23
1.3.5. Preferences on energy technologies	25
1.4. Conclusions	26
1.5. Annex: data sheet of the sample	27
Bibliography	29
2. Perception of the coastline and adaptation to climate change in Catalonia Cristina Tous, Antonio J. Trujillo and Françoise Breton	31
2.1. How is climate change on the Catalan coastline expressed?	33
2.1.1. It never rains but it pours: the factors of artificialisation and population density make the Mediterranean coastline a space particularly vulnerable to the impacts of climate change	33
2.1.2. Socio-economic situation	36

2.2. Challenges posed by climate change	37
2.2.1. The global-local dimension: The principle of caution with an uncertain future and the necessary construction of socially approved responses	37
2.2.2. The exhaustion of resources and the changes in the social and economic situation	38
2.2.3. Research on the perception of the coastline and climate change of the INTERFASE team	40
2.3. Conclusions	45
Bibliography	51
3. Climate change and perception of the risk of flooding in Catalonia	
Maria del Carme Llasat and Montserrat Llasat-Botija	55
3.1. Introduction	57
3.2. An example of the different social impact of two flooding events	58
3.3. Methodology for creating a press database on natural risks and climate change	60
3.4. The social impact of flooding through press information	61
3.5. Comparison between the news on floods and climate change with respect to the rest	63
3.6. Conclusions	67
Bibliography	68
4. Climate change in the Catalan press, 1990-2006	
Anna Serra, Cristina Tous and J. David Tàbara	71
4.1. Introduction	73
4.2. Method	74
4.3. Findings	75
4.4. Discussion	77
Bibliography	79

5. Evolution and current state of the climate change policies	
J. David Tàbara	81
5.1. Introduction	83
5.2. The international and European Context	84
5.3. The Spanish and Catalan framework	89
5.4. Evaluation	99
Bibliography	105
6. To conclude	
J. David Tàbara	107
6.1. Change of perceptions, political agenda and social learning	109
Bibliography	114

Prologue

Climate change is one of the biggest challenges facing us as a society today. Moreover, it is not just a scientific challenge but also one with an evident economic, social, cultural and political dimension. And it is a global and a local issue at the same time: it is *glocal*. All these aspects are important, whether we are talking about its causes or its consequences. It is therefore a complex phenomenon that needs to be understood and recognised by planners and managers as well as by society in general, and by our citizens in particular. Understanding the public and political perception of climate change has become a key factor in guiding the actions that must enable us firstly to raise awareness of this huge challenge, and secondly to motivate changes in our behaviour.

This publication presents a compilation of the studies made by different Catalan university research departments as a result of an agreement between CADS, the Department of Innovation, Universities and Enterprise, the Institut d'Estudis Catalans (Institute of Catalan Studies - IEC) and the Fundació Catalana per a la Recerca i la Innovació (Catalan Foundation for Research and Innovation - FCRI) to study the communication of climate change in Catalonia and its perception. This work focuses on how Catalan society in general, and the media in particular, view climate change and the phenomena that may be associated with it, such as violent storms, floods and coastal erosion, amongst others.

With this publication, the CADS hopes to contribute to adapting and reducing climate change by fulfilling one of its main missions as an advisory body: promoting research and the dissemination of knowledge, in this case in the field of social sciences, in relation to sustainable development in Catalonia. Understanding the public perception of this phenomenon and conveying an analysis of it to planners and decision-makers is one of the remits of the CADS, and should enable us to develop more realistic, targeted policies not just for tackling the immediate objectives of global warming but also to address the level of priority all of us give to this issue and the manner in which we approach it.

The Advisory Council for Sustainable Development has a great deal of experience in collaborating in research on climate change. For many years now the CADS, together with the Meteorological Service of Catalonia and with the support of the Institut d'Estudis Catalans, has been behind the drafting of the first exhaustive study on this issue in Catalonia, which was published in 2005 under the heading of *Report on Climate Change in Catalonia*. The report had a big impact on every level and is still the benchmark publication for everyone working in academic research and other disciplines on climate change. Headed by Professor Josep Enric Llebot, a recognised expert and authority on this subject, the re-

port represented an interdisciplinary achievement as it included the scientific, social and institutional aspects that were necessary to illustrate the panorama of climate change in Catalonia. Studies are currently underway that will result in a second report, which will delve even deeper into, and update, the contents of the previous report on a subject – Climate Change – towards which huge, and very necessary, research efforts are being directed in both Catalonia and around the world.

The coordinator of the publication presented here was Dr. David Tàbara, who was also involved in the first *Report on Climate Change in Catalonia*, which led to the constitution of the Group of Experts on Climate Change in Catalonia (GECCC), of which he is a member. The GECCC is made up of more than fifty experts in Catalonia who study climate change from different scientific approaches (scenarios, adaptation, mitigation, effects on health, social perception, regulatory context, competences, etc). The GECCC has now become an advisory authority for the public authorities and for debate on climate change, under the auspices of the CADS.

Understanding people's perceptions of climate change in general, and its repercussions on Catalonia in particular, is of great interest when it comes to tackling the different kinds of challenges facing us – scientific, social, cultural, political and economic. At the CADS we are confident that this new contribution will help towards a better understanding of what our citizens are thinking and, as a result, will give us more scope for making the right decisions on what we in Catalonia need to do to address this huge global challenge.

Ramon Arribas i Quintana
Director, CADS

Introduction

Our perception of the world is always selective. We can not perceive everything that surrounds us at all times. The mechanisms and factors that influence the perception of our reality are diverse and complex, and can never come down to a single dimension. Personal experimentation, the role of the media, our own interests and social conditions, oblige us to take a decisive and often different perspective on the same social reality. Partly, as was said by Aaron Wildavsky and Mary Douglas in a famous essay called *Risk and Culture*, “we end up perceiving what we want to perceive”, simply to justify and back up our own beliefs, values and lifestyles.

However, in matters concerning climate change, we must beware of falling into an excessively relativist or constructivistic-social position. In the same way as we social scientists are interested in seeing how the different social groups see things in a different way, we are also interested in explaining *why* some people perceive things in one specific way, or simply why they do not perceive them. The curious ‘apperception’ of climate change by certain social groups, including certain economic or political corporations, does not only respond to lack of awareness or ignorance problems. It is obvious that this also affects (and might explain why it is that public or private investment is still carried out in delta, coastline or mountain areas) but there are other factors. Studying the role played by the interests and the power structure, or how the processes of knowledge diffusion are materialised is essential to understand and explain why we end up perceiving what we perceive. In this sense, one of the most noticeable singularities in the perception of climate change has been the important role that *political science* has had in recent years and in particular, the procedures for the integral evaluation carried out by the Intergovernmental Panel on Climate Change. It seems, though with some difficulties, that the weight of shared scientific reason broadcast through the media, is beginning to modify certain public perceptions and finally is being imposed on certain corporate interests and powers.

Certainly, concern for climate change has already become international. Recent results obtained by the *Pew Global Attitudes Project* in 37 countries (<http://pewglobal.org/>), show that global warming is generally considered a serious problem in most cases. This study showed how 70% of the Spanish population considered that climate change was a very serious problem (figure 1). Other works, like those performed by the *Real Instituto Elcano*, in June 2006, were aimed at observing more political questions with regard to the problem, although 80% of the Spanish population said that at some time they had heard

talk about the Kyoto Protocol, against 19% who had not and 1% who did not answer. In the same study, when asked to what extent they believed that Spain was complying with the global commitments of fighting against climate change in comparison with other neighbour countries, 48% of the interviewees said 'less', 37% said 'the same', and 12% said 'more' against 3% that did not know or refused to answer¹.

The aim of this article is to present a series of recent research works and work groups which have worked on the question of the perception of climate change in Catalonia from different perspectives. Likewise, it was considered convenient to include a section on the situation and evolution of climate policy, which could better place the reader in the institutional context where the current discussion on the subject lies. It is a pleasure to see the growing participation and concern by Catalan social scientists in these subjects, with different theoretical backgrounds and methodological approaches.

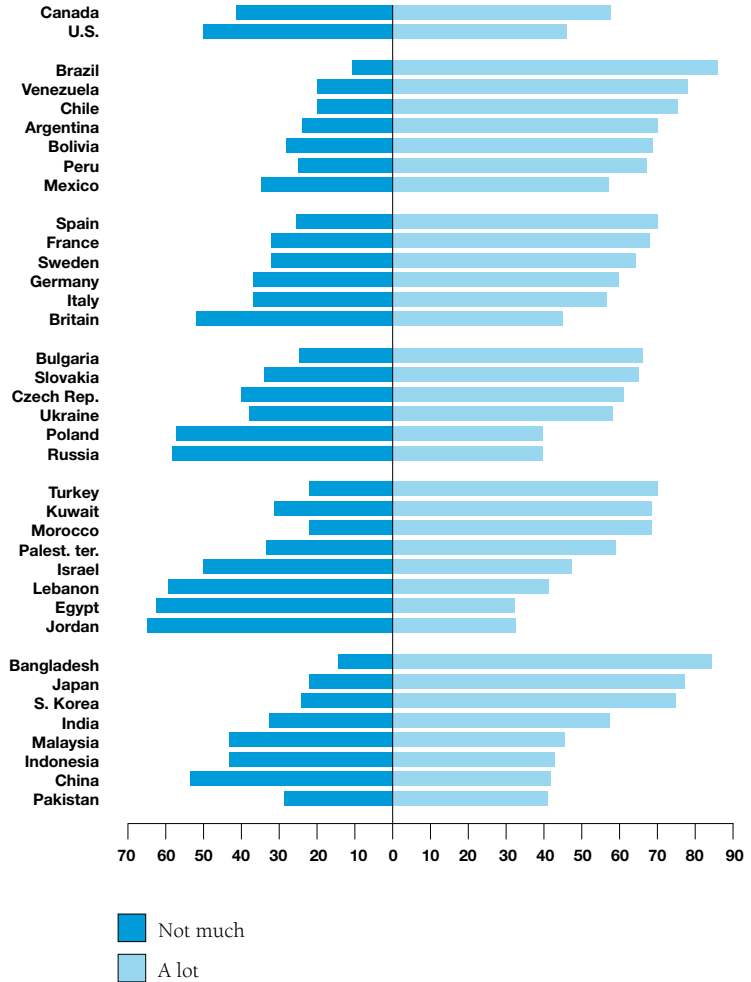
The work begins with the chapter by Roser Solà, Christian Oltra and Roser Sala, which gives the results of a survey carried out in Catalonia in December 2006. It is an important study, firstly because it is the largest survey carried out to date in Catalonia on the specific subject of climate change (according to our information). And secondly, for the amount of findings it presents and which situate global warming as one of the main environmental concerns in Catalan society. It is striking in the study the position of the Catalan population against nuclear energy, a technology often discussed as a possibility when dealing with climate change².

The chapter by Françoise Breton, Antoni José Trujillo and Cristina Tous deals with the perception and the problem of climate change in the coastline areas. Climate changes poses the need to adapt to a highly anthropised, transformed environment with many links with other social and environmental dynamics. According to these authors, in general people do not perceive the coastline as an ecological, functional system connected to the inland area and tend simply to see beaches as a place for leisure, where the perception of the coastline ends on the shore. However, in their opinion, a change in perception is occurring of what the coastline constitutes, a process that could be intensified by activities of evaluation and management aimed at adapting to climate change, now possibly with a

¹ Real Instituto Elcano. Barometer of the Real Instituto Elcano (Brie). *12th wave. Results June 2006*. Madrid.

² The matter of nuclear energy and climate change is constantly in media, for its defenders very often mistake *energy for electricity*. On the other hand, it is argued that nuclear energy is not a real option to climate change as it is an energy principally aimed *only* at the production of *electricity* (60% in Catalonia), which only accounts for a very small part of all *energy* consumption today (under a quarter in Catalonia). The contribution of nuclear energy (not electricity production, but the total consumption of final energy) is effectively very small and is not easy to actually increase (today, it only covers 14.5% of the final energy consumption in Catalonia). Moreover, it is said that nuclear energy is an energy based on a non-renewable and limited resource, with long-term large-scale serious potential risks, with energy lifecycle analyses that show that its installation and operation requires far more energy than it finally produces. It is therefore possible that the public is not so mistaken in this sense.

Figure 1. Global warming, how important do you consider this problem?



(Source: Pew Research Center Project. 2007.47-Nation Pew Global Attitudes Survey. Pew Research Center: Washington, USA. www.pewglobal.org [27th June 2007])

more participative, integrated nature. These changes in perceptions may also be stimulated by the new information technologies and the new models and tools of environmental accounting, which better represent the possible future impacts, and develop indicators and evaluations that could play an important role in the coast-line planning policies.

The chapter by Maria del Carme Llasat and Montserrat Llasat-Botija and the chapter by Anna Serra, Cristina Tous and J. David Tàbara focus on analysing the press as a way to explore perceptions of climate change in Catalonia. International research has shown that the public perception of global problems such as climate change is highly dependent on the media. In the first study (focused on the examination of flooding as a paradigmatic example of one of the possible effects of climate change), the authors find that tolerance thresholds of the Catalan population are falling: situations that were previously accepted as normal are now considered extraordinary. Anna Serra et al. have detected a spectacular increase in the number of news related to climate change in Catalonia, and distinguish between two different periods ranging from 1990 to 2003 and from 2004 to 2006. As a hypothesis, they argue that during all this whole period, new cultural frameworks have appeared when interpreting climate change, such as the discourse that stresses the economic, social and health aspects of the climate problem.

Although we hope that the results given here are interesting, at least for their originality and, I would even dare to say, their specularity, we must say that these documents are far from exhaustive. The intention is only to show some findings and recent examples from different research groups in Catalonia. I would not be surprised to very soon see more national specialists of social and environmental sciences taking an interest in finding out how we perceive climate change, which populations are most aware (or most unaware) and the factors that have the greatest effect on their social affirmation. Explaining and understanding how we perceive our own reality is the basis for being able to begin to change it, if needed, if we can and want, with a little more intelligence.

1. Public perception of climate change in Catalonia. A quantitative approach

**Roser Solà
Christian Oltra
Roser Sala**

1. Public perception of climate change in Catalonia. A quantitative approach

Roser Solà, Christian Oltra and Roser Sala

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1.1. Introduction

In recent years, there has been significant progress in public broadcasting of climate change. The Stern report on the economic impact of climate change, the Conferences of the Parties to the United Nations on Climate Change in Nairobi, the appearance of the documentary *An inconvenient truth* by Al Gore, and the campaigns started by different governments and ecologist organisations have stimulated public discussion around the seriousness of climate change and the possible strategies for mitigating it and adapting to it. The potential environmental and social consequences of climate change have taken an outstanding place in public debate. From three different areas, the need has been indicated for cooperation between all of the social actors, the government, the economic actors, the non-governmental organisations, the experts and the general public in developing effective actions in view of the possible impacts of climate change.

To ignore the values and attitudes of the public when deciding on the management of climate risk may lead to problematic situations (Lorenzoni and Pidgeon, 2006). The political measures regarding climate change will require a certain degree of acceptance and public understanding to be able to be implemented. Understanding the social perception of climate change, the political attitudes and preferences of the citizens, could help in designing more effective communication strategies, in establishing research priorities, in designing policies better adapted to the concerns of the citizens and in nurturing the involvement of citizens in the public discussion on climate change.

In order to examine the public perception of climate change in Catalonia, this chapter shows the results of a survey to the Catalan population carried out in December 2006. It is one of the main efforts made to explore the Catalan population's perception of climate change. The aim of the study is to analyse different dimensions of the public perception and opinion concerning climate change. Matters are considered such as: the degree of concern for climate change, the degree of information and knowledge, the energy technology preferences, the opinion on the work of the government, the perception of agreement among the scientific community and the perception of different mitigation and adaptation options.

1.2. The study of the public perception of climate change

The effort to know the public's perception of climate change starts more systematically in the late 1980s, as a logical development of the studies on the concern for the environment since the 1960s (Bord, Fisher and O'Connor, 1998). Since then, research in social sciences has adopted different approaches such as public opinion studies, studies of the attitude to climate change and the perception of the risk. Different quantitative methodologies based mainly on surveys and qualitative methodologies, or based on discussion groups, participative processes and interviews have been adopted. Research into the public perception of climate change has thus gone further into different dimensions, such as: citizens' true knowledge of climate change, the existing degree of concern among the population, the risk perceived by the individuals, the support for certain policies of mitigation and adaptation, the perception of possible solutions to climate change and confidence in the different social actors.

The studies of public opinion on climate change have held an outstanding place in social research in recent years. One of the points on which the different international studies converge is that citizens have a general high concern for climate change. The surveys carried out in different countries in recent years show that citizens' concern for climate change is high. However, this concern still fails to match that of other problems. If we look at the international surveys data (Dunlap et al., 1993; Brechin, 2003) in the 1990s, in a large part of the countries selected, most of the population was at least slightly concerned about climate change. This concern seems to be confirmed in different studies. Studies made in the United States (USA) and Great Britain (Immerwahr, 1999; Bord et al., 1998; Norton & Leaman, 2004) show that a large majority of citizens from both countries consider that climate change is a real problem and are concerned about them. Likewise, citizens seem to give widespread support for the efforts of the government to reduce greenhouse effect gas emissions (O'Connor, Bord i Fisher, 1999).

According to data of the Eurobarometer on the environment (European Commission, 2005), climate change is one of the four environmental problems that most concern European citizens, along with water pollution, man-made disasters and air pollution. This concern varies significantly between the different European countries, with less concern among new members. The public perception of climate change in Spanish society does not seem to differ greatly from the other countries of the European Union (EU). If we look at the data of the Eurobarometer and the Centre for Sociological Research (CIS, 2005; European Commission, 2005), in European and Spanish society, climate change appears as one of the main environmental problems for citizens.

In Catalonia, there are few investigations that have analysed the population's perception of climate change³. The most significant quantitative studies on the perception of environmental problems, which include the question of climate change were carried out in 1994 (Tàbara, 1995) and 2000 (Environment Department, 2001). The available data generally show a slight increase in the public concern of the Catalan population for climate change in recent years. This perception remained stable in the 1990s, with a tendency to increase alongside the general concern for environmental problems. In 2000 climate change was the third most important environmental problem for the citizens, behind forest fires and the thinning of the ozone layer.

Between 1996 and 1999, a qualitative study was carried out based on the *Integrated Assessment Discussion Groups* methodology, to go further into the generation of collective knowledge and reflections on climate change in Barcelona (Tàbara, 2000). The study shows how individuals more broadly contextualise the question of climate change, by referring to social, ethical and political aspects. The need for individual action in mitigating climate change is widely known, but more limited by the lack of information than by psychological, social and political matters. Individuals' participation in the integrated assessment caused an increase in the perception of uncertainty on climate change, a greater feeling of a need for action, greater acceptance of economic and legal measures, and greater awareness of the need to reduce consumption throughout the population.

More recently, the Omnibus study (Centre d'Estudis d'Opinió, 2007) brought in some questions referring to the environment and climate change. The study asked citizens about the measures that the Generalitat should tackle to deal with climate change. The data reveal a public preference spread around the three suggested options. In the first place, a change in habits (47%), referring to the importance of individual behaviour regarding the consumption of energy and resources. In second place, legislative measures are considered necessary (20%) and finally, incentives to companies and citizens (20%). These results show the existence of significant public awareness on the need to make changes in lifestyles and consumption habits, while the importance is considered of legislative and economic measures.

The great concern shown for climate change must be clarified, as is shown by the studies on social perception. The study's analyses of the perception of climate change are sometimes ambiguous (Kempton, 1991; 1997), as they analyse topics on which people have not reflected sufficiently, and may not precisely reflect the attitudes of the citizens. For this reason, the studies on these questions generally show certain ambivalence (Lorenzoni & Pidgeon, 2005). First of all, because citizens seem to be less concerned about the problem of climate change than about

³ A summary of the main results of these studies on the public perception of climate change in Catalonia, based on surveys or qualitative in nature, can be found in Tàbara (2005).

other social, personal or environmental matters. Secondly, because although there is great concern for climate change, citizens show little concern for the risks associated with this problem, which as we will see, is considered a little distant and is not related to the citizens' daily lives and individual behaviour. Thirdly, because true awareness of climate change among citizens seems to be small.

The data therefore seem to indicate that the great concern for climate change among citizens in different countries may be a reflection of socially desirable responses and not true estimates of the risk (Bord et al., 1998). People thus consider climate change as something fairly serious just as they would do with other problems that might be suggested to them and depending on the social and political context of the time, and not because they have a true perception of the risk. Furthermore, the evolution of this concern among citizens shows a fluctuating and not a growing tendency, which is highly significant. Therefore, for example in the United States the percentage of people considering climate change a very serious issue fluctuates in the 1980-2003 period, and the level of public concern falls lower in 2003 than in 1989 (Brenchin, 2003).

Citizens' opinions of the different measures for mitigating climate change have not received so much attention since the studies of the social perception of climate change. A recent work on public attitudes to energy policy and climate change in different countries (Reiner et al., 2006) showed that the attitudes to climate change vary significantly between countries. However, international public opinion seems to give more importance to the balance between the support for individual replies to climate change and the support for technological replies. As recent studies have shown (Poortinga et al., 2006; Reiner et al., 2006), both the change in individual behaviour and the use of renewable energies or the application of efficient technologies receive significant public support. In other words, public trusts in the development of renewable energies and technology to face climate change, but also in changes in individual behaviour to reduce energy demands. Regulations and taxes, and the use of nuclear energy are the options for mitigating climate change most poorly evaluated by citizens (Poortinga et al., 2006).

In short, despite the easy convincing public opinion and the many elements of attitude and context that influence pro-environmental behaviours (Stern, 2000), different attitudinal factors of individual action have been identified with regard to climate change. Elements such as the perception of climate change as a serious social threat, the true awareness of the causes of climate change (O'Connor et al., 2002) or the presence of pro-environment values and beliefs are elements that influence individual intentions to take action and support for governmental actions to mitigate climate change. Despite the difficulties and limitations in studying public perception of climate change, these and other questions must continue to be pursued to achieve a better understanding of the replies of society, its individuals, organisations and institutions to global environmental change.

1.3. Results of the survey

The survey was run by researchers from the *Massachusetts Institute of Technology* (MIT) in the USA. It had previously been given in the United States, the United Kingdom, Sweden and Japan. It is intended to study public attitudes to key questions on energy and environment. When taking decisions and reporting strategies to be adopted, it is essential to understand the attitudes of the public to climate change and their preferences and awareness of the technologies to mitigate the anthropogenic emission of greenhouse gases.

The analysis of the study shows a series of descriptive indicators of the perception of the Catalan population with regard to climate change. The study basically deals with questions such as: the degree of public concern at climate change, the importance of climate change on the economy, the awareness of a series of strategies to face up to climate change (energy saving, more efficient electrical appliances and cars, nuclear energy, biomass, wind energy, solar energy, collection and storage of CO₂), preferences on strategies for facing and the will to pay more money on the electricity bill to solve climate change, and the opinion on the governments action with respect to climate change (central and autonomic).

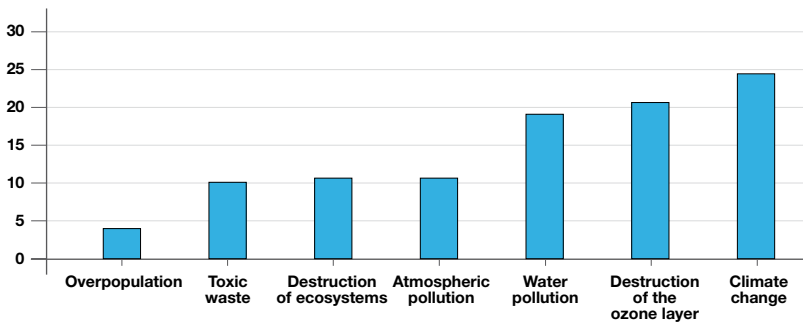
1.3.1. Affective aspects: concern and seriousness awareness

The interviewees were first asked about what was in their opinion the most important question their country faces, to indirectly know the citizens' concern for the environment. These questions were the following: immigration, public safety, environment, economic aspects (such as unemployment, poverty and taxes), assistance services (such as teaching, health and the elderly people), social welfare and values (which would include family values, drugs, etc.). Of all these possible problems, 31% the Catalans give priority to immigration, followed by public safety (19%). The environment appears in third place, not far from the previous (15%). Therefore, only 15% consider the environment as the first problem the country faces, which reflects a very low general concern for the environment.

General concern for the environment is low when asked about other social or personal aspects related more closely to the daily lives of those surveyed; when we ask about the importance of the environment with respect to the economy, the large majority of those surveyed clearly give priority to environment. In fact, 31% say that the environment has absolute priority, whereas 42% consider that although both aspects are important, environment is a little more. There would therefore seem to be a significant public attitude in favour of protecting the environment, according to the cultural tendencies of advanced societies. Only 20% of Catalans believe that the economy has priority over the environment.

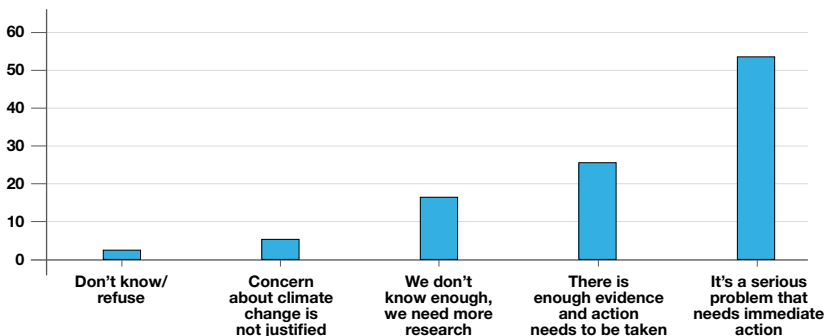
When being more specific and asking about the different environmental problems, and which they believe to be the main challenge in the country, climate change comes first with 24% of replies (Figure 1.1). Therefore, although the environment in general is not considered the main problem today, climate change does appear as the fundamental environmental problem, closely followed by the depletion of the ozone layer and water pollution.

Figure 1.1. First environmental problem the country faces



With respect to the perception of the seriousness of climate change, a significant 53% recognise that it is a serious problem that requires immediate action; 24% believe that there is enough evidence for action to be taken. On the whole, 77%

Figure 1.2. Perception of seriousness of climate change



of the Catalan population believe that climate change is a sufficiently important problem for more or less immediate action to be taken. Only 18% believe that more research is required before doing anything, and 3% believe that the concern for climate change is somewhat unjustified. There therefore seems to be strong agreement with respect to the seriousness of this problem and the need to take measures.

1.3.2. Cognitive aspects: information, knowledge and perception of agreement on climate change

To study the amount of information on the different energies and technologies proposed for mitigating climate change (energy-efficient electrical appliances, hydrogen cars, biomass and wind energy) they are asked whether they are aware of the different technologies. Figure 1.3 shows that it seems that the Catalans know a large part of the options, except for: the collection and storage of CO₂ (of which one out of every ten people have heard) and bioenergy or biomass (of which only 28% admit to have heard). On the other hand, there is especially solar energy, wind energy and energy saving, as more than 90% of Catalans say they have information about these. Hydrogen cars are in an intermediate state; approximately 7 out of 10 people say they have heard about this.

To evaluate the Catalan population’s awareness of the causes of the atmospheric emissions of CO₂, they were asked what impact a series of activities may have on CO₂ levels. There generally seems to be a tendency to affirmative answers, that is, to say that most of them contribute to increasing carbon dioxide concentrations. Therefore, for activities that really contribute to increasing these levels (cars, factories, coal combustion plants and domestic heating) the percent-

Figure 1.3. Awareness of different technologies

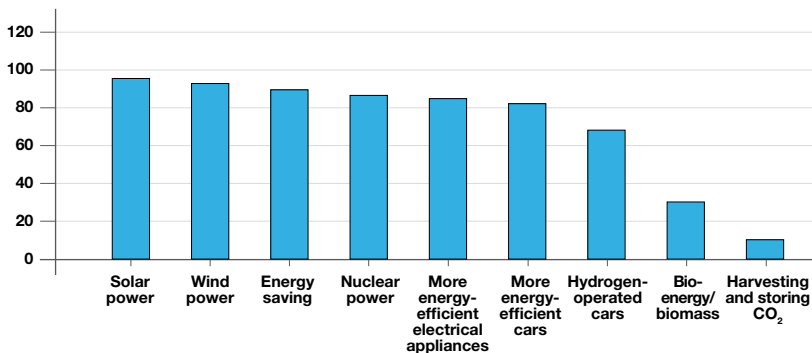
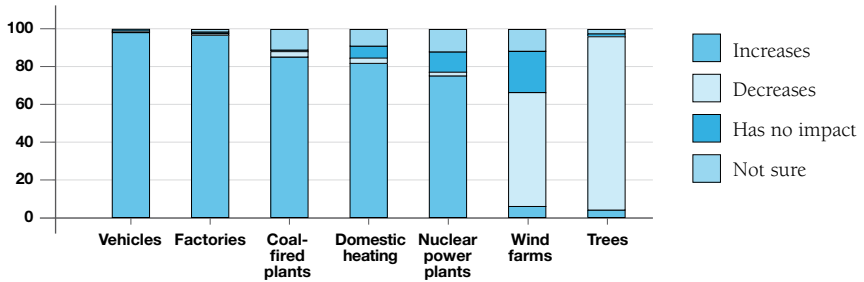


Figure 1.4. Awareness of the causes of the emissions of CO₂



age of right answers is very high, ranging between almost 99% for cars (it seems very clear that cars give out CO₂) and 82% in the case of domestic heating. We also find a high percentage of correct answers when asking about the impact of trees on CO₂ levels: 92% of the Catalan population understand that they contribute to reducing the atmospheric concentrations of carbon dioxide; 75% say that the nuclear power stations increase CO₂ levels, and with respect to wind farms, 60% believe that they reduce CO₂ levels. Finally, the activities that present most uncertainty and therefore receive a higher percentage of replies (“Not sure”) are the wind farms, the nuclear power stations and the coal combustion plants.

With respect to the perception of agreement among scientists on the question of climate change, the study reveals some significant data. Although 44% of Catalans feel that scientists agree with the subject of climate change, this almost half of the population is countered by a large 43% who perceive great disagreement among the scientific community on this subject, and 13% prefer not to give their opinion on this question.

1.3.3. Willingness to pay. Action to be taken

Although different studies have shown that concern for climate change and pro-environmental values are not always predictive of actions to solve the problem, people were asked about their individual willingness to pay more to finance corrective measures. This would be understood as a will to take action, although it can not really be interpreted as action. The question consisted of asking whether they would be willing to pay 5 euros more on their electricity bills to participate in the payment for actions to palliate climate change. If the answer was affirmative, the same question was asked with 10 euros and so on with 25, 50 and up to 100. 71% of Catalans said they would agree to pay 5 euros more for

Figure 1.5. Willingness to pay more to finance the solution of climate change

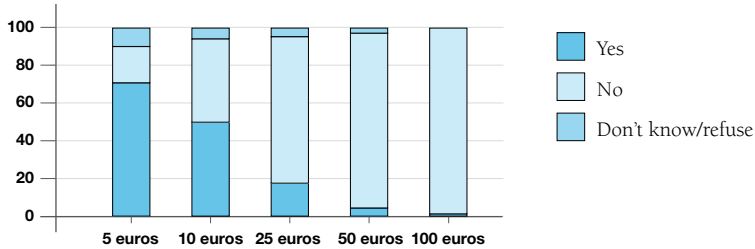
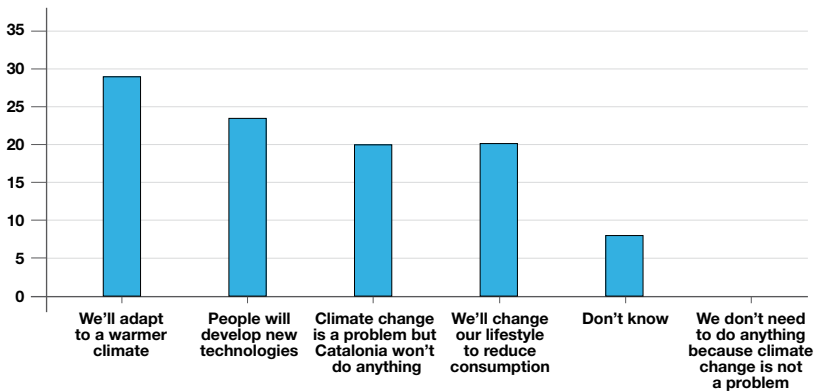


Figure 1.6. Beliefs on how Catalonia would face climate change



this reason, but this percentage falls to 50% at 10 euros. The percentage of those willing falls significantly as the amount to be paid rises: only 18% say they would be willing to pay 25 euros, 5% 50 euros and 2% 100 euros.

When the Catalans are asked about how they believe climate change would be dealt with in their country, only 20% reply that it would be necessary to change their lifestyle to reduce consumption; on the other hand, 29% believe that they will simply adapt to a warmer climate, while 24% believe that new technologies will be developed to face this problem; a further 20% believe that although climate change is a problem, Catalonia will not do anything.

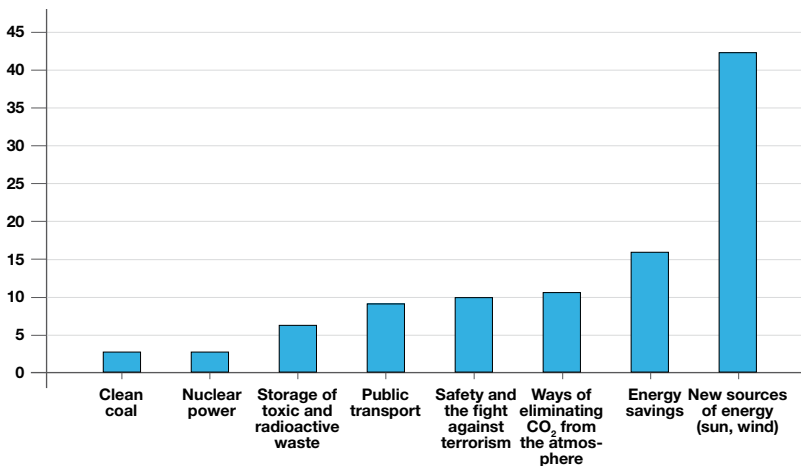
1.3.4. Opinion on the policy of climate change

Concerning the Catalans' evaluation of the actions taken by the governments (central and autonomic) to mitigate climate change, we find practically unanimous agreement on the need for governments to do more (approximately 95% in both cases). Only 3% consider that the governments are doing the right thing to solve the problem of climate change.

Therefore, those surveyed consider that the reduction commitments assumed by the government are desirable (92%), and only 1.5% says they are not. The citizens are also divided on whether they are reasonable or not: 46% believe that as well as desirable, these commitments are reasonable, whereas 45.5% believe that although they are desirable, they are not very reasonable; 7% of citizens say that they are not sure.

On the other hand, when asked about which option the competent authorities should finance first to confront climate change, the Catalans clearly prefer new sources of energy, such as solar or wind. Specifically, 42% agree to this. In second place we find energy saving with 16% and in third and fourth places, respectively, the ways of eliminating CO₂ from the atmosphere (10%) and public transport (9%); nuclear energy and clean coal combustion, on the contrary, receive around 3%. Catalans therefore believe that it would be necessary to finance collective solutions related to alternative energies first and then more individual type solutions such as

Figure 1.7. Options for authority financing

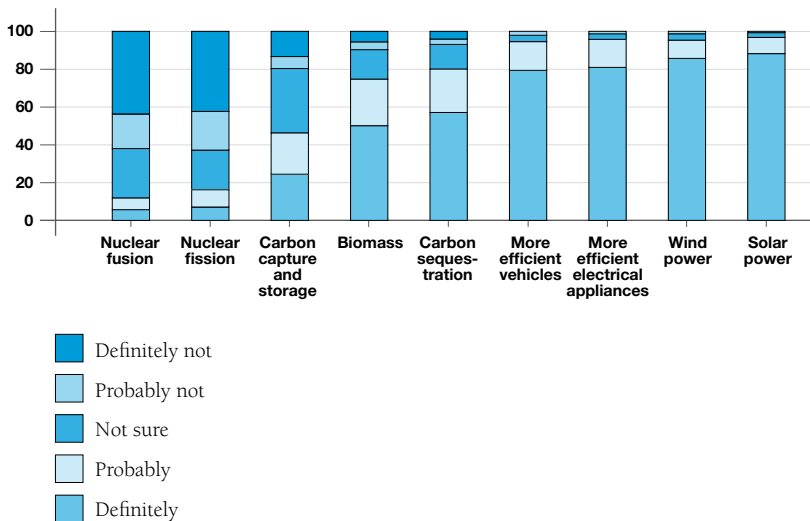


energy saving. These results could be explained by the awareness of the possible solutions, as there is more information on solar and wind energy and on their relationship with climate change. The relationship between the incentive of public transport and climate change is probably less well-known. Furthermore, we see how the population does not come down much in favour of nuclear energy.

1.3.5. Preferences on energy technologies

Finally, individual preferences were explored with respect to different technologies or energies proposed as available technological or energy options, or future options for attenuating climate change. For each of these options, a brief description was made to give them a basic idea of what it consisted of and they were asked to say whether they would use it or not. Figure 1.8 shows the answers. Of all of those suggested, looking at the percentage of people who say they would use the energy, the best accepted is solar (88%); closely followed by wind energy (86%); more energy efficient electrical appliances (81%) and more energetically efficient cars (79%). Therefore the Catalan population comes out in favour of new energy sources and energy efficiency. 57% of the population are in favour of using CO₂ sequestration, defined as: “the use of trees to absorb the carbon dioxide in the atmosphere” and 50% are in favour of biomass: “the production of energy from trees or agricultural waste”. The

Figura 1.8. Individual preferences of use for mitigating climate change



collection and storage of CO₂ (defined as “collecting the CO₂ given off by energy centres and its storage in underground reserves”) lies in seventh place with 24% that say they would surely use it and 22% that say they would probably use it. The last places are held by nuclear energy (“production of energy through nuclear fission reactions, such as the current nuclear power stations”) with 6.5% of people saying they would surely use it and 9.5% saying they would probably use it, and nuclear fusion (“energy generated from nuclear fusion reactions”) with 5% who say they would surely use it and 6% saying they would probably use it.

Looking at the rejection percentages, that is, the amount of people who say they would certainly not use this option to mitigate climate change, nuclear fission energy stands out (42%) and also nuclear fusion (44%). Following this, though with a much smaller percentage, the collection and storage of CO₂ (13%), biomass (5%) and CO₂ sequestration (4%). As for the remaining options, the absolute rejection percentages lie at around 0%.

Finally, if we consider the rates of uncertainty, the higher percentage is for collecting and storing CO₂ (34%) followed by nuclear fusion (27%) and fission (21%). Biomass and sequestering are at an intermediate point (16% and 13% respectively) whereas uncertainty is very low (under 4%) in the remaining options.

1.4. Conclusions

The results of the survey show that the deterioration of the environment is the third general concern for citizens in Catalonia, after immigration and public safety. Despite this, only 15% of Catalans consider that environment is the main problem of the country. However, when the economy-environment dilemma is posed, a large majority (73%) declare that the environment is a priority over the economy. Confirming the wide public diffusion of the problem of climate change in recent years, this appears as the main concern among different environmental problems. 24% of the citizens deem so. Despite the difficulties of comparing with the data of 2000 (Environment Department, 2001), it seems that the question of climate change has gained public importance in the last seven years. Therefore, 53% recognise that climate change is a serious problem that requires immediate action. We could therefore say that there is outstanding awareness of the problem of climate change in Catalonia and that a large part of the population feels concerned, in a certain way, as it is seen as a serious problem.

The Catalans have information on a large part of the energy or technological options that have been proposed for mitigating climate change. Particularly solar and wind energy stand out, which are widely recognised by the Catalans. However, some proposed technologies, such as the collection and storage of CO₂ or biomass are less known. Similarly, the majority of Catalans know the impact of certain activities on the CO₂ emissions: they know that cars, factories, coal combustion plants

and domestic heating increase these levels and they also know that the trees contribute to reducing them. The most important confusion refers to the effect of the nuclear power stations and the wind farms. The population is divided over the perception of whether the scientists agree on climate change. Generally, with respect to information and knowledge, we could say that the citizens of Catalonia have information, and therefore know some of the aspects related to climate change, but that there are knowledge gaps that cause confusion.

Individual willingness to pay in order to contribute to attenuating climate change is rather low. Although 71% of Catalans say they would be prepared to pay 5 euros more on their electricity bill to contribute to financing climate change, only 20% admit that this problem will be dealt with by changing our lifestyle and reducing consumption. The majority believe that the solution lies in developing new technologies to resolve the problem or in simply adapting to a warmer climate.

There is practically unanimous agreement on the fact that both the central and autonomic governments must do more to deal with climate change. The commitments achieved by these authorities are perceived as desirable, though practically half of the population does not think they are reasonable. Citizens want financing, in the first place, for renewable energy sources such as solar or wind energy, and energy saving in second place. On the other hand, there is little willingness to finance nuclear energy or clean coal combustion.

Finally, the Catalans prefer the use of renewable energies (solar and wind) and energy efficiency (applied to cars or electrical appliances) to mitigate climate change. Most of them are against the use of nuclear energy (both fission and fusion) for this reason. Many are undefined with respect to the technology for collecting and storing CO₂, proposed by the IPCC. Biomass and carbon dioxide sequestration by the trees and plants are in an intermediate term. Once more these results might be affected by the information and knowledge that the citizens have on each of these options.

1.5. Annexe: data sheet of the sample

Confidence level: 95.5 %

Variance: $p=q=0.5$

Size of the sample: 500 individuals

Margin of error: $\pm 4.47\%$

Area: Catalonia

Universe: Catalan population 18 years old and older residing in Catalonia.

Method for collecting information: Computer Assisted Telephonic Interview, CATI

Sampling procedure: Multi-stage design with layering by province and size of municipality, with random selection of the end units (individuals) by quotas of sex and

age. The layers were formed according to the size of the habitat in the municipalities. The level of studies was checked for all of the interviewed individuals.

The size of the municipalities was divided into 6 categories:

- 5,000 inhabitants or under
- From 5,001 to 50,000 inhabitants
- From 50,001 to 500,000 inhabitants
- Over 500,000 inhabitants

The age groups were:

- from 18 to 24 years
- from 25 to 34 years
- from 35 to 49 years
- from 50 to 64 years
- 65 years or more

The study groups were:

- under primary school or primary school incompleted
- first grade (primary school)
- secondary school, first cycle
- secondary school, second cycle
- university (3 years degree)
- university (4 years degree, doctorate)

The base used in calculating the quotas was the Population Register of 2006.

Size of the sample: 500 interviews with the following provincial distribution:

- Barcelona 376 interviews
- Girona 47 interviews
- Lleida 29 interviews
- Tarragona 54 interviews

Sample error: The margin of error for the whole sample is $\pm 4.47\%$, with a confidence level of 95.5% and on the assumption of maximum uncertainty ($p=q=50\%$).

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2. Perception of the coastline and adaptation to climate change in Catalonia

**Cristina Tous
Antonio J. Trujillo
Françoise Breton**

2. Perception of the coastline and adaptation to climate change in Catalonia

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INTERFASE Team. Research Group in Coastal and Scenic Resources. Geography Department. Universitat Autònoma de Barcelona

2.1. How is climate change on the Catalan coastline expressed?

2.1.1. It never rains but it pours: the factors of artificialisation and population density make the Mediterranean coastline a space particularly vulnerable to the impacts of climate change

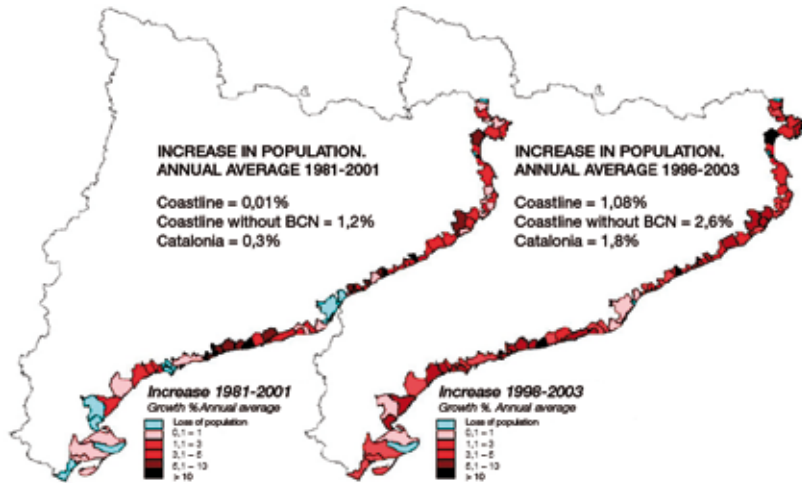
The coast, the inter-phase area between land and sea that includes the coastline, including the estuaries, deltas and the continental shelf, is a strategic area for social and economic development. The coastline is therefore exposed to many anthropic pressures –urban, industrial, agricultural, fishing and tourist– to which an additional pressure is applied: climate change (Breton, 1996a). The risk of climate change threatens above all the low coastal areas, and particularly the relative rise in the sea level and the intensity and frequency of storms, with everything that this might suppose for the local population and its activities.

In 2000, according to data of the Plan Bleu, one third of the population of the Mediterranean countries lived in the coastal regions (NUTS 3 level shore administrative regions for European countries, and the equivalent for other countries). By 2025 this population is expected to have risen by 20% to 176 million. This increase will be particularly due to the high annual growth rate of the countries of the southern and eastern shores such as Egypt, Algeria and Turkey. On the northern shore, the annual growth rate is expected to be negative, although in Spain it is 2.3% (Attané & Courbage, 2001).

In Catalonia today, nearly 70% of the population live within twenty kilometres of the coast (DPTOP, 2005). The coastal population increased each year by 1.8% between 1998 and 2003. If these statistics do not include the Barcelonès region, the increase is of 2.6% per year. This is because Barcelona is suffering a marked loss of population (figure 2.1).

With respect to the tourist population, the seasonal population on the Catalan coastline in 1998 accounted for 21.08% of the whole of the coastal popu-

Figure 2.1. Annual average growth in population of the coastal municipalities in Catalonia, increase from 1981 to 2001 and from 1998 to 2003



(Source: DPTOP, 2005 from data from IDESCAT.)

lation, and over 50% on the Costa Brava and the Costa Daurada, whereas on the coasts of the Metropolitan Region of Barcelona the figure did not exceed 25%, apart from Sitges (DPTOP, 2005). The Costa Brava is the coastal region of Catalonia with the largest seasonal population, with 2.6 visitors per inhabitant in 2001. Moreover, 30% of the tourism on the Costa Brava has there its second homes (Sardà et al., 2005). This residential tourism, generally from other countries of Europe, travels with great ease in private vehicles and low cost companies. The coastal plain works as a privileged axis of communication and is witness to the present massive movements of population (for work or leisure). It is normal to find large infrastructures, such as airports with great passenger traffic, just a few kilometres from the coast. These artificial elements are found along the whole of the Mediterranean coast (figure 2.2).

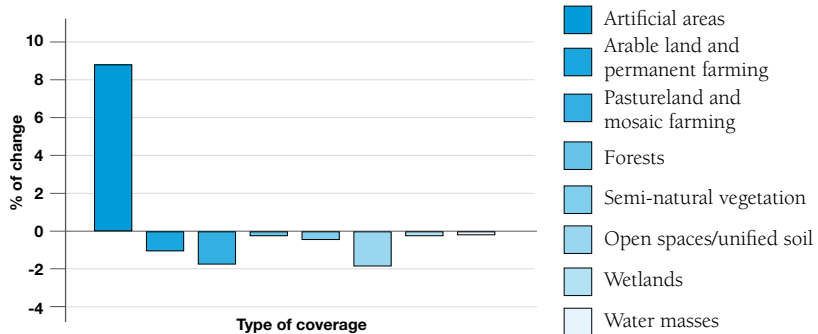
The coastline is suffering from progressive artificialisation, which is particularly intensive within the first 10 kilometres from the Mediterranean coast, where the artificially covered surface area increased in 1990-2000 by 804 km², or 9% (figure 2.3). Spain, with 18% of coastal area built, is among the first three European countries with the largest percentage of artificial area on the coast. The growth rate of this kind of surfaces in Europe was 33% faster on the coast than inland, and particularly within one kilometre from the sea (EEA, 2006a).

Figure 2.2. Coastal roads and airports



(Source: Plan Bleu, 2005: <http://www.planbleu.org/red/>)

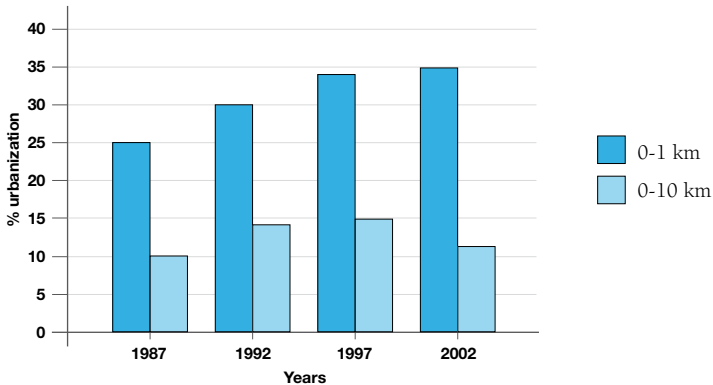
Figure 2.3. Changes in the land cover within 10 kilometres from the coast in the Mediterranean countries, 1990-2000



(Source: EEA, 2006a: http://reports.eea.europa.eu/eea_report_2006_6/en/eea_report_6_2006.pdf)

As for Catalonia, the built surface area in the first 10 kilometres from the coast rose from 10% in 1987 to a little over 15% in 2002. This change is still clearer in the first kilometre from coast, where it rose from 25% of urbanised surface area in 1987 to 35% in 2002 (figure 2.4). These growths in the urbanised

Figure 2.4. Percentage of urban development in the first and first 10 kilometres of coast in Catalonia (1987-2002)



(Source: Projecte DEDUCE, 2007 <<http://www.deduce.eu/>>)

surface area have occurred mainly at the expense of agricultural and natural or semi-natural land.

With these intensive developments, the coastal landscape has lost its signs of identity, causing a considerable degradation of the landscape (soil impermeabilisation, loss of fertile agricultural land, fragmentation and degradation of the areas and homogenization). These, very fast changes have made the coast more vulnerable to seasonal climate phenomena (heavy rains, sea storms). All of these anthropic factors mean that the coastline is suffering from a series of dysfunctions that are reducing its ability to reply to exceptional climate events.

2.1.2. Socio-economic situation

The structure and dynamics of the Catalan coastline economy are related to the tourist activities, followed by trade, services and construction. By contrast, there is a decline of the more traditional primary activities (agricultural and maritime), generally due to urban pressure. Agricultural land has decreased by 30% since 1957 (DPTOP, 2005), and the same has happened with the natural areas. This has been accompanied by an intensification of the agricultural and fishing activities (such as aquaculture).

The marked seasonality of the economic activities creates labour precariousness that affects the conditions of life (temporary contracts, demand for cheap, not

skilled labour, etc.). Immigrants, women and young people are among the most precarious labour groups. A change in climate affects and will still more affect the sectors that depend on it, such as tourism, agriculture and fishing. Although climate change may stretch out the season for tourism, this does not affect the other two sectors.

Tourist activity is making the construction on the coast grow. The most important coastal areas with respect to construction are the Costa Brava, the Garraf and the Costa Daurada. In 2001, second homes in the coastal towns accounted for 50.5% of the total (DPTOP, 2005). Normally, these second homes are empty for a large part of the year, influencing the increase in housing prices. Paradoxically, there is a problem of access to housing for social classes in a state of precariousness (retired people, young people, immigrants, etc.). One problem is the appearance of estates inhabited by people with scarce resources, such as elderly residents on small pensions. Normally, these estates fail to meet the correct sanitary conditions for this kind of population. With the impacts of climate change (for example, increased temperatures and the frequency of heat waves) the south of Europe might change its function and no longer be the ideal retirement place. However, it is still the entrance door for waves of young immigrants from the south, in a Europe with a tendency towards ageing population.

On the one hand, the international experts point to the Mediterranean as one of the areas of the world that will suffer most intensely from climate change. Exposed in the same way to the impacts, not all social groups are in identical situations. Locally, we might find economic sectors and social groups with different degrees of vulnerability in view of the risks expected by these impacts. This is the reason for the importance of working with subjects of territorial and environmental adaptability, but also social and cultural.

2.2. Challenges posed by climate change

2.2.1. The global–local dimension: The principle of caution with an uncertain future and the necessary construction of socially approved responses

Climate change is an unequivocal fact (IPCC, 2007). Attempts are made to model the effects of climate change with scientific parameters, but the framework of uncertainty is still very large. Science does not have all of the answers and so work must be done with the local populations to share the existing knowledge (scientific and popular). Precisely because the processes are uncertain, it is vital to

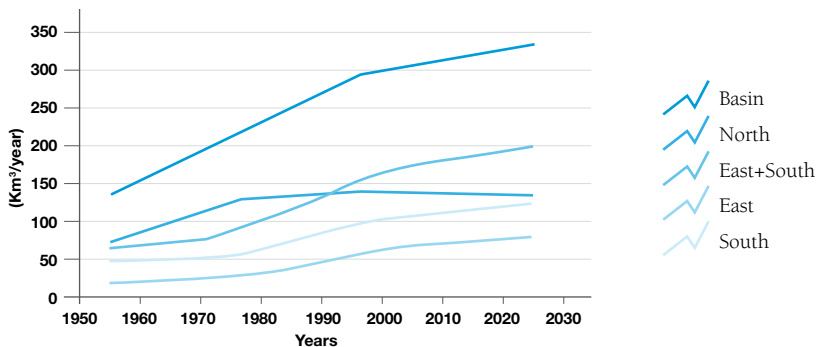
involve the population in taking decisions on the local/regional level in order to build socially acceptable replies to offset the damage and pick up on the new opportunities. Adaptation is a process in which new social, cultural, economic, environmental, planning skills are acquired, etc., to react and adapt to the changes.

The biophysical and socioeconomic implications of climate change pose new challenges both in policies for planning and protecting habitats and in the social behaviours and conducts aimed at adapting to the changes that will affect the state of the biosphere, the economic sectors, and which will transform the daily patterns and the ways of living (access to water, human health, the use of energy, housing conditions, etc.).

2.2.2. The exhaustion of resources and the changes in the social and economic situation

The first problems of the series of effects of climate change arise around access to the natural renewable resources such as water, crops, forests and the fishing areas. Water is one of the resources most affected by climate change. According to the World Health Organisation (WHO), it is calculated that by year 2015, 40% of the world population will live in countries with very scarce water resources (WHO, 2002). The Mediterranean is particularly sensitive. Today, 30 million people do not have access to drinking water and the estimates of the Plan Bleu show a growth in the demand for water in the basin between 2000 and 2025 of 15% (figure 2.5). In the countries of the south and east of the basin, this may be 25% (Plan Bleu, 2005).

Figure 2.5. Growing evolution of the demand for water in the Mediterranean basin by regions (1950 to 2000 and estimates for 2000-2025)



(Source: Plan Bleu, 2005, <<http://www.planbleu.org/red/>>)

The lack of water is an important factor in the conflict. It also has direct implications on the basic conditions of food and food safety, and also on the health of ecosystems and people. The reply here must lie in water saving policies and improvements in its management, along with policies of water regulation for populations and ecosystems.

Climate change brings in new risks for health, from the more frequent occurrence of heat waves causing greater mortality in the more vulnerable layers of the population, to the diffusion of tropical diseases in areas where they were believed to have been eradicated (such as malaria, chikungunya fever, dengue, etc.) as a result of the increase in temperatures and rainfall, facilitating the proliferation and dispersion of the vectors (mosquitoes and other insects) and the increase in allergies due to longer periods of flowering. These factors are important challenges to which a reply must be given if we want to develop efficient responses in adapting to the impacts of climate change.

The tourist sector will be affected by the effects of climate change. Part of the elements that are attractive for visitors will disappear, such as the beaches as for the coast (due to the rise of the sea level) and the snow in the mountains (increase of temperatures); the problems of supplying the seasonal population with water and energy may rise, and also the risks to health (heat waves, sunburn). There seems to be a clear attitude of modernisation and diversification of the sector in search of better adaptation to climate change.

The low coasts and the deltas are particularly at risk due to the rising sea level (coastal flooding and loss of beach areas, and other sedimentary formations such as coastal erosion and the saltwater intrusion in the aquifers). This seasonal or definitive flooding has and will have important implications for the means of life of the coastal population.

A worsening of the infrastructures, of the ecosystems and, as a result, of the economic sectors affected by these effects will reinforce the peripheral condition of many coastal areas. At the light of this social and environmental challenge, effort is required from the public sector to develop measures with regard to: i) adapting the economic sectors to create new alternatives and jobs, accompanied by educational and training measures (identification of emerging training needs aimed at the labour market); ii) adapting the territory by relocating and new sizing of the artificial infrastructures and settlements in terms of risk, and also the full evaluation of natural infrastructures and the role they play in adapting to climate change; iii) adapting the ecosystems for the protection of their internal functions to allow resilience and assure the production of ecosystem services for society; and iv) sociocultural adaptation with measures for greater equity in the access to basic resources (water, food, housing, education and health).

The Administration, companies and firms hold the alternative of a pact to adopt new models of energy, education, consumption and mobility and new forms of government to deal with the climate “threat”. This threat may also be perceived as an opportunity to face social and environmental problems to which we have been unable to reply up to now (efficient planning, development and co-operation policies, sustainability, etc). The question that also remains: and will we be able now?

To achieve this, research on the perception and adaptation to the risk is essential because it provides knowledge and tools for decision-taking, tools to reveal the problem in potentially affected groups (on a local level) and in the sectors and population that may suffer the impacts (on different extent). To become aware of the risks associated with climate change and social and territorial vulnerability means thinking in the long term and in the future of the planet, and is the first step in the collective construction of measures to adapt and manage efficient resources.

2.2.3. Research on the perception of the coastline and climate change of the INTERFASE team

Since the 1990s, the INTERFASE team (Coastal and Scenic Resource Research Group) led by Dr. Breton has worked on the perception of the coastline in Catalonia from different perspectives.

First phase 1984-1995

The first works were aimed at studying the perception of the fishing communities to deepen in the knowledge of the marine medium, the fishing industries, the fishing arts and their environmental impacts. The study of the fishermen’s perception of their resources helped to draw up a cartography of the sea beds, including the Posidonia meadows. This was done at a time when they were beginning to be degraded through anthropic action: increase of the sea nutrients and intensification of trawling (Breton, 1984-1989; Lleonart, 1988-1990). The study was useful to start the protection of the posidonia meadows on the Catalan coast (Breton, 1990; Breton et al., 1991).

Users’ perception of the beaches was carried out in different coastal areas to better manage the beach resources as a quality area for leisure and socialization. Likewise, this study of the perception of the beaches as an ecosystem that provides service to society opened perspectives on social participation in the management of resources and methodologies for the local agenda 21 (Breton, 1992-1993; Breton, 1993). In this phase, work was also done on the subjects of

risk and vulnerability on the coast, focused on the question of the risk of floods in the Costa Brava, Maresme and Llobregat delta tourist areas (Saurí, 1993-1994; Breton, Saurí & Ribas, 1996).

Second phase 1995-2000

In the second half of the 1990s, work was done on questions relative to the government: preparation of local and regional agenda 21, environmental audits and processes of social participation in managing coastal resources (Breton, 1996b; Breton, Cebollada & Ollé, 1997; Breton, 1998-1999a; Breton, 1999-2000). The impacts of climate change on the coastline are posed in relation to the right type of planning for protecting the coastal ecosystems. Participation techniques are used to involve people in knowing the natural processes and in managing the coastal resources (Foix delta, beaches of the Llobregat delta). Work is done, for instance, on the function of the dunes and marshes as a buffer to sea storms and other impacts of climate change, and how these have to be restored and managed. It is being considered the creation of a natural corridor between the Garraf, the Foix, the long beach at Vilanova i la Geltrú and Els Colls. It is gratifying to see that the proposals made in 1997 have been taken up by local associations and town halls, and has led to the implementation of these protection concepts ten years later.

The group is drawing up the first works on adaptability in relation to the delta and the coastal resources of the Baix Llobregat. The starting point is an analysis of the ability to respond of the coastal social ecosystems. The role of dunes, marshes, the pine forests and the agricultural zones as areas of soft protection of the urban settlements in the coastal areas is studied (Breton, 1995-1997; Breton, 1997). The team was helped by the geomorphologist Norbert Psuty of the Rutgers University in the United States and the sediment on the beaches of the Llobregat delta was monitored (Breton, 1998-1999b).

Third phase 1996-2006

After 1996, the INTERFASE team extended their line of research to the study of the social and environmental changes in the long time in which they have modelled the coastal areas on a regional level. Through the European Archaeomedes II project, the team took part in a co-ordinated manner with multi-disciplinary work groups of different countries of the European Union (Van der Leeuw, Breton & Saurí, 1996-1999).

The aim of the project was to understand the historical process of desertification in the coastal area of the Empordà. The use of paleoecology techniques showed how the landscape and the climate had changed from the Iberians times to the end of the 20th century. The historical analysis of the conflicts, the recent

changes in the use of the land and the use of the perception of the resources by the agents (farmers, municipalities, natural parks, etc.) showed the existence of a historical process of joint evolution between society and the surroundings.

The study of this historical process of joint evolution on the coast of the Empordà showed that the changes in the form of ownership (common, public and private), in the organisation of the territory and the management of the coastal landscape (dissection of marshes through the extension of traditional agriculture and then the intensification of the irrigation, urban growth due to tourism and afforestation as a consequence of the abandonment of agriculture) had caused an intensification in the consumption of the land and water resources. Moreover, the transport networks have continued to develop along the historical corridors of communication (Roman) and, along with the changes in the use of the land, have intensified a coastal landscape fragmentation process.

With the information collected in the project and the use of Geographic Information Systems (GIS) *Landscape Sensitivity Mapping* was carried out to confirm how the transformations in the coastal landscape had accentuated the risk of desertification, fires and floods (McGlade & Picazo, 1999; Breton & Romagosa, 2002; Pavón, Ribas, Sauri & Breton, 2003).

Alongside the Archaeomedes II project, greater depth was given to the study of the social and environmental perception of the coastal wetlands of the Empordà and the French Mediterranean coastline (Ribas, 1996-1997; Breton, 1996-1999). These areas needed a more careful treatment. These areas are highly sensitive to anthropic impact, which have had a much greater historical exploitation than had been evaluated to date, and were historically considered repulsion areas (salubriousness, malaria). The human activities in such areas (particularly traditional agriculture and its adaptability to flooding) have had great effects on the maintenance of the territorial processes and the habitats of these areas. Traditional stockbreeding and rural tourism have been determining in the preparation of proposals for more sustainable management (Romagosa, 1999; Sauri, Breton, Ribas, Llundés & Romagosa, 2000; Romagosa, 2007).

From December 2000 to December 2006, the research team worked on two projects co-ordinated by the Ministry of Science and Technology, the aim of which was to perform an integrated study of the social and environmental changes in the land-sea inter-phase bands of the Alt Empordà and Llobregat delta coastlines (Breton, 2000-2003 and Breton, 2003-2006).

The INTERFASE team co-ordinated an interdisciplinary work group formed by experts from different universities and research centres in Catalonia. A follow-up was made of the evolution of the changes and the territorial transformations in the Empordà and the Llobregat delta from 1950 to 2000. A start was therefore made with the most detailed information available and new databases were produced

with field work (sedimentology, marine biology, land hydrogeology, changes in the use of land...). The analysis placed the emphasis on the evolution and the type of settlements (urban and tourist). On the coastal plain of the Empordà the relationship between the type of settlements, the water consumption and the waste production are analysed by making a study of the aquifers and the types of urban settlement of the Empordà plain (Baradad, 2004; Cuadrado, 2005).

The agricultural activities and preservation practices were also analysed in the Alt Empordà and the Llobregat delta, in the last case looking at the indexes of nature and the peasant practices in the agricultural park (Pino, Seguí & Álvarez, 2006). The project studied the perception of the agricultural area in the Llobregat delta, which is highly vulnerable to the urban growth that surrounds it and the effects of climate change. In-depth interviews were carried out with farmers and technicians of the coastal administrations of the delta to evaluate the role of peasants in the management and preservation of the social ecosystem (Breton, Tulla & Sempere, 2001; Sempere, 2002).

As an instrument of support to the results integration, a Geographic Information System (GIS) was built on the largest work scale allowed by the available data (regional-local). The integration of the different data in a coherent overall view allowed carrying out the construction of indicators of analysis and management of the coast in greater depth. In this respect, the construction of a GIS served as an integrated model to perceive the most important geographical events (land-sea inter-phases), by showing the environmental processes and the anthropic impacts on the coast (Trujillo, Pino and Breton, 2003).

In parallel to the INTERFASE projects, since the year 2000, Dr. Breton has been responsible for the scientific management of the European Topic Centre on Terrestrial Environment (ETC-TE) and since 2006 the European Topic Centre on Land Use and Spatial Information (ETC-LUSI). Through these centres, work has been done with experts of the European Environment Agency (EEA) and representatives (technical and political) of the different European countries. With the databases available in Europe for the coast, work was done on a land and ecosystems account methodology known as LEAC (Land and Ecosystems Account) (Breton & Weber, 2002).

In this phase, the methodology uses the cartography of land coverage of the European project CORINE (Co-ordination of Information on the Environment) to know the stock of each kind of cover in an initial year and a final year. By analysing the evolution of the changes in the covers we can understand what changes have occurred in a certain period (profits and losses of cover surface area) and identify the flows that have determined these changes (transformation of meadows into agricultural land, abandonment of cultivable land, fires, reforestation, urbanisation, etc.). As of 2000, other world (Globcover) or regional-local cartographies were also undertaken to apply this methodology.

The flow and its importance can be compared with statistics or field studies that allow a better analysis of the phenomenon and the driving forces that determine it. In this way it is possible to relate the changes and the flows with the different problems (accumulation or loss of biomass, habitat fragmentation, land contamination, presence of nitrates, protection of natural areas, etc.) which allow dysfunctions and potentials to be identified and a more precise accountability to be drawn up of habitats and ecosystems. This is very useful for understanding the processes of improving or degrading the coastal landscape.

The work with CORINE and the LEAC methodology has produced an image of what the coastal landscape is, which has contributed to increasing its perception. By using the GIS technology of statistical generalisation methods (*smoothing*) a new cartography was produced for the coast based on the criterion of *Dominant Landscapes Types*. The resulting maps are a representation of the diffusion of the main tendencies of transformation of landscapes, but reproducible in their criteria and methodology, which gives them more objectiveness and comparability (Weber, Pàramo, Breton & Haines-Young, 2003).

Furthermore, the LEAC methodology places the emphasis on the need to define units of analysis. For the coast, the priority has been to define a standard coastline, and from here identify a series of definitions following different criteria: geometric (areas of influence with a distance from the coastline to the land and the sea, nets of different resolutions, etc.), physiographical (elevation and depth models showing the relief of the land and sea) or establishing criteria defining the coastline on both sides (land-sea). These definitions may be associated with the dominant landscapes (produced from maps of covers and uses of the land), administrative boundaries, etc. (EEA, 2006a).

Fourth phase 2006-2009

After 2005, the INTERFASE team was recognised as a quality research group by the Generalitat de Catalunya (SGR2005-00746) (Breton, 2005-2008). In this stage, the team took up the work line of Integrated Management of Coastal Areas (Spanish GIZC) and promoted actions to mobilise knowledge transfer on GIZC through the construction of a network of agents in vulnerable coastal areas such as the deltas of Western Africa, and especially the Senegal river mouth. In these highly vulnerable coastal areas, work is being done on the question of climate change with the local population, by identifying forms of adaptation with them to improve their economic alternatives and their quality of life (Breton, 2006; Breton & Trujillo, 2007).

The research group is currently working on local adaptation to climate change in coastal areas of Catalonia through the Interfase III project (Breton, 2006-2009). Taking the Ebro delta as the area of study, the project evaluates the possibilities in the In-

tegrated Management of Coastal Areas (GIZC) and the planning initiatives in relation to social and spatial adaptability in view of climate change in the delta.

In this context, the project studies the recent changes in land covers to analyse the type of settlements in an integrated assessment based on two points. On the one hand, the LEAC methodology evaluates the areas of the delta on a local level that will be affected by climate change, by producing tendency maps and indicators.

On the other, the use of perception techniques becomes the second working point. The notion of climate change on the coast has gained weight as a result of the global finding that climate change is an unequivocal fact (IPCC, 2007). The effects on the global level are clear (global warming, accelerated desertification in certain areas, thawing and rise in the sea level), but the effects of the change must be understood on a local level to be able to analyse its impacts and the social perception of the phenomenon.

In this sense, the Interfase III project develops a study of the perception of climate change on a local level in the Ebro delta. The social implications, the existing proposals of adaptation and the extent to which people are prepared for this problem are evaluated. The in-depth interview technique is used on territory agents (local administration, economic sectors and civic and environmental associations). In the interviews, three aspects are analysed: 1) the values and services of the delta that are recognised, 2) the interviewees' perception of the effects of climate change on the values and services of the ecosystem, 3) how it is considered that it will affect the way they live and the resources they use, and 4) what alternatives must be taken for better adaptation to the changes.

The research done to date shows how the delta society has great knowledge of the dynamics of the river and the role the rice fields play in maintaining the fauna and as an element of tourist attraction. Their awareness of and bonding with the territory must make them take part in many initiatives for managing resources and preserving certain spaces of high environmental and landscape value (the *ullals de Baltasar* (lagoons) between Amposta and Sant Carles de la Ràpita). This society's perception of climate change (in the delta) is strongly focused on the loss of land due to the rise in the sea level and the worsening of the subsidence that the territory is already suffering due to the anthropic impacts.

2.3. Conclusions

After more than twenty years' experience, the research of the INTERFASE team on the perception of the coastline in Catalonia shows that:

- As a functional unit, the coastline is not highly visible to general society, as they are aware of the beaches for leisure, but are not interested in and have little knowledge of the natural and anthropic processes that take part in its formation.

- The perception of the coast stops at the coastline. There is a lack of knowledge on the sea, which reduces the perception to the land area.
- This fragmented view of the coast has also been given by a lack of scientific knowledge and databases on the coastal-marine inter-phases that might connect with the existing land data.

The lessons learnt throughout the years show that climate change does not operate on an ideal territory, but on a territory transformed and affected by human action. This accumulation of impacts gives rise to situations of understanding and complex management.

The experience acquired by the team in processes of Integrated Management of Coastal Areas has been a key to understanding that climate change cannot be faced from a sectoral position, but that it has to be faced with approaches that deal with climate change as a transversal issue. However, working from this approach is not devoid of difficulties. From the science sector, there is often an excessively specialised view. The general population has a partial view of what climate change is, and its effects.

The integrated work should be closer to the base of our knowledge, otherwise the social perceptions will continue to be fragmented, egocentric and unable of dealing with this new challenge. In this sense, climate change is an opportunity for revising society's response to these impacts, such as the planning and organisation of the territory and the form in which they are applied (citizens' participation, new forms of government).

The role of the media and advertising has greatly influenced the perception and how the perception of the coast has changed. The "desired" image created for the last 15 years by the media is that of a Caribbean coast of fine sands, palms and hammocks. This created view has justified many management actions in coastal beach areas, such as the cleaning of remains of *Posidonia* that gave a sensation of "dirtiness", although it is scientifically recognised that the presence of leaves on the beaches has a protective function by undermining the power of the waves, and therefore the erosion.

The team also reported the "dominant" model of coastal planning, constituted in the 1980s and 1990s by the construction of the seafronts (Miralles, 1997). Many town councillors do not know what to do with their beaches if they do not intervene to make it more urban. The nudist and ecological movements have significantly contributed to preserving natural areas on the coast.

Climate change used to be a question that society did not perceive in the first studies of the team on the perception of the coast in the 1990s. For general society it was something distant that was unrelated to daily life.

The alarms all sounded when the international bodies recently showed the main implications of climate change, and the cost of acting or not acting (Stern, 2007). The future scenarios, foreseeing the risk, the vulnerability and the social perception of this risk on the coast, have become a priority for the economic system, now moved by the need to palliate the foreseen economic losses.

The results of specific studies made recently by the team (2006-2007) show a change in perception. The majority of actors on the coast are beginning to evaluate the impacts in economic and social terms. But there are still few who understand that to face climate change and to reply to it, it is necessary to go beyond economic measures of specific planning. Adaptation implies a deep change that obliges the current way of living to be replanned. The adaptation policies will not be able to be applied efficiently if they are not accompanied by mitigation actions to stop the cause, the emissions and the rather unsustainable uses of the land.

Since the INTERFASE team, there has been no study of the perception of the coast in itself, but rather from the approach that it is necessary to know the perception and its deformations to be capable of advancing with real actions in managing the coastline. And in this sense, to be able to change people's perception for action.

To be able to conceive great strategies for adapting, people must have information at hand to be able to participate and decide. Work patterns must be developed with people. Methods and tools must also be found to overcome the gaps between perception and the facts that occur. Some of these new methodologies and tools are:

The factor of perception

Perception is intuitive, imperfect knowledge of reality, and may be individual or collective. When studying it, it is necessary to reflect on the reason for this perception and the distance between the perceived situation and the real one, by identifying the aspects of perception it is possible to understand how people imagine the facts and classify them according to their preferences (for example, that users only want to use car parks close to the beaches, which does not mean that the territory managers have to attend this request without bearing in mind other factors such as the preservation of the natural area, pedestrian mobility, etc.).

Reality represented in GIS

This information technology helps people to understand the territorial and social and environmental processes and to give visibility to a specific territory and the flows caused there. When representing the coast, we always come up against the land-sea inter-phase that can not be reached by direct perception. On this point, the GIS play an essential role. They show a physical continuity be-

tween the emerged and submerged coast, and also the distribution on both bands of covers and different uses of the land, but with many connecting vessels that help to understand the coast as a functional unit beyond the land part.

Thanks to the capacity of the GIS to integrate different databases of different origins in the same working environment and reference system, it is possible to represent the dynamic of the coastal processes on different spatial scales (local, regional, global) with the use of models (sea currents, distribution of fisheries, extension and behaviour of the contamination points by outlets into the sea, etc.) and to analyse the temporary changes that are also difficult to approach with human imagination (Breton [in press]; Trujillo & Breton [in press]).

The LEAC methodology

The environmental accounting methodology is an instrument that strikes us because of its capacity to integrate different databases to achieve consistent results and work on different related scales, both in space and in time. It is an extremely important methodology for passing to a more objective view and the integration of different knowledge on the coasts (natural, statistical, social and economic, etc.) in specific spatial and time frameworks. From all of this, a great capacity is seen for building indicators to evaluate the changes and the quality of the coastal landscapes and to dynamise participative processes on knowledge, information gaps and actions to be taken (EEA, 2006b; Breton & Trujillo [in press]).

Future models and scenarios

Reality is complex. The territory presents accumulated impacts of anthropic origin, but also of climate origin, as there have been climate variations that have marked the history of humanity and its adaptation to these changes.

Through the scenarios, a future image is drawn of the areas that will be exposed to the effects of climate change. Depending on different parameters (temperature increase, rise in the sea level, CO₂ emissions, etc.) they allow the tendencies of the change on the coast to be shown. The current models allow us to better understand the social and environmental processes, but in a simplified form, like any other scientific model. The uncertainty of the models means that we still have not been capable of modelling and reproducing closed systems, even with high degrees of simplification. We can then wonder whether we will be capable of reproducing extremely more complex open systems. Despite all of this, it is necessary to work along the line of multiscale models to understand the most important tendencies with regard to possible lines of adaptation.

The participation factor

To face the challenges of adapting to climate change, the economic and social agents must actively take part in taking decisions on the coast. The studies developed for the last 15 years to understand the perception of the different social and cultural groups and encourage their participation have been very positive; the involvement of society in some places in Catalonia has shown that it is possible to reach the end of the consequences of a specific study. The mobilisation to save the Platja Llarga from urbanisation and connect different areas of ecological interest show that science must be based on participation processes with dynamic local groups.

Transformation of the perception

It is necessary to promote the change from a consumist perception to a perception responsible for the planet, which visualises the value of the resources. Actions must be promoted for a change of concepts in representing the world. The worst side of globalisation is the sensation of distance with respect to the environmental and social responsibilities. This is one of the causes of this inability of the population to perceive the problem of climate change, and explains the reason why they perceive it as a progressive normality and take time to change.

Working locally with the people to propose management formulae for specific, suppliable resources (a beach, dunes, a lagoon, etc) allows people to understand dynamic processes and the little known relationship between them (for example: the relationship between the construction of reservoirs, the lack of sediment and the erosion of beaches, the relationship between the Posidonia vegetation and the processes of sedimentation and erosion, the effects of land impermeabilisation and the chance of flooding, etc).

The analysis of the territorial, social, cultural and environmental exposure and vulnerability

The work with scientific tools such as the GIS and LEAC, though not representative of the entire reality, allow the most important aspects to be objectively extracted from it to build the future models and scenarios of climate change. Through participative actions we go further into the socio-cultural knowledge of the people, who understand the deep situations of the different social groups (especially faced with the vulnerability and response capacity) and the dominant perceptions in relation to the effects of climate change and the possible actions. By comparing the scientific instruments and methodologies with the analysis of the perceptions, the synergies which are necessary to drive towards a socially useful action can be created.

Specific actions for adapting to climate change

A large number of European countries have started to work on specific actions for adapting to climate change on a national level, and especially the countries of northern Europe such as the United Kingdom, the Netherlands and Finland, which have already started up action proposals (EEA, 2005). This replies to the concern of the European Union for this issue, which in 2007 brought out the *Green Book* on adaptation to climate change (Commission of the European Communities, 2007). It must be seen how these experiences will be applicable to the situation of climate change in our country. In any case, all of the actions applied must be set out in a participative manner on a local level.

The Mediterranean is a very important area of study for analysing climate change on the coast. Recognised by the experts as one of the areas that will most suffer the impacts of climate change, it is a territory with anthropic and climate impacts accumulated throughout time which have given rise to ecosystems that have certain regeneration capacities. On the other hand, it has its own culture of historical adaptation to the territory. All this makes the Mediterranean a living laboratory for studying and testing actions for adapting to climate change on the coast, within a new framework of government.

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3. Climate change and the perception of the risk of flooding in Catalonia

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3. Climate change and the perception of the risk of flooding in Catalonia

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3.1. Introduction

Between 1971 and 2002 the Insurance Compensation Consortium (CCS) paid out a total amount of €1,574,530,945 for flooding in Spain. The flooding and the drought, followed by the fires, the wind and hail storms, are the main natural risks in Europe. A report presented by the European Union in Dresden on 13th October 2003 showed that the European countries most affected by flooding in the last decades have been France and Italy, with 22% and 17% of the European total, respectively, whereas the largest number of victims occurred in Italy (38%), Spain (20%) and France (17%). Likewise, the countries with most flood damage were Germany and Italy (€11,000 M) followed by Spain and the United Kingdom (€6,000 M). Apart from the flooding in summer 2002, largely responsible for the damage in Germany, this difference is given by the variation in the vulnerability from one country to another, a difference more marked in the case of England, with infrequent severe flooding and related, amongst other factors, to a higher relationship between an economic valuation and losses.

In the same line would be the discussion on the increase in natural risks hypothetically associated with climate change. While there is still scientific uncertainty with respect to how climate change might already have caused a significant, general increase in the frequency and magnitude with which flooding occurs, there is common agreement that its impact has increased as a result of the increase in vulnerability and exposure, and its social perception.

The media is one of the most important sources of information on natural disasters and have a decisive influence on the view and response not only of the population, but even of the government. Fisher (2004), for example, demonstrates that the accuracy of the perception of what happens before, during or after the disaster or risk depends on what the media say. The image that the natural disasters and local risks, which have always existed in a region, are increasing as a result of climate change is considerably fed by the press and television (García Co-drón & Silió, 2000). This image often hides other factors of a non-climatic nature, such as those related to the change of uses of a territory, the urban actions or un-

wise attitudes. For example, between 2005 and 2006, 66% of the deaths in tides or flooding in Catalonia were caused when the victims tried to cross a river.

The treatment of climate change by the press in Catalonia was dealt with by Tàbara in his chapter on “Perception and communication on climate change” published in the book *Informe sobre el canvi climàtic a Catalunya* (Report on climate change in Catalonia) (2005). Among other aspects, it discusses the good correlation between the presence of climate change in the press and its perception among the public, giving as an example the work by Lacey & Longman in The United Kingdom (1997). Also following the results achieved by Clark et al. (2001) and Schreurs et al. (2001), Tàbara comments the role of the press in increasing or reducing public attention on climate change, although, like other global environmental problems, those responsible for identifying and estimating them are essentially the scientists.

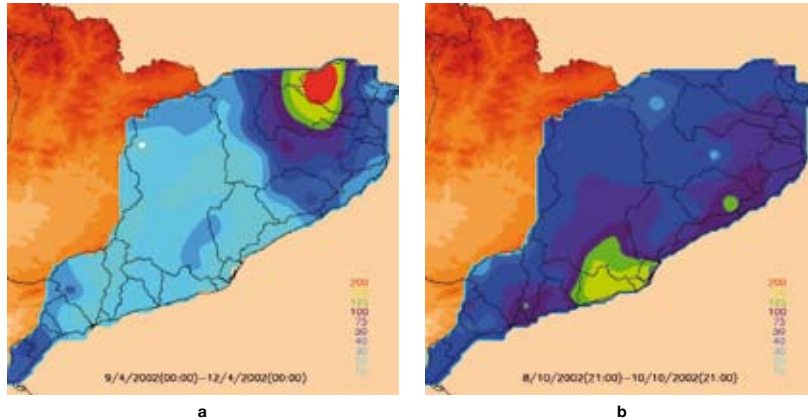
Given these considerations, this work presents an example of the social perception of floodings through the press, and compares it with the news on other natural risks and the news on climate change. After reflecting on the social impact of two cases of flooding, the methodology that is followed in creating a press database and classification of the subjects treated is introduced. Based on this, a comparative study of the different issues and their evolution in the last 25 years is analysed.

3.2. An example of the different social impact of two flooding events

One example of the different social impact would be the two main episodes of flooding that occurred in Catalonia in the year 2002 (Llasat, 2004). Between the 9th and 12th April, rainfall was accounted of more than 240 l/m² in different areas of the Alt Emporda, with a maximum 345.7 l/m² in Boadella, 321.7 l/m² of which were collected in just 24 hours (Figure 3.1a). The rivers Llobregat de l’Empordà and Manol overflowed, there were power cuts on the communications, the schools were closed, the rush of water down the rambles cut populations off and there was serious damage to agriculture and the ground floors of buildings. The episode was worsened by a heavy windstorm that affected the entire region of Catalonia, with gusts of over 128 km/h and waves of 5 m. Catalan television (TV3) devoted a few minutes on the news programme and *La Vanguardia* newspaper gave 11 headlines between the 12th and 16th April 2002.

Months later, between the 8th and 10th October, 2002 heavy rain was registered in different regions, with a maximum 174.1 l/m² in 24 in Sant Joan Despí (Baix Llobregat), accumulating 196.5 l/m² in 48 hours (Figure 3.1b). As a result of this rainfall, the fire brigade were called out 370 times, the power was cut in the underground, on the railways and roads, there was damage to the ground floors of buildings and to agriculture, some 1,000 cars were trapped on

Figure 3.1. Rain distribution (l/m^2) collected in Catalonia between the 9th and 12th April, 2002 (a) and between the 8th and 10th October, 2002 (b)



the Castelldefels freeway in a traffic jam that lasted six hours, the airport control centre was flooded and numerous flights were cancelled. However, it was not treated as an episode considered catastrophic (the definition may be found in Llasat et al., 2005) as it had been in June 2000 or November 1982. But it occurred in an extremely vulnerable area and at a time of considerable political confrontation. Therefore, the television devoted a large part of its news to it and also a special programme, whereas, for instance, a single daily newspaper (such as *La Vanguardia*) devoted 24 news items to it between the 10th and 15th October 2002.

From a meteorological and hydrological viewpoint, the April episode was considerably more serious, but the impact of the October episode was far greater. To the factors mentioned before, we must add facts such as the population of Castelldefels, which passed from 24,000 inhabitants to 46,000 in 20 years, which seriously increases the vulnerability. In this town only, registered damage was valued at about €892,000. The total amount paid by the Insurance Compensation Consortium (CCS) in 2002 was €28,885,200 as flood damage, of which €24,714,080 were in the province of Barcelona (bear in mind that the total damage is always higher than the compensations of the CCS). By way of comparison, in the episode of the 10th June 2000 the losses were estimated at €65,000,000 and *La Vanguardia* devoted 41 news items to it between the 11th and 18th June. It must be considered that the impact of any natural risk in the media is always greater if it occurs near the Barcelona area.

3.3. Methodology for creating a press database on natural risks and climate change

The press news database related to natural risks and climate change in built in ACCESS support and contains the digitalisation of all the information on a news item and its content. The base focuses on the news published by *La Vanguardia* since 1982, although in cases of particular interest it is extended with information from other newspapers. The database now has 3,166 entries. The news are classified by type, along the following proposal:

1. Floods, heavy rainfall and landslides.
2. Wind and sea storms, tornados, hurricanes.
3. Snowfalls, avalanches, cold waves.
4. Agro-meteorological risks: forest fires, drought, lightning, hail, icing and heat waves.
5. Sustainable development, climate change, pollution, hole in ozone layer,
6. Emergency chain, management of emergencies in a disaster associated with a natural risk, communication of risk.

The information concerning the news in itself refers to the information, its position in the newspaper (even or odd, cover, etc.), number of photographs and graphs, length, etc. The information on the content selects some keywords to allow later research: the headline and sub-headline, the details of the episode of which it is referred, the damage, etc. It is also distinguished whether it is an episode, such as a flood, for instance, or a subject, such as the legislation on floors or the presentation of an IPCC report. In this way, the fields to be considered are the following:

- Main and secondary headlines
- Newspaper
- Date of publication
- Number of the page or whether it is a cover
- List of the space occupied by the news with respect to the total
- Location of the news on the page
- Number of columns
- Amount of photos and/or diagrams
- Date on which the episode started and ended

- Meteors or subjects leading the news
- Name of the type of episode
- Locations affected
- Region: whether it has affected Catalonia
- Economic damage
- Human damage
- Other data.

Other fields are the values of some of the meteorological measurements (temperature and amount of rainfall) or a brief description of the episode or subject.

3.4. The social impact of flooding through press information

The news concerning floods normally refer to the impacts of the rain, the rises in rivers and drains, the floods “in situ” and other risks that can occur as a result of heavy rainfall, such as landslides, wind, electric storms and, on fewer occasions, tornados or hailstones. In the last 25 years, the episodes that have occupied most space in the press have been those of November 1982 and June 2000. Figure 3.2 makes it clear that there is no correlation between the impact of the news and the seriousness of the rain episode from a meteorological viewpoint. It was the episode of June 2000 that had the greatest press impact, with 52 images and 41 news items. Figure 3.3 is a clear example of the impact that the

Figure 3.2. Distribution of the number of news items, pages and images for the most important floods recorded in Catalonia between 2000 and 2006, with respect to the maximum total rainfall in the episode

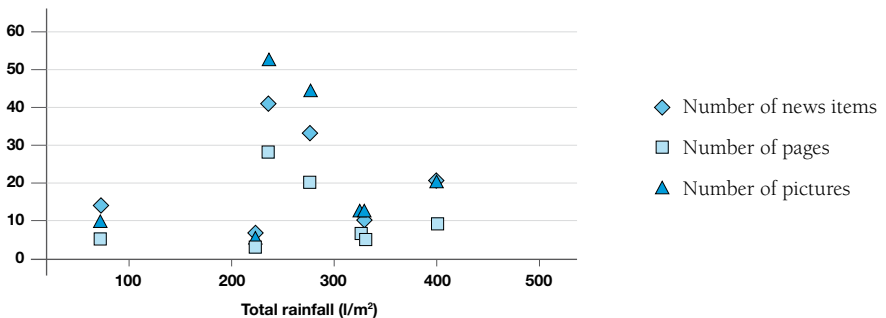


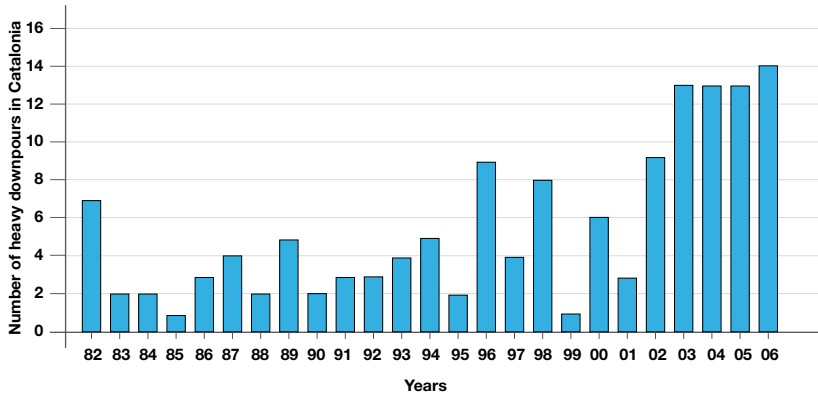
Figure 3.3. Front page of *La Vanguardia* on 10th October 2002



press can have and how it can bring in a reflection on the responsible agents, as the episodes of October 2005, April 2004 and October 2000, with rainfall maximums of 393.321 and 319 l/m², are higher values than those of September 2006 (267 l/m²) and June 2006 (224 l/m²) but had less than half of the impact.

A careful study of the evolution of news on floods and landslides in the last 25 years corroborates this growing media tendency (Llasat-Botija et al., 2006) commented in the previous paragraph. Figure 3.4 shows the evolution of the floods discussed in the press since 1982. A marked growth is seen in recent years, with a maximum between 2003 and 2006, which is not justified by a real increase in flooding and is probably caused by an increase in perception and a fall

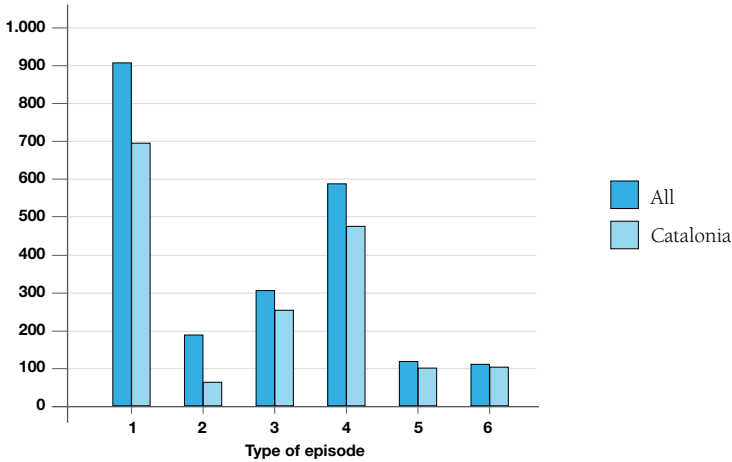
Figure 3.4. Temporary evolution of the episodes on floods appearing in the press base in the last 25 years



in the tolerance threshold. In fact, In Catalonia since 1982, the episodes of the most catastrophic floods were recorded in November 1982, November 1983, October 1987, November 1988, October 1994 and June 2000 (Llasat et al., 2003). It must also be said that from the year 2000 to December 2006 there were 10 floods in Catalonia with serious consequences, and material damage amounting to over €155 million. The material impact is ever larger due to the increase in vulnerability. For example, in the last episode of floods in September 2006 the Insurance Compensation Consortium paid €55,993,194 as compared with the €59,892,409 paid in all of the episodes registered in 2005. Furthermore, the total damage amounted to some €73 million, a figure far higher than the €65 million of the losses caused by the catastrophic rainfalls of June 2000.

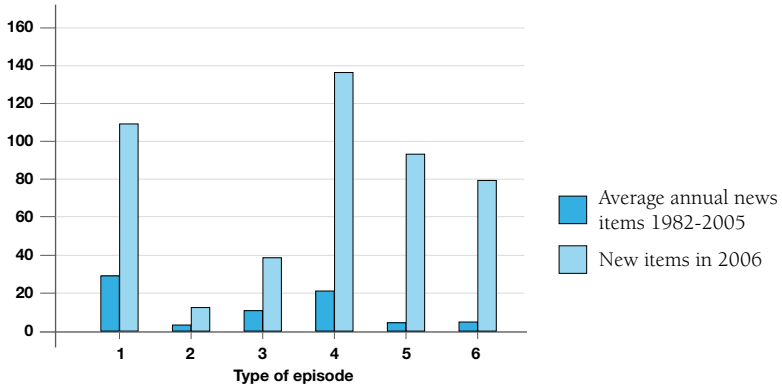
3.5. Comparison between the news on floods and climate change with respect to the rest

Figure 3.5 shows the distribution of news classified according to the above types in the period of 1982-2005. The news on flooding and associated phenomena are the most frequent, with a total of 903, of which 696 refer to Catalonia. In second place are the news referring mainly to fires and drought, with 589, of which 476 refer to Catalonia. It is interesting to see that the subjects related to climate change and pollution hardly reach 113 items, 101 of which refer explicitly to Catalonia (this kind of news are considered to affect Catalonia if they talk directly about it or about global aspects of the world that also affect it).

Figure 3.5. News items published between 1982 and 2005

The growing tendency that was already found with respect to the frequency of episodes of flooding as seen in figure 3.4 is corroborated when, for instance, the news published in the year 2006 are compared with the average number of news items published between 1982 and 2005, as shown in figure 3.6. The number of news items published in 2006 is considerably higher in all subjects, and particularly in type 4 and 5 news, especially as a result of the increase in news about droughts, small forest fires and climate change. The increase in the last of these was the consequence of the very high temperatures registered throughout the year, which was associated with climate change, and the announcement of the preparation of the fourth report of the IPCC.

If we consider the fact that causes the news item as an episode, albeit the development of a potential natural risk or a meeting or event with a public repercussion, it is important to note that for the same period, the impact of the episodes linked to forest fires (6.4 news items/episode), drought and hail is higher than the impact of episodes of flooding (5.6 news items/episode), and even more than the episodes related to wind (figure 3.7). This fact seems to be basically related to the fact that forest fires and hail occur mostly in summer, when journalist activity and news related to other subjects are lower. Another fact to be considered would be the fact that floods are the most frequent natural risk in Catalonia, and

Figura 3.6. Distribution of news items in Catalonia by year

that, as a result, they are “less” of an object of news if they are not related to disasters or considerable losses.

This would be the case of the year 2006, as can be seen in figure 3.7. In this year, the impact in headlines of the episodes of flooding were greater than those relative to fires or drought, despite the seriousness of the latter, with 8 news items/episode against 3.8 in the last type. This fact was mainly linked to the flooding caused between the 12th and 15th September in Catalonia, which strongly affected the metropolitan area. It has been seen that when floods affect Barcelona and its surroundings, the media impact is considerably larger (Llasat et al., 2004). It was precisely as a result of this episode that the subject of flooding and landslides was the only one, with respect to natural risks of meteorological origin, as it recorded an increase in the proportion of news per episode. Effectively, there is a clear fall in subjects 2, 3 and 4, which, associated with the increase in the annual number of news items for the same fields, would indicate an increase in episodes appeared in the press in 2006. Although this increase might be related to an increase in the risks, it could also be due to a growth in the perception or a fall in the tolerance limits.

If the proportion of news per event relative to the risks is compared with the news on climate change and pollution, the proportion of the latter is seen to be considerably lower with an average value of 1.1 news items/episode. This is in line with the fact that they refer to a certain public act, regulation or a reflection as a consequence of the current situation. For example, every public act that has been carried out in relation to the preparation of the fourth report of the IPCC

Figure 3.7. Comparison between the news items/episode published in 2006 on the different subjects, and the average number of news items/episode for the 1982-2005 period

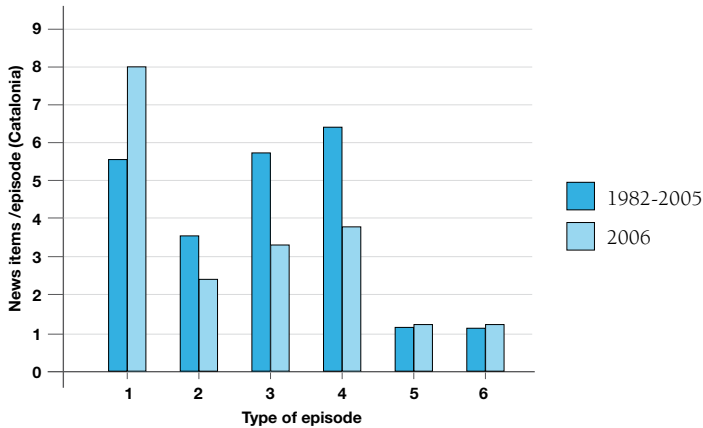
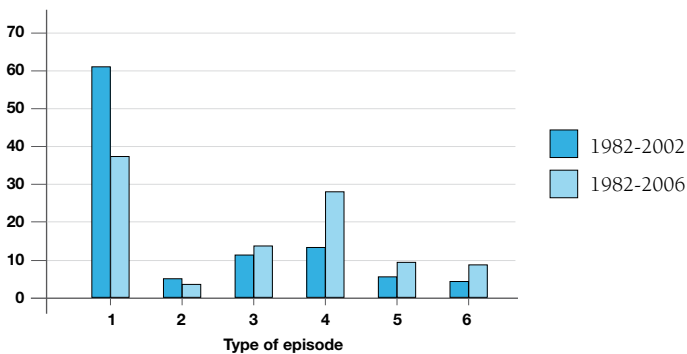


Figure 3.8. Comparison of the percentage of news items on the different subjects during the periods 1982-2002 and 1982-2006



appears as a different event. It is also important to note that an increase in the proportion is registered in 2006, rising to 1.2. In the referred year, the number of episodes relative to floods in the press was 14, in comparison with 37 for subject 4 and, more notably, 77 for subject 5, concerning climate change and pollution.

Finally, if in figure 3.8 we compare the distribution of press news items for the 1982-2006 period with the 1982-2002 period (Llasat et al., 2004) a significant increase is seen in the number of articles referring to subjects 4 and 5 with respect to 1. In fact, while in 1982-2002 period issues 1 and 5 constituted 60.8% and 5.4 % of the total number of news items considered in the database, when the time is extended to 2006, the percentages become 36.9% and 9.1%, respectively. Also worth highlighting is the increase in subject 4, mainly due to the heat wave of the summer of 2003 and the long drought of recent years.

3.6. Conclusions

The press is a good way to measure the social impact that events that are related to natural disasters and climate change might have. For a large part of the population, they are the most faithful source of information on these facts, and as a result their awareness and sensitisation is heavily moderated by the content and type of news. On the other hand the press is suitable for drawing up a type of statistic with caution on the distribution of natural risks in Catalonia. In this sense, flooding appears as the first natural risk in Catalonia, a perception that is in line with reality given that the number of victims and material losses is the highest in comparison with other risks. Similarly, the increase in the number of news items on flooding recorded in the last decade corresponds to an increase in the episodes documented in the press more than the number of news items per episode. This positive tendency points mostly to a greater perception of situations that formerly passed unnoticed and which can be justified by observing four factors:

- A fall in the tolerance thresholds of the population, who now consider extraordinary the situations that were previously accepted as ordinary.
- An increase in the degree of information in all areas related to the environment and natural risks.
- An increase in the losses associated both with an increase in the population in areas of flooding risk and the value of the exposed materials.
- An increase in social mobility leading to unawareness of the surroundings and increasingly careless actions.

With respect to the comparison of the news related to climate change, an increase is detected both with regard to the documented events and the number of news items per event. This increase responds to a growing social concern about climate change, fostered by results obtained in the scientific field as much as intuitive association, albeit not necessarily correct, regarding climate change and the increase in natural risks.

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4. Climate change in the Catalan press, 1990-2006

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4.1. Introduction

For more than a decade, social researchers have investigated the role of the media in the social and political construct of climate change. The first studies focused mainly on the United States (Mazur et al., 1993; Mazur 1998; Bell 1994a, 1994b; Trumbo, 1996), and the relationship between science, politics and the public in respect of reporting on climate change (Weingart et al., 2000; Wilson 2000; Brenchin, 2003; McComas et al., 1999; Stamm et al., 2000). In recent years, the analysis of *interpretative frameworks* or cultural frameworks for climate issues, along the lines of Schreurs (2001), or more recently, the role of the different communication strategies of different climate actors (Carvalho, 2005), has assumed more importance. In this regard, as shown by A. M. Mcright and R. E. Dunlap (2000) in the case of the United States, the late nineties saw the emergence of large numbers of “non profit-making” organisations, linked to or funded by private and conservative interests, aimed at creating communication strategies intended to discredit or question the approaches of the IPCC or the developments achieved in climate change policy. In particular, a large share of these groups’ efforts were directed at issuing counter-arguments and reports designed to “re-frame” the debate so that climate change would stop being considered a political and social *problem*, and simply be labelled a natural phenomenon.

The study shown next is not intended to provide a comprehensive bibliographical review of this subject, but rather to analyse how climate change has been communicated through the written press in Catalonia. More specifically, our aim is: a) to describe quantitatively the evolution of articles related to climate change published in the highest circulation newspapers of Catalonia (*El Periòdic*, *La Vanguardia* and *l’Avui*) and the most widely-read newspaper in Spain (*El País*), between 1990 and 2006, both inclusive, b) to analyse their content in general. From our analysis of 2601 news items and articles in total, we observed a rising trend in climate change-related information over the last 16 years. Additionally, communication regarding climate change in the Catalan written press, although subject to the same cycles as international events, has increased substantially, especially since 2004. Although the period that we analysed ends in 2006, we have been able to observe the continued increase of climate change coverage in 2007 associated to exceptional events such as the Al Gore documentary, the Stern

report and the presentation of the fourth report of the IPCC (Intergovernmental Panel on Climate Change), which very likely helped to further increase general awareness of this problem in Catalonia. This work is still in a preliminary phase, so only the most significant results are shown.

4.2. Method

The work shown here is a continuation of the data presented in Tàbara (2005) on the evolution of climate change in the Catalan press 1990-2002, both inclusive. In that period, three Catalan newspapers were chosen (*El Periòdic*, *La Vanguardia* and *l'Avui*) for a complete review of each printed issue, designed to determine the number of articles published on climate change.

The press analysis in the 2003-2006 period followed the same procedure with the newspaper *Avui* and included consultation of the digital dailies of *El Periòdic* and *La Vanguardia*. We completed the information obtained from reviewing the three Catalan newspapers with the articles published in the daily *El País* between 1990-2006⁴. We analysed the printed copies of the newspaper published during the abovementioned period of study.

Once the articles had been selected, sheets were used to describe the subject and actors to which the news items referred. As with the previous period, the research excluded the Sunday papers and other supplements. The articles had to contain at least one of the four selectors considered to allow readers to link the facts to the problems of climate change⁵. The identified subjects were as follows (with examples of the relevant key words):

- *Problem identification*: temperature, rainfall, annual variations, thawing, climate evolution, glaciations, the 'Niño' phenomenon, etc.
- *Causes*: emissions, CO₂, pollutant gases, atmospheric contamination, anthropogenic factors, etc.
- *Consequences*: future, development, survival, delayed effects, local changes, impacts, infectious diseases, growing risks, threats, environmental safety, etc.
- *Scientific uncertainty*: uncertainty, complexity, irreversibility, forecasting, scientific evidence, scientific disputes, principle of caution.
- *Sociopolitical debate*: negotiations, treaties, international conferences, objectives, north-south imbalance, economic growth, market, taxes, political will, promises, etc.

⁴ Excluding 1991, which is missing.

⁵ The following selectors were chosen: Climate change, the greenhouse effect, global warming and the Kyoto protocol.

- *Technical solutions*: energy, fossil fuels, nuclear energy, renewable energies, energy saving, bioclimatic architecture, transport, cars, etc.

The main actors of the articles in question were classified according to the following groups:

- *Scientists*: IPCC, OMM, OMS, NASA, ESA, CSIC, meteorological and Arctic/Antarctic research centres and institutes, universities, environmental agencies, etc.
- *Politicians*: Rio Conference, Rio+10 Conference, United Nations Framework Convention on Climate Change, Conferences of the Framework Convention Parties and the Kyoto Protocol, UNO, FAO, UNEP, EPA, NOAA, National Climate Commission, etc.
- *Institutions and interest groups*: Greenpeace, WWF, Friends of the Earth, Climate Action Network, Worldwatch Institute, Red Cross, Oxfam, International Energy Agency, OECD, Davos Economic Forum, European Atomic Forum, unions, employers' associations, private companies, RACC, etc.
- *Others*: Companies, citizens, etc.

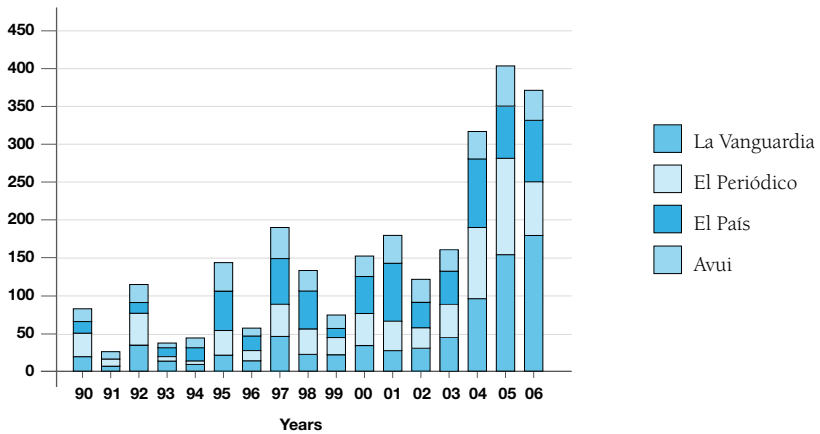
4.3. Findings

If we look at the number of news items and articles published in the Catalan written press, and at the events and actors appearing in them, we can clearly distinguish two periods:

- 1) The first period runs from 1990 to 2003. Over this time, 1509 articles were published on climate change in the 4 analysed newspapers, with the number of published news items increasing slightly throughout the period. Nonetheless, they were subject to cycles, mostly dependant on international events and conferences, such as the Kyoto protocol negotiations, when communication regarding climate change was at its peak (figure 4.1 and 4.2). If we look at the actors involved, the number of scientists drops off in the first half of the nineties, as politicians increasingly come to the forefront. Finally, the context of the events described in the articles is basically international, but also regional, in other words, at the state and autonomic level.
- 2) At the same time, the second period starts in 2004 and finishes in 2006. Whereas the first 13 years saw the publication of 1509 articles referring to climate change, in just 3 years (2004-2006) 1092 were published (figure 4.3 and 4.4). Although we can see a slight drop in 2006, the overall trend is on the increase, for example: *El País* published 81 articles in 2006; on the other hand between 1st January and 17th November 2007, it published 125. Over this period, scientists lose strength as politicians increasingly appear in the written press. Also, we should mention the increasing appearance of actors whose presence in the press up until then had been rather more symbolic, in other words,

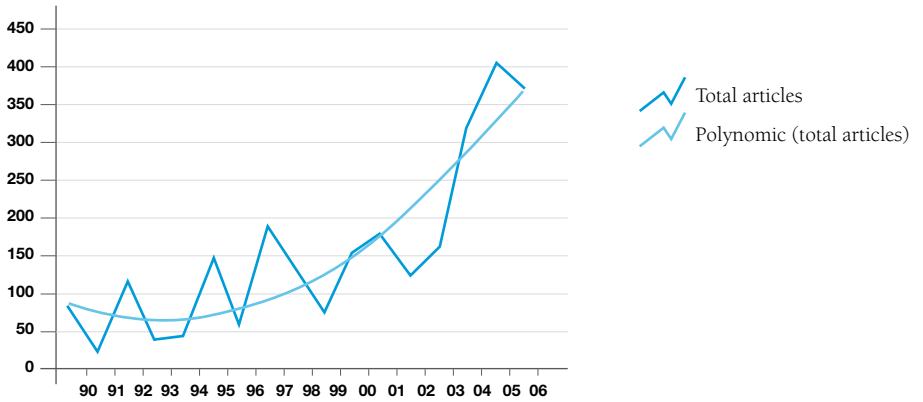
institutions and interest groups, such as the NGOs. However, the most interesting appearance is that of citizens. Citizens are increasingly engaged in calling for a fight against climate change through popular events such as cycle rides, blackouts and concerts. We also need to mention the media, which in parallel to making scientific disclosures open a line based more on educating about the problem, focused on generating public awareness. As a result, during this period, although the international and regional arenas hold centre stage in the written press, the local arena starts finding a place for itself in articles related to climate change.

Figure 4.1. Number of annual articles on climate change in *La Vanguardia*, *El Periódico*, *el País* and *Avui*, 1990-2006



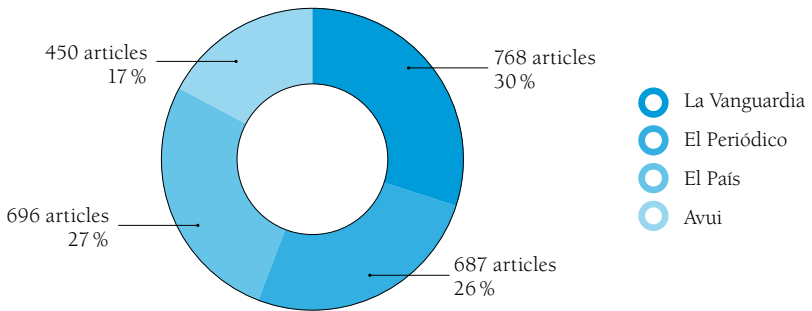
(Source: Own preparation.)

Figure 4.2. Total annual number of articles on climate change in *La Vanguardia*, *El Periódico*, *el País* and *Avui*, 1990-2006



(Source: Own preparation.)

Figure 4.3. Total number of articles on climate change in *La Vanguardia*, *El Periódico*, *el País* and *Avui*, 1990-2006



(Source: Own preparation.)

4.4. Discussion

The two stages from 1990 to 2003 and from 2004 to 2006 show a significant change in the coverage of the climate change problem by Catalonia's leading written media, not just in quantitative but also in qualitative terms. Although the qualitative aspects are yet to be examined (requiring a more in-depth look at the material obtained) we can, however, advance some trends that we believe propose a significant hypothesis. Initially, there was more emphasis on questions of doubt in relation to certain catastrophic views of climate change, and the opportunities to act were hardly mentioned. A possible result of this could be generating some disinterest in these issues on the political and decision-making level and creating a distant perception of the problem. It would seem that most of the evidence provided by the IPCC and the increased presence of climate change and its findings in the media, has led this problem to now be declared an indisputable reality with global and ecological consequences. Therefore, in recent years there has been greater coverage of the results of climatic research (at the same time as more consensus), as well as of decision-making processes for identifying mitigating measures (ratification of the Kyoto protocol by Russia in 2004, the Catalan Convention on Climate Change in 2007, amongst others) and recently too of adaptation processes. At the same time, the media shows citizens increasingly sensitive to climate change with more and more news items on new mobilisations and actions in this field.

Moreover, new interpretative frameworks have emerged during this period. In the beginning, the debate on climate change was presented as a scientific or environmental problem, whereas now the economic aspects have been included, such as emission trade or the cost of implementing the Kyoto Protocol, as well as social and distribution factors –e.g., North-South- and health-related. A more in-depth examination of the enormous amount of information obtained will almost certainly reveal new interpretative frameworks of a cultural nature that could be very useful for understanding the limitations and possibilities of one of the main mechanisms we have in public communication: the written press.

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5. Evolution and current state of the climate change policies

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5. Evolution and current state of the climate change policies⁶

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5.1. Introduction

Climate change is such a vast and complex problem that it is one of the most important challenges facing public environmental policy today. The structural changes that it calls for, the number of sectors and actors whose participation is needed, and the problems of co-ordination and co-operation are so huge, that it is hard to imagine how they can be possible without the widespread structural reform of the economic, political and social organisation of current societies. Climate change is the result of an accumulative process of pollution, difficult to ‘disaccumulate’ in a total, global system such as the biosphere. Therefore, we need to consider the persistence of its effects and the different time scales between emissions, concentrations, impacts, responses and the effect of responses and political measures. Action-reaction timescales vary a lot limiting policies’ effectiveness. To some extent, delays in becoming aware and taking relevant action can be explained by the scale of the problem, although in recent years we are seeing considerable positive movement towards improved coordination between international and sub-state political actors related to climate change.

As in general with other environmental problems, in the case of climate change, talk is not so much about solutions as about social responses and political processes, aimed at either *mitigating* the problem, where the intention is to reduce the causes behind it, or *adapting* to it, where the idea is to minimise the impact of possible outcomes on a country or community. In this regard, achieving efficient social responses to climate change implies overcoming enormous problems of collective action, because it requires high levels of international co-operation. Therefore, a social actor who accepts that the impact of climate change is a possibility but who is completely “rational” and a *profiteer*, from the maximising utility point of view, would tend to choose adaptation before mitigation, since adaptation suggests a much higher profit-cost ratio in the short term, although mitigation of the causes could produce a much higher public benefit in the

⁶ This chapter reviews and expands on the presentation given on the opening day of the Catalan Convention on Climate Change, held on 17th October 2007.

long term; at the same time, countries that are typically classed as profiteers would tend not to initiate, or even to adopt co-operation strategies, waiting for other countries to do it for them. However, in practice, the joint combination of adaptation and mitigation strategies will be necessary to fight the effects and the causes of climate change simultaneously on a global and local scale.

In reality, we can conclude that climate change policy does not involve a single policy, but rather many intertwined and closely interdependent policies. At the same time, the only way for the multiple actions required in this field to be minimally effective is to design, apply and monitor an explicit, participative, and coherent policy for which all the different social actors and the citizens in general are accountable (Weaver et al., 2006). In the following exposé I provide a brief description and analysis of the evolution and current state of climate change policy internationally, and in Spain and Catalonia.

5.2. The International and European Context

Although the greenhouse effect was already described in 1824 by the French physician Fourier, it was not until the end of the 20th century that it started to enter the international political arena. After the second world war, the first steps taken in this field were mainly led by the scientific communities, which later found strength and backing from different non-governmental organisations. This led to an increased publication of scientific reports and in the late fifties to the building of a global network for climate observation, resulting in 1979 in the First World Climate Conference in Geneva. A year later in Villach (Austria) the World Meteorological Organisation (WMO), the United Nations Programme and the International Council of Scientific Organisations met for the first time to organise a conference that would take place in the same city in 1985 and which would declare climate change a global concern. In 1988, various governments established the Intergovernmental Panel on Climate Change (IPCC) in order to evaluate and present the state of the matter on these subjects and assess them for the corresponding actions to be taken. According to the latest estimates of the IPCC in its fourth evaluation report, published in 2007, 11 of the 12 years between 1995 and 2006 were the hottest since records began in 1850. In the northern hemisphere, these temperatures have probably been the highest in the last 1300 years. One of this last report's most important features is the unequivocal statement that this change in temperature is *very probably* due to human activity. Depending on the different scenarios and policies adopted from now on, the average global temperature in 2100 is expected to rise by between 0.3 and 6.4 degrees, with all the consequences on the ecosystems that this entails: rainfall changes, rises in the sea level or economic impacts in key areas such as world food production.

Although in the eighties there were several world meetings to deal with the problem of climate change, like the one held in Toronto in 1988, which made a call for reducing global CO₂ emissions by 20% for 2005, and in The Hague in 1989, it was not until the United Nations Environment and Development Conference in Rio de Janeiro in 1992 that this problem fully entered the international political arena. In Rio, the Framework Convention of Climate Change was approved, which was enforced in March 1994 (*United Nations Framework Convention on Climate Change, UNFCCC*). After this, a series of annual Conferences were held between the Parties (*Conferences of Parties - CoPs*) to adjust and strengthen the convention, the most recent in December 2007 in Bali, Indonesia. The Bali conference was particularly important for Canada and the United States' commitment to enter negotiations on specific reduction targets to be enforced as of 2013, and for the inclusion of developing countries such as China, India and Brazil, which had not been considered by Kyoto. In Bali, participant countries also approved the fourth report of the IPCC as the leading and most authorised source for supporting global policy on the subject of climate change and decided to develop an adaptation fund equivalent to 2% of the Clean Development projects.

The Kyoto Protocol established the objective of reducing greenhouse effect gases in developed countries by 5.2% in 2008-2012 in relation to 1990 levels. For Kyoto to come into force, before March 1999 at least 55 states responsible for at minimum 55% of the emissions in 1990 had to have subscribed. Kyoto also established a series of flexible mechanisms that allowed each country to comply with the commitment to reduce or not increase greenhouse effect gas emissions. These mechanisms include the following: the international trade of equivalent CO₂ emissions, the systems of joint implementation, and the promotion of joint investment projects in clean technologies in developing countries. To avoid situations like the United States', which intended to buy between 80 and 90% of its emission reduction objectives from third world countries, the European Union, under the German presidency, proposed that every country's reduction should be at least 50%. The commitment made under the Kyoto protocol was for the European Union to reduce 8% of overall emissions, although attempts were made to make it 15%. The Kyoto Protocol finally came into force in February 2005 thanks to its signing and ratification by Russia, a country that emits 17.4% of the world's greenhouse gases. However, the EU15 has only managed to reduce its greenhouse gas emissions by 1.5 – 2%, partly due to the failure of countries such as Spain. However, if we count the EU27 and the recourse to flexibility mechanisms we could say that the 8% reduction objective has largely been met.

The negotiation process around climate change is highly complex and subject to strong pressures and interests of all kinds. Just as in other fields of international politics, one of the actors exerting the most pressure on current climate change negotiations is the United States, which refused to sign Kyoto. In its opinion, emis-

sion limits should not only apply to industrialised countries, and therefore should not exclude developing countries. Furthermore, it argues that the established targets do not have a solid scientific foundation, that they were rushed, and that they would seriously constrict its economy. The US also defends itself by saying that on the whole it already contributes more to research on climate change than the EU and Japan combined. In exchange, it proposes to conduct more research into this field, to foster advances in new clean technologies and to cooperate more with developing countries. However, the attitude of rejection and gradual withdrawal of the United States from other international environmental policy processes, and especially the United Nations bodies (by not signing the Cartagena Protocol on bio security to protect the interests of the biotechnology industry for example) has always let us know that the US (which emits more than a third of the global greenhouse gas emissions (GEG) is unlikely ever to play a proactive role in relation to climate change. Nonetheless, despite the federal government's negative approach, the beginning of a climate change policy was coming within sight on the local level: three months after the Kyoto protocol came into force, in May 2005, some 130 mayors from US cities accounting for more than 30 million inhabitants, signed an agreement in Seattle to take measures on a local level to comply with, and even surpass, the reduction objectives agreed in Kyoto. This process culminated in the difficult Conference of the Parties in Bali in December 2007, when the United States finally agreed to enter UN negotiations to establish global targets for reducing emissions.

For its part, in June 2001 the European Union established the European Climate Change Programme. Its purpose was to identify the most effective measures in both cost and environmental terms for the different member states to comply with the obligations assumed under the Kyoto Protocol. The programme insisted on the fact that actions directed at dealing with climate change, obviously from an integrated perspective, should contemplate the participation of *all economic and social sectors at the same time*. Starting from a consultation process with all the agents involved, a total of 42 measures were identified, divided into three categories according to several criteria but mainly on the basis of their contribution to reducing greenhouse gases, their cost effectiveness and execution timelines. The programme was drawn up on the basis of suggestions and proposals contributed by six work groups: (a) flexibility mechanisms (b) energy supply (c) energy consumption (d) industry and equipment (e) transport and (f) research, at the same time leaving the process open to include other sectors such as forestry and waste treatment. In October 2005, the European Commission approved the second European Climate Change Programme, also with six work groups in the following areas: (a) first plan review (b) aviation (c) CO₂ and cars (d) CO₂ capture and storage (e) adaptation (f) emission market system. Of particular note among all these, is the enforcement by Europe in 2005 of the emissions trading system (covering some 11,500 highly contaminating installations and planned to include emissions from the aviation sector also), and the drafting of directives and measures aimed at increasing energy efficiency, controlling energy

demand and achieving a gradual penetration of renewable energies, in addition to controlling transport, and freight transport in particular⁷.

European Climate Change Programme I & II

- **June 2001:** I European Climate Change Programme. Identifies 42 possible measures and creates 6 work groups: (a) flexibility mechanisms (b) energy supply (c) energy consumption (d) industry and equipment (e) transport and (f) research.
- **October 2005:** II European Climate Change Programme. 36 measures are revised, expanded or created and also 6 work groups are constituted: (a) first plan review (b) aviation (c) CO₂ and cars (d) CO₂ capture and storage (e) adaptation (f) emission market system.

EU objectives for 2020

1. **20 percent** reduction of greenhouse effect gases (GEG).
2. **20 percent** reduction of global energy consumption.
3. **20 percent** increase in the use of renewable energies.
(with a possible contradiction given the fact that it allows biofuel imports...)

Designed to contribute to the overall objective of not surpassing the 2 degree threshold of global warming by 2100.

One of the main problems facing climate policy, as in other fields of environmental policy, is *institutional and regulatory fragmentation*. For example: On the one hand we have a full set of regulations concerning water planning with instruments such as the Water Framework Directive (which only deals with quality, but not quantity) and on the other, we have other European Policies such as the Common Agricultural Policy (CAP) and the Cohesion Funds. All of these policies act on different institutional levels and flagrant contradictions occur between them that have to be harmonised if climate policy, which is transversal, is to have any effect in the long term. Climate change policy is a prime example of the scales of time and space used by the different administrations failing to fit in with the real problems affecting the environment and sustainability, with different actors working in different arenas at

⁷ However, these measures still encounter a fierce resistance due precisely to the nature, principles and main objectives of the EU, which consist of guaranteeing a competitive common market. We can find a more in-depth treatment of these contradictions, often referred to as 'European environmental schizophrenia' in Tàbara (2006).

the same time, and carrying out different functions at once. For current governmental organisations, most proposals for reducing the earth's global warming tend to promote solutions that are more or less technical or national, aimed at reducing carbon dioxide emissions in some very specific fields of action, while maintaining most of the production and political representation systems more or less intact. Therefore, the intention is to discuss, act and frame the solutions on the *consequences* of the problem, in other words, on the increase in emissions, rather than on dealing with its origins, which lie in the general unsustainability of relations under the production/ consumption system based on the consumption of non-renewable fossil fuels, or specifically with regard to international climate change policy, on the lack of representativeness of the negotiations framework used by nation states to deal with this matter. Thus, for example, debates regarding the equality of compensation mechanisms for dealing with climate change talk about how convenient it may be to adopt emission-reduction measures and objectives that take into consideration countries' different income and consumption levels, when in fact many more criteria are being discussed for dealing with these questions of distribution (see table 5.1). In this model terrain, which is representative of other realities, we can therefore see how the administration is severely limited when it comes to assuming not just a relevant but also an effective role regarding such a complex and interrelated field: some of the main decision centres are not within the scope of the administration where they need to act, and their competences are generally too restricted to be able to deal with climate mitigation and adaptation in a minimally satisfactory manner.

Some potential criteria for redistributing the burden and responsibility for the global climate

- By countries, based on 1990, according to Kyoto.
- By countries, according to historical emissions (e.g. since industrialisation).
- By countries, according to current emissions (e.g. China and Asia come out losing). The reference year of 1990 has to be moved.
- Per capita ('climate tax' would work as a direct tax).
- On consumers or on producers, as an indirect tax. E.g., by profit/service per ton produced or consumed in the end product (it would favour technologies and practices that foster decarbonisation).
- By distinguishing between '*Basic and survival emissions*' and '*luxury*' emissions. Not considering all emissions equal, as they depend on why they are produced, what is paid for them, and/or what responsibility each of them has assigned.
- By their contribution to mitigation.

5.3. The Spanish and Catalan framework

Until very recently, in both Spain and in Catalonia, the agents that normally contribute to presenting the problem socially –according to the media: scientists, environmentalist groups or the administration– have not taken part in either the scale or variety of strategies that other countries have in this field. The non-existence of a broad associative movement with sufficient resources to connect this problem with local concerns and private interests may have been one of the main reasons for the lack of climate change policy in Spain. However, the current situation reflects the general lack of understanding and value that our society gives to aspects of global environmental change in relation to aspects of economic growth, for example. Although the Spanish state has potentially important features that could facilitate reducing emissions in some key sectors, such as the possibility of using renewable energy sources like the sun or the wind, there are significant institutional obstacles that make it impossible, or at least very difficult, for these reductions to be able to occur in the medium term. The certain challenge in coming years will be to overcome these institutional, social and cultural obstacles, which are not simply technological or scientific in nature, so that this potential to reduce emissions can materialise and adapt for compliance with international commitments.

In particular, Spain's history of climate policy is proof of Spanish politicians' weak conviction for pushing through decisive action in this international field. Potentially in order to avoid an excessively poor image at the Rio conference in 1992 and to be able to negotiate with a bit more strength, the Spanish government hurriedly created the National Climate Commission (a few days before the conference was officially held), with no participation by a single scientist, like the institution that replaced it six years later, the National Climate Council. While the National Climate Commission lasted, it was incapable of drafting a final version of a National Climate Plan, less so therefore, one that the Cabinet could have approved. Spain signed the Framework Climate Change Agreement of Rio de Janeiro in December 1993 and the Kyoto Protocol in April 1998, which was ratified on 31st May 2002.

Since the National Climate Commission proved to be useless, the government replaced it with the National Climate Council (CNC) in 1998. According to its composition and initial functions, the National Climate Council was ascribed to the Ministry of the Environment and in addition to a technical secretary, comprised five work groups: industry and energy, agriculture and environment, transports, institutional relations and interdepartmental co-ordination. Nevertheless, it was obvious that with this structure there was also considerable overlapping and omissions that limited its capacity to function. For example, the Meteorology Institute was at the same time the technical secretariat and the interdepartmental co-ordination group, and among other things, there was no representation either

of the Autonomous Communities or of many other social sectors. Its lack of social representation and poor functionality led to its reformation by royal decree in November 2001. Later, the National Climate Council was formed by a series of bodies that constitute the plenum and some representatives constituting the group of vocal members. The plenum comprised: the Minister of the Environment as Chairman, the Secretary General for the Environment as Vice-chairman, and the Secretary General of the Spanish Office of Climate Change, acting as secretary. The group of vocal members included a large number of representatives, including five general managers, one representative of 12 ministries, one representative from each Autonomous Community, and representatives of local entities, ecologists and unions of business groups or consumer groups. Prior to this reform, the government decreed in July 2001 the composition and functions of the Spanish Office of Climate Change, so as to co-ordinate actions in this field within the scope of the Ministry of the Environment and so as to monitor the obligations assumed under its international and European commitments. However, although the number of actors and the total volume of human resources increased greatly, both the order and the royal decree of 2001 explicitly established that the operation of both bodies should not suppose an increase in public spending beyond what was already assigned for other areas of the ministry.

At first, given the different levels of economic development, the Spanish state agreed before the United Nations Framework Covenant on Climate Change (UNFCCC) not to reduce its emissions of greenhouse gases, but to increase them by up to 17% by 2010. However, following the agreements made by the European Union at the Council of Luxembourg in June 1998, this percentage was reduced to 15% and the period for compliance was increased, leaving it open for the period 2008-2012. At the same time, given that the EU agreed in June 2001 that it would ratify the Kyoto Protocol so that it would be enforced before the Rio + 10 summit in Johannesburg, and given too that Spain was to take on the European presidency on 1st February 2002, the Spanish government agreed to send the protocol to the parliament for ratification. However, at that time the Spanish state had not yet processed the *National Communication* where it had to specify the details of its emissions and submit a plan with the different measures to be taken. Even in spring 2002, when the *Third Communication in Spain* was finally presented, it did not contain any detailed, quantified plan specifying the greenhouse gas reduction estimates from the different measures, nor did it discuss how it intended to comply with international commitments or how the different flexibility mechanisms would be used in this respect.

Time and again there were proposals to prepare a comprehensive Spanish strategy on climate, until finally in February 2004 the fourth draft of the strategy appeared (MIMAM, 2004). This strategy was the outcome of numerous meetings of the actors and even of the Autonomous Communities, and included a range of

more than 400 possible climate measures. The last draft was presented in February 2007 before the *National Climate Commission*. As has occurred with subsequent actions, including *The Spanish Strategy on Climate Change and Clean Energy–Horizon 2007-2012-2020* and the complementary plan of urgent measures approved in July 2007, it shows the Spanish administrations refusing to quantify the objectives and reduction potential of the different measures to be applied, which in practice means that it is impossible to perform an effective follow-up and assign the corresponding responsibilities (see table 5.1).

However, in January 2005, under strong pressure from the EU before the imminent entry of the directive on emission trade, Minister of the Environment, Cristina Narbona, finally presented the Spanish emission assignation plan for non-diffuse sources in Brussels. This plan specifically included 957 industries in total and allowed a total of 513.6 million tons of equivalent CO₂ emissions to be managed, distributed between the electricity sector (256.2 tons) and the cement industry (some 82.5 tons), amongst others.

Spain is the EU country that has most increased its emissions in percentage terms in relation to the Kyoto commitments. Spain has exceeded and multiplied its established emissions by 3.5 (see table 5.2). In light of this situation, the EU has approved Spain's proposed plan to increase its emissions by 37%, obviously not without paying. Specifically, the 15% that Spain had agreed would be cost-free, but the rest would be distributed as 20% for purchasing emission rights and 2% for increasing forest land in compensation. This contrasts with the fact that the European Union has set itself the goal of enforcing the required policies to reduce greenhouse gas emissions by 20% by 2020, with these measures also including the objective of reducing energy consumption by 20%. The overall objective is to contribute to the global aim of not exceeding the 2 degree increase in temperature, a threshold already considered high risk or catastrophic.

From these figures it is obvious that Spain, despite the large numbers of documents and good intentions presented at international political forums, is suffering from a proven incapacity to deal with this problem, which is obvious from the lack of an integrated, direct, explicit, accountable policy from the different social actors that would allow it to be minimally effective, or even to maintain the basic standards of equality and co-responsibility in this field. Obviously, Spain cannot transfer its (i) responsibility to the European Union and to other countries, even though the EU operates under the Framework Covenant as a single country. Finally, the EU has accepted Spain's increase of emissions by up to 37% purchasing the remaining 20% from others, which will entail a likely cost in excess of 5,000 million euros, much of which could probably have been saved if action had been taken on time.

Table 5.1. Plan of urgent measures approved by the Spanish government on 20th July 2007*

		Measure	Total forecast reduction 08-12 (ktCO ₂)	Total additional reduction 08-12 (ktCO _{2,e})	Total additional annual average 08-12 (ktCO _{2,e})	
URGENT MEASURES	E4+	1 ACTION PLAN E4 08-12	210.421	27.709	5.542	
	Transport	2	Minimum percentage of biofuels	PA E4	PA E4	PA E4
		3	Review of RD 61/2006	ADDITIONAL	N.C.	N.C.
		4	Change of car registration tax	ADDITIONAL	N.C.	N.C.
		5	Sustainable mobility plans	PA E4	PA E4	PA E4
		6	Assessment of change to Road Tax	ADDITIONAL	N.C.	N.C.
		7	Pilot schemes for sustainable mobility	ADDITIONAL	N.C.	N.C.
		8	Programme of support measures for goods transport by rail	PA E4	PA E4	PA E4
		9	Reduction of emissions from Public Administration vehicle fleets	ADDITIONAL	4,61	0,92
		10	Energy savings and efficiency and renewable energies in Public Administration buildings	PA E4 + ADDITIONAL	1.125	225
	R&C&I	11	Public street lighting	PA E4	PA E4	PA E4
		12	Awareness-raising campaign on energy savings and efficiency, and labelling of domestic electrical appliances	PA E4	PA E4	PA E4
		13	Regulation on Heat Installations in Buildings	PA E4	PA E4	PA E4
		14	Progressive replacement of incandescent filament bulbs	ADDITIONAL	BEING STUDIED	BEING STUDIED
		15	Energy efficiency strategy in the lifecycle of the Construction sector	ADDITIONAL	N.C.	N.C.
		Power	16	Revamping of wind farms	ADDITIONAL	5.750
	17		Marine wind power	ADDITIONAL	4.500	900
	18		Electric meters	PA E4	PA E4	PA E4
	F-Gases	19	Regulation 842/2006	ADDITIONAL	2.750	550
		20	Voluntary agreement SF6	ADDITIONAL	330	66
		21	Voluntary agreement PFCs	ADDITIONAL	100	20
	CH4	22	Recovering biogas from dumps	NOT ADDITIONAL	URGENT	URGENT
		23	Biodigestion of slurry scheme	ADDITIONAL	8.900	1.780



Measure			Total forecast reduction 08-12 (ktCO ₂)	Total additional reduction 08-12 (ktCO ₂ e)	Total additional annual average 08-12 (ktCO ₂ e)	
URGENT MEASURES	N2O	24	Reduction in the use of nitrogen fertilizers	ADDITIONAL	785	157
		25	R&D and innovation strategy for Energy and Climate Change	N.C.	N.C.	N.C.
	Horizontals	26	Procedures for flexible project-based mechanisms	N.C.	N.C.	N.C.
		27	Modification of PNA 2008-2012	N.C.	N.C.	N.C.
		28	Register of voluntary commitments made by companies	ADDITIONAL	5.000	1.000
Other	Other non-CO2 gases (N2O+CH4) PA E4+		ADDITIONAL	3.500	700	
RESULTS	TOTAL		210.421	60.454	12.091	
	PNA 08-12 objective			188.500	37.700	
	Updated efficiency objective			135.617	27.123	
	Distance to objective			75.163	15.033	

* If the detailed reduction potential of each measure remains unestimated, how can we know the total?

(Source: Medidas urgentes de la estrategia española de cambio climático y energía limpia – 20/07/07).

NC = non quantified

Therefore, since the Spanish state has not been able to reduce its emissions as agreed (and it is inevitable that it will have to buy them) it will also need to find new possibilities for meeting the Kyoto Protocol obligations by other means, such as adjusting climate policy to the administrative reality we now have in the Spanish state. In this last sense, it could consider the possibility of giving a strong impulse to the design and execution of autonomic and local policies on the subject of Climate Change, and a deeper study of climate market mechanisms (see table 5.3). This could mean, for instance that the Autonomous Communities wishing to do so could open emissions registers and use the flexibility mechanisms as if they were countries with full competencies in this area, taking part directly in the emission trade between the different Autonomous Communities, for example. Another possibility for encouraging internal and autonomic markets to reduce emissions is for the autonomic administrations simply to make offers for purchasing emissions directly from Spanish companies or the respective Community. All of this would obviously require an increased capacity to monitor and account for emissions, applying the principle of subsidiarity in such a complex field as Climate Change, and avoiding many of the difficulties that the different Autonomous Communities show when agreeing on environmental material

Taulla 5.2. Evolution of greenhouse gas emissions in the EU. Spain increased its emissions by 52.3% between 1990 and 2005, despite having agreed to increase them by only 15%

MEMBER STATE	Base year ¹ (million tonnes)	2005 (million tonnes)	Change 2004-2005 (million tonnes)	Change 2004-2005 (%)	Change base year-2005 (%)	Targets 2008-12 under Kyoto Protocol and "EU burden sharing" (%)
Austria	79.0	93.3	2.1	2.3	18.1	-13.0
Belgium	146.9	143.8	-3.8	-2.6	-2.1	-7.5
Bulgaria	132.1	69.8	0.9	1.3	-47.2	-8.0
Cyprus	6.0	9.9	0.0	0.2	63.7	-
Czech Republic	196.3	145.6	-1.5	-1.0	-25.8	-8.0
Denmark	69.3	63.9	-4.3	-6.3	-7.8	-21.0
Estonia	43.0	20.7	-0.5	-2.3	-52.0	-8.0
Finland	71.1	69.3	-11.9	-14.6	-2.6	0.0
France	563.9	553.4	-2.7	-0.5	-1.9	0.0
Germany	1,232.5	1,001.5	-23.5	-2.3	-18.7	-21.0
Greece	111.1	139.2	1.6	1.2	25.4	25.0
Hungary	123.0	80.5	1.0	1.2	-34.5	-6.0
Ireland	55.8	69.9	1.3	1.9	25.4	13.0
Italy	519.5	582.2	1.7	0.3	12.1	-6.5
Letònia	25.9	10.9	0.2	1.5	-58.0	-8.0
Lithuania	48.1	22.6	1.5	7.2	-53.1	-8.0
Luxembourg	12.7	12.7	-0.1	-0.4	0.4	-28.0
Malta ²	2.2	3.4	0.2	6.1	54.8	-
Netherlands	214.6	212.1	-6.3	-2.9	-1.1	-6.0
Poland	586.9	399.0	2.3	0.6	-32.0	-6.0
Portugal	60.9	85.5	0.9	1.0	40.4	27.0
Romania	282.5	153.7	-6.4	-4.0	-45.6	-8.0
Slovakia	73.4	48.7	-0.8	-1.6	-33.6	-8.0
Slovenia	20.2	20.3	0.4	2.1	0.4	-8.0
Spain	289.4	440.6	15.4	3.6	52.3	15.0
Sweden	72.3	67.0	-2.7	-3.9	-7.4	4.0
United Kingdom	779.9	657.4	-3.0	-0.5	-15.7	-12.5
EU-15	4,278.8	4,192.0	-35.2	-0.8	-2.0	-8.0

¹ For EU-15 the base year for CO₂, CH₄ and N₂O is 1990; for the fluorinated gases 12 Member States have selected 1995 as the base year, whereas Austria, France and Italy have chosen 1990. As the EU-15 inventory is the sum of Member States' inventories, the EU-15 base year estimates for fluorinated gas emissions are the sum of 1995 emissions for 12 Member States and 1990 emissions for Austria, France and Italy. The EU-15 base year emissions also include emissions from due to deforestation for the Netherlands, Portugal and de UK (see EC Initial report, EEA, 2006c).

² Malta did not provide GHG emission estimates for 2005, therefore the data provided in this table is based on gap filling (see Chapter 1.8.2.).

Nota: Malta and Cyprus do not have Kyoto targets.

(D. Tàbara, 2007). This possibility is also being considered in federal countries such as the United States, despite its well-known position with the negotiations blocked by the government of G. W. Bush. Meanwhile, the role of local entities is fundamental in this sense; in Spain an initiative appeared in November 2004, called the *Spanish Network of Cities for Climate*, backed by the Spanish Federation of Municipalities and the Ministry of the Environment, which could play a potentially important role.

Today, economic policies for reducing emissions are highly limited precisely by the fact that the current climate markets are very rigid, with few actors, little competition and little participation. All these measures also have a very important potential effect on awareness, joint responsibility and social transformation, since prices are one of the main mechanisms of collective information that most condition individual actions.

In general, Spain's current situation is characterised by a lack of organisation and constant administrative reorganisation in respect of climate issues, in addition to carelessness and extraordinary excess in relation to emissions, which can be explained by several reasons. On the one hand, the relative and recent introduction of the trends of industrial expansion (on the level of income and adopting the consumption habits that predominate in the rest of the countries in Europe) has resulted in greater concern for economic growth, to the detriment of public policies aimed at preserving and improving the environment. And furthermore, the lack of an environmental policy culture, proven amongst others by the absence of ecologist parties with parliamentary representation, combined with the prevalence of certain governments not highly sensitive to issues of environmental change. This situation has been exacerbated by the lack of a strong leadership to coordinate the different actors and encourage institutional innovation (on recent measures, see table 5.5). As already mentioned, in Spain the small participation and the small pressure that the social actors have exerted in this area have been symptomatic, in comparison with what has happened in other European contexts. The scientific and academic community has not been particularly active up until now either, as the first evaluation and policy reports appeared after 2005 both in Spain and in Catalonia (Moreno, 2005, Llebot, 2005). The lack of teaching and interdisciplinary programmes in this field, apart from very few exceptions, shows how scientists have not played an important role either in defining the impacts of including on the political agenda initiatives that could be carried out at the state level to deal with this challenge.

In Catalonia, although some measures led by the Department of Industry have been carried out for some years, it can not be said that there has been an integral climate change policy yet. Thus, for instance, participation of the Department of the Environment in this area is very recent, and it was not until 2001, and in particular the preparation of the declarations of good intent suggested by

Some potential measures aimed at increasing the role of the climate markets. Actions to improve transparency and economic democratisation in matters of climate change:

- **Creation of emission trading systems between Autonomous Communities:** where communities that can sell emission reductions because they have invested in renewable energies, for instance, may sell them to other Autonomous Communities if they wish.
- **Direct purchase of emission reductions by the State or the Autonomous Communities from companies in Spain or the respective Autonomous Community:** this could encourage local investment in new technologies and the creation of new companies. This is a policy that is truly simple to implement and potentially highly efficient, for it is precisely the emissions put on sale that are reduced.
- **Development of an individual market of emission rights.** First voluntary, where people who can certify personal GEG emission reductions can sell them to sectors (or to the Administration) that need them or have to have them available, for example, when producing certain goods or services or consuming others of great climatic impact, such as petrol or private transport. Having tried out this measure, it could be extended to other sectors by making it compulsory or even by creating personal emission quotas that could provide a source of income for those who do not use them (and costs for those who exceed them). This is a progressive, redistributive measure that penalises those who pollute most and could entail additional income for those who do not pollute or who take active measures to reduce emissions.
- **Development of a labelling system for consumer goods.** In order to improve the information available to consumers when they purchase consumer goods such as foodstuffs or others. Trading and recovery may be promoted in certain sectors such as local and ecological agriculture.
- **Development of an auditing and business certification system relative to greenhouse gas emissions.** To know which companies have active climate change business policies, so that consumers and investors can have this information clearly and accessibly and make their corresponding decisions.
- **To improve financial entities' public transparency in relation to the climate impact of investments from large personal funds such as pension plans.** The public is entitled to know the climate impact of investments made by large financial entities funded by personal salary payments or pension funds, etc. Reforming the financial system on the basis of sustainability and public transparency criteria is fundamental for dealing with the problem of climate change.

Some recent 'actions' by the Spanish State

- February 2004. *Spanish Strategy on Climate Change to comply with the Kyoto Protocol. Draft 4*. It contains more than 400 measures, but not quantified and finally not very practical.
- January 2005. Emission assignment plan for non-diffuse sources, under pressure from the EU because of the enforcement of the emission trade Directive.
- October 2006. Approval of the *National Climate Change Adaptation Programme*. This is a reference framework for evaluating the impacts and vulnerability of climate change as support for the administrations of autonomous and local communities, but does not constitute an obligatory regulatory framework.
- February 2007. New draft of the (*Spanish Strategy on Climate Change and Clean Energy – Horizon 2007-2012-2020*). Idem, the reduction potential is still not quantified in detail.
- July 2007. Plan of urgent measures, once more vague and insufficient quantification of the effectiveness of each measure, it is impossible to follow up effectiveness and compliance.

Agenda 21 for Catalonia, that a new orientation appeared in this regard. GEG emissions had risen in 2005 by 47% in relation to 1990, and although they are five percentage points below Spain's they still exceed Kyoto by more than three times (see table 5.3). In Catalonia, the *Catalan Thematic Network of Climate Change* was created, now the Group of Climate Change Experts of Catalonia, aimed above all at research, and which works as an advisory and epistemic community in the area of Catalonia. The report on climate change in Catalonia (Llebot 2005) was a decisive step for starting to fill a large gap in the knowledge about this field in Catalonia. And institutionally, the creation in December 2006 of the Catalan Office of Climate Change (though without operative funds until February 2007), the Interdepartmental Commission of Climate Change, and the organisation of the Catalan Convention of Climate Change starting in October 2007, could encourage us to believe that we are finally entering a new stage of climate policy in our country. In the end, it is always achieved final emission reductions that will determine the success or failure of this area of political action.

Finally, in the local context, in Barcelona in 1999, a municipal decree was approved obliging all new buildings, and all those integrally refurbished consuming 2,000 litres or more of running hot water a day to be fitted with solar water heating systems to cover 60% of the energy demand and avoid the emission of

Table 5.3. Increase of GEG emissions in relation to base year 1990

Sector	Increase in emissions in Catalonia compared to base year of 2005	Relative weight in terms of emissions from each sector compared to total emissions in Catalonia in 2005
Combustion in producing and transforming energy	135%	15,31%
Non-industrial combustion plants	75%	8,53%
Industrial combustion plants	68%	22,80%
Industrial process not involving combustion	31%	8,26%
Extraction and distribution of fossil fuels/geothermal energy	57%	0,97%
Use of solvents and other products	441%	2,49%
Road transport	44%	22,93%
Other transport systems and mobile machinery	34%	3,89%
Waste treatment and disposal	104%	4,99%
Agriculture	13%	8,34%
Other sources	1%	1,49%
Total Catalonia	47%	100%
Total Spain	52%	

Font: DMAH, 2007

considerable amounts of CO₂ into the atmosphere. In 1996, Barcelona signed the Heidelberg Declaration, committing its subscribers to reduce greenhouse effect gases by 2005 to 20% of the levels in 1987 by developing a local action plan that included, among other measures, the promotion of renewable energies and the reduction of energy consumption associated to the vehicle fleet and buildings under municipal ownership. However, these commitments were not met. According to the energy plan of the city of Barcelona, in 2010 the city hall planned to increase the power provided in the use of solar panels to a total 14.14 megawatts.

5.4. Evaluation

Today's societies have moved away from ignoring the climate, onto understanding that the climate is changing and now accept that *the climate has to be protected*. Although this new perception of the climate as a social and political problem was initially seen as too complex to be able to enter the normal sphere of political

decision-making, a large number of public and private actors and sectors are realising that this is a question that provides enormous political, social and economic opportunities. In fact, one could argue that societies that manage to take advantage of these opportunities on time and that direct the necessary human and economic resources in the right direction, will, in the medium term, achieve a series of benefits and comparative advantages in such strategic fields as: innovation and institutional consolidation, research or financing and leadership of international investment projects that could be decisive in directing their development.

In particular, among the opportunities, advantages and potential benefits of carrying out a consistent policy at the state and autonomic level concerning climate change or private sector participation in some of the flexibility mechanisms presented by the Kyoto process, we would highlight the following:

- Climate change is already creating the main market of environmental services in the world. A large number of corporate decisions are currently being made in order to take positions in the participation in flexibility mechanisms, as is the case of emission trading or the Clean Development Mechanisms. These are large scale decisions, as in the case of reforestation, which are moving large sums of money and mainly follow the logic of economic efficiency and profit maximisation. Companies and governments that take rapid action in this respect will have great advantages, considerable cost reductions in producing emission reductions, and larger profits in the very near future.
- Strategic positioning in the creation of systems for financing social and economic development projects and technology transfer to third world countries, which in other circumstances would have very few chances of access. Acceleration and encouragement of technological innovation and development, mainly towards an economy without coal.
- Positive indirect effects on the general quality of the environment, aside from combating climate change, such as the improvement of the air quality in urban areas or greater energy efficiency.
- Opportunities for developing and financing new lines of scientific research and teaching, especially in the university field.
- And in general, the creation of synergies fundamental for a climate change policy truly integrated with strategies aimed at improving sustainability standards, both at the local and the global level.

However, if we examine these opportunities and advantages a little more closely, we will possibly reach the conclusion that many of them could materialise right now regardless of having to wait to check the ultimate or scientific existence of climate change. In other words, many of the policies that can significantly contribute to combating climate change do not necessarily require climate chan-

ge to be justified in order to be carried out. Most of these actions have multiplying and positive effects in many other economic and social fields, aside from the environment, which is the case of improvements in competitiveness or opening new global markets to clean technologies. No being able to (or not wanting to) specify the causes or the final impacts of climate change cannot be an excuse for not carrying out these actions, because they can be justified far beyond purely environmental considerations. Therefore, it makes little sense to frame the discussions on climate change policy on whether climate change *exists or not*, as this discussion has already been considered ended, largely thanks to the work of the IPCC. We now have a policy and international and European commitments, as well as mechanisms and opportunities to participate, and it is from this new framework of action that we need to consider the new deliberations.

However, although the opportunities are many and varied, the criticisms and risks to the political processes surrounding the treatment of climate change by the international community are no less so. In this sense, the most outstanding criticisms are directed at the architecture of the agreements designed in Kyoto (and which are possibly aimed at a far more fragmented system). According to some authors, some of the mechanisms and/or the whole of the Kyoto Protocol are:

- *Insufficient*: the established reductions are insufficient for combating the causes of climate change and should be at least 10 times more than those agreed in Kyoto to have a medium and long term effect on mitigating the causes of global warming. The new commitments that have to come out of Bali go in this direction.
- *Ineffective, inequitable and potentially expensive*: there is concern about how to guarantee the transparency and equality of the systems and measures for achieving the emission agreements reached globally in Kyoto, especially with respect to the flexibility mechanisms. Many of these difficulties stem and stem from the prickly issue of deciding and following up on the distribution of loads and the share of solidarity that different countries are willing to support to accomplish objectives that are not only minimally effective, but also especially inequitable. Likewise, most of the projects of the Clean Development Mechanisms are large scale (and therefore avoid the transaction costs) and are based on criteria of efficiency in reducing emissions, but benefit the large multinationals and forget the basic questions of equity and sustainability that are basic for local populations.
- *Practically impossible to calculate*: with regard to both the sources of emissions and the connections intended for calculating how to implement the flexibility mechanisms. These difficulties in calculating international emissions through common, clear protocols, spreads to the national and local level. It is still necessary to solve the issue of measuring units used in trading emissions between different regions (e.g. American and/or European).

Therefore:

- *In ecological terms, what is necessary are global reductions that are not relative, but rather absolute:* the Kyoto mechanisms do not attack the root causes of the problem, which lie precisely in the emission in absolute terms of greenhouse effect gases, beyond the global ecosystem's capacity to absorb them.
- *There are other better alternatives to the flexibility mechanisms:* and especially those relative to the promotion of technologies that do not emit greenhouse gases, for example, flexibilisation of the energy market and the nurturing of competitiveness for decarbonised, non-nuclear renewable energy companies. Some of these mechanisms run the risk of purchasing "hot air", that is, reductions that would also have occurred by applying 'business as usual' strategies.
- *The Kyoto Protocol has encountered considerable difficulties in its implementation.* despite finally coming into force in February 2005, there are still some matters pending solution. On the one hand, the United States' failure to ratify has reduced the efficiency of the international process in this field⁸. Furthermore, the Kyoto Protocol does not establish sufficiently clear and strict procedures for guaranteeing its fulfilment, or the measures to be taken in the event of non-compliance, further weakening its effectiveness.

However, it is obvious that the reductions proposed by Kyoto are insufficient, although it must be remembered that Kyoto is a negotiation process consisting of several rounds for the progressive and global adoption of commitments between the parties. The Stern report⁹ asserts that a stabilisation of the global GEG concentrations at around 550 parts per million could be achieved at a cost of only 1% of global GDP and that this interval is likely to be between 1% (net gains) and 3.5%. It is also clear that Kyoto will be more expensive for countries with policies that are not very efficient or which wake up late (like Spain). Likewise, Kyoto is based on the idea that industrialised countries have to act as leaders and role models in both international negotiations and the true decarbonisation of the economy.

Therefore, finally everything appears to show that the debate on climate change has been directed at particularly emphasising the opportunities and not making too much noise about the difficulties, which makes a lot of sense. Or more specifically, to deal with this problem as if it were merely a huge political business, economic, academic and/or social opportunity. Some argue that this conclusion has surely been reached as the only way to do it, that doing it this way was something that could work or perhaps the only thing that would work. Because this issue ap-

⁸ On the other hand, Australia's position in respect of Kyoto, up to now similar to that of the United States, has isolated the US position still further following the change in the government.

⁹ You will find a summary of the report in Catalan at <http://www.mediambient.gencat.net/cat/el_medi/C_climatic/occc/docs/stern.pdf>.

Some general criteria of climatic policy action

- **To integrate and seek synergies between mitigation and adaptation policies.** For example, directing the profits obtained from taxes aimed at mitigation (e.g. registration or road transport) at policies of adaptation (e.g. management of the withdrawal from the coastline, preservation of vulnerable spaces and species and/or water and forest management with climate criteria).
- **To be aware of the knowledge required for acting and formulating the right policies, in order to suitably prepare the relevant sectors and actors.** For example, to quantify the reduction potential and to apply indicators for following up on the different measures and policies in different sectors, the possible combinations and their respective costs. To formulate it as different packages of alternatives according to different action scenarios, depending on different political wills and objectives agreed in a participative manner (e.g. application of the EU reduction objective for Catalonia (20 % by 2020) or higher; clear objectives are also needed in the longer term, (e.g. in the order of 60-80 % by 2050).
- **To integrate climate change in the measures aimed at making current sustainable development.** For example, to mainstream climate change in the actions and policies designed to reform the present organisation of time and work (avoiding unnecessary travel or transactions). To apply decisively the criterion that 'he who contaminates pays' and start important tax reform aimed at decarbonising the economy.
- **To place special emphasis on *experimentation for social learning*.** The transition to a decarbonised society requires knowledge and skills that have to be learnt from experiments and demonstrative actions and small scale innovation moving progressively to large scale ('learning by doing, doing by learning'). Opportunities must be given for agent transformation and it must be decided which sectors may benefit most from these innovations. For example, to create an industrial or urban area (or even a motorway or an airport) with zero emissions by effectively reducing emissions and/or carbon offsets that serve as an example for other areas or sectors of the country.
- **We must anticipate biophysical limits and understand the social determination and growth-limiting policies or measures for dealing positively and decisively with climate change, as an opportunity for social innovation, for improving quality of life and guaranteeing sustainability.**
- **To apply policies that share out responsibilities, costs and individual benefits in a suitable manner.** For example, by developing market mechanisms for reducing emissions on the individual or regional level. At present it is more important to talk about **who** is the problem, and not so much about **what**. In other



words, clear systems must be found to identify and apportion liability, including economic costs and benefits, to those who create environmental problems or have to participate in their resolution.

- **To reorganise administrative and institutional systems to adapt them to the new climate, territorial and regional realities.** Currently administrations are organised on the basis of targets (e.g. of growth or identities) that fail to consider the new climate situation. We could think of a possible process of large scale political and administrative re-regionalisation aimed at institutional adaptation to the climate.

pears in principle to be far from the most immediate and closest interests of the most relevant set of social actors, where the difficulties for collective action are of such tremendous proportions, and where the *free-rider* problem is omnipresent, appealing to private and individual interests presented itself as the only way of overcoming them. It was therefore understood that the different social actors would not take part in actively introducing new technologies and policies aimed at decarbonising the economy simply because the state said so. Each of these actors had to perceive climate change not as an added cost (both social and economic) and far above its individual benefits, but as an opportunity to achieve their own interests in each of the different social arenas where they work. In fact it might be interpreted that the medium and long term ‘success’ of Kyoto will not depend on anything more than precisely this, stimulating private interests, so that the income from participating is at least sufficiently large so as to compensate the costs of not doing so. Although on the other hand, the criticism is that for the moment current negotiations do not pursue, are not trying, or are unable to seriously combat climate change (especially when so much emphasis is placed on the flexibility mechanisms, more aimed at gaining time), as they fail to solidly attack the root cause of emissions (social organisation and current schemes and distribution of power and inequality), and only and above all deal with the symptoms. Therefore, it is now said that Kyoto only intended to sit down the different actors, and particularly the main emitters, at the same table (so that once there they could not get away), to be able to open a second round of negotiations. However, what is not seen as an opportunity might carry very serious risks in the future, given that large investments, particularly in the wrong sectors that fail to attack the root causes of the problem, could cause costs and withdrawal situations that are very difficult to overcome, from the main sectors and actors. Then, if the measures are not sufficiently efficient and sufficiently equitative at the same time, with regards to the results and the decision processes, the actors may not be prepared to renegotiate when they see that everything

they have done has not served the purpose that it was designed to in principle: combating both the causes and the consequences of climate change. Therefore, both Kyoto, as an international process, and participatory processes carried out at the local level need to prove that they are capable of achieving substantial social transformation. That show that the transition process towards a decarbonised society has begun despite the refusal of corporate actors or even countries such as the United States, and that it is possible to generate visible, effective, equitable results to lead another round of negotiations and commitments on both a global and a local scale that are more strict after 2008-2012.

Finally, in relation to the state of scientific knowledge, current models still have important limitations with regards to regionalising the impacts of Climate Change, more so when these are projected in the medium and long term. Many of the current scenarios start with ideas that project considerable continuity and graduation in the social and ecological dynamics; and thus, the sudden changes that could arise from these socio-ecological systems are not considered, some highly negative and irreversible (the *tipping* points) derived precisely from the continuity, accumulation and retroactivity of these dynamics (in the form of growing contamination and global systemic degradation, or the growing scarcity of resources; other sudden changes could, however, go in the opposite direction, if certain acceleration processes were caused in social learning and innovation, though not very likely in the short term). To some extent, the Intergovernmental Panel on Climate Change (IPCC) has already done a large part of the main work that strictly conventional science could or had to do (although obviously greater depth is always needed): to prove the existence of climate change, the role human activities play and the main possible impacts on ecosystems and human societies. The main challenge now lies 'beyond science', in political and social expression, or rather in the reformulation of the role of science and knowledge in this social expression towards the creation of capacity for the social agents to mitigate and adapt by means of a true process of social learning.

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6. To conclude

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6.1. Change of perceptions, political agenda and social learning

To a degree, science has always had a difficult or conflictive role with the dominant culture and powers (known examples including Galileo Galilei and Charles Darwin with the religious and academic institutions of the time. In the 21st century, the science of climate change also comes into conflict with many of the cultural and institutional ideas that we accept about the organisation of our society and our relations with our surroundings. There are even people who say that climate change and the sciences of global change in general question the bases of today's dominant 'religion', which currently takes the name of the market economy (a system of beliefs based on the alleged benefits of ideal competition, individual work discipline and imposing no restrictions on growth). Maybe we do not need to go so far, but for some, the 'discovery' and penetration of climate change in the economy and in politics partly reflects the end of the economy's pre-eminence as a science and doctrine of faith (and therefore not only theoretical, but also regulatory) isolated from knowledge and the evolution of ecological systems. The publication of the Stern report was decisive in this sense, at it revealed that the economy, though fundamental and essential for understanding and guiding global society, requires a less dogmatic treatment of its findings and above all knowledge of the ecology to be able to inform policies. Basic economic assumptions such as 'caeteris paribus' (the rest remains the same) or 'if demand rises, supply will too in principle', in many cases moves further away from reality. The same concept of ownership that some question and others cling to, for dealing with climate connections such as the tropical rain forests, are also starting to be questioned since environmental and climate change in particular started to enter global discourse. The same belief in the existence of no limits, in either the availability of natural resources or the global ecosystem's capacity to absorb contamination without disastrous effects, is being more and more put into doubt. We know very little about the texture and implications of this cultural change stimulated in part by the irruption of the climate debate, a cultural change that is in its early stages, and where the study of perceptions of the public and the key social agents may play a crucial role in understanding where we are going. However, in recent years we have seen a change in the way of understanding the relationship between

society and the climate system, from understanding that the climate was changing to understanding that *the climate has to be protected*.

According to Canadian sociologist John Hannigan, for the environmental problems to exist in a social universe and finally become a political question, three things must happen: first, scientists must *combine* the different evidence on the matter, giving coherence and sense to a series of phenomena that were previously understood in a disconnected manner; second, the social movements must feed and maintain a certain conflict; and third, the *media* must sufficiently disclose the fact. In the case of climate change, the social awareness of the problem has been relatively slow, but as we have seen in this article, it has accelerated intensely in recent years. The scientific evidence, structured through the IPCC (*Intergovernmental Panel on Climate Change*) has been decisive and, in part, has counterweighted the inexistence of an open conflict between the parties involved, which is difficult to express in a global, interconnected system where liability for the problem is not easily assigned, at least without the help of science. For their part, the media have introduced a growing number of news items related to climate change, which in some countries has begun to have a notable effect on establishing the political agenda. However, in Catalonia, although climate change's presence in the media has taken off, and the subject now seems to form part Catalans' environmental awareness, it is still early to see how these perceptual and communicative changes translate into measures and specific, stable and effective action processes.

The policy of climate change is a race against time. Many of the measures currently designed to give an economic value to the issue using market mechanisms are actually nothing more than measures to buy time. Therefore by collecting greenhouse gases, by planting forests, we may put off the the tipping point or critical threshold of no return by a few years (a few), before certain ecological systems enter a phase of unforeseeable and potentially catastrophic behaviour. But such measures are temporary and short term, for in the long term the only feasible measures will be those aimed at effectively reducing emissions and restoring ecosystems that, together with compensation mechanisms, may have an effect on the whole of the climate system.

As we have mentioned above, Spain agreed before the European Union to increase (not reduce) its emissions for 2008-2012 by 15% at most. However, in 2005, the emissions of greenhouse effect gases in Spain had reached 52.3%, that is 3.5 times more than was agreed. In Catalonia, the emissions grew by 47% in the same period, so we can not say that Catalonia has done a particularly good job in this sense either. Institutional climate negligence can also be observed on the local level. In 1996, Barcelona signed the Heidelberg Declaration, which committed subscribers to reduce by 20% by 2005 the greenhouse gas levels of 1987. More than a decade has passed and not only has this objective not been achieved,

but the production of greenhouse gases has gone in the opposite direction. To some extent, we give the impression of always starting but never going anywhere, postponing decisions that should have been taken yesterday and therefore wasting time that we don't have. We hope that with the constitution of new institutional mechanisms such as the Catalan Office for Climate Change, the Interdepartmental Commission of Climate Change, and the start of the Catalan Convention on Climate Change, Catalonia might end up taking a proactive, clear position in relation to its climate commitments. In my view, this should mean setting very specific, ambitious, quantifiable objectives for reducing greenhouse gases (at least 1.5-2% a years in the coming 20 years), along with an integral programme of adaptation. The public administrations are obliged to create a calm and continuous space for debate, as free as possible of corporate, party interests and/or in the shortest possible term, to discuss the corresponding strategies. And this discussion will obviously have to seriously consider the impact of expanding and building new infrastructures (including ports, airports and roads) to achieve these aims. Only if it is possible to generate all of the means and develop all the collaborations in civil society needed to achieve these collective objectives, will we be able to gain the maximum benefits and opportunities that climate change can provide and at the same time avoid the costs and the losses that a reactive position might imply in this area. In this sense, and from a strictly economic perspective, it is easy to justify why these reductions (and the investments required) are necessary as soon as possible. As the international commitment to fight climate change consolidates, we can foresee that it will become increasingly expensive to emit greenhouse gases in both the European Union and internationally. In fact, many of the institutional developments in the emissions market are aimed at guaranteeing stable, but rising, prices in the emission of CO₂ in the coming 30 or 40 years. Societies that have advanced in developing and implementing solid technologies and organisational systems capable of integrating climate change will have competitive advantages not only when exporting clean technologies to other countries, but also when 'paying' for emissions that will be more and more difficult to afford. This challenge requires a high level of social organisation and the Catalan Convention of Climate Change has raised a series of expectations in this regard that cannot be disappointed¹⁰.

In particular, I understand that the Convention and the new institutional instruments created in Catalonia should go beyond finding the means for com-

¹⁰ The social sciences play a very important role in contributing to this independent, calm and necessary debate, both because their findings and research are based on rigorous work and methodologies and, inasmuch as possible, are separate from corporate interests and commitments. However, in our country the environmental social sciences are practically non-existent in relation to all other scientific fields. We need to overcome excessive voluntarism, or as someone said, the 'scientific quixotism' of those whose intend to bring a socio-scientific perspective into the debate on climate change. Without support and more institutional backing for environmental social sciences, the work of researchers in this field is practically impossible.

plying with the minimum mitigation objectives established by Kyoto for Spain (though to be realistic and under the present conditions, achieving this would mean a lot). And it is in this regard that I understand civil society's participation could play a very important role. Actually, the only way to effectively and equitably deal with the problem and the policies of climate change is by integrating as much knowledge, will and capacity as possible by means of social participation. Nevertheless, on the field of climate change we can detect four situations where the role of participation could be different. As shown in table 6.1, the potential and the effects of this participation are very different, depending on where they are directed, either at mitigation or adaptation or at obligatory (imposed by the Kyoto commitments) or voluntary (bottom-up) actions. At present, the public's participation is limited to contributing to doing what has to be done, that is, the compulsory actions of mitigation of quadrant I, given that there is still not a sufficiently developed framework for adaptation. Nonetheless, participation may play a much more important role in institutional innovation, and not only by legitimating compulsory policies in the other quadrants but with the will to go beyond and create new regimes of obligation, for example in the case of further commitments to mitigation or adaptation that are yet to be developed

Table 6.1. The role of participation can change according to where the action is directed: at actions of mitigation or adaptation or at compulsory or voluntary actions

Strategy in Catalonia	Mandatory actions	Voluntary actions
MITIGATION (reducing emissions)	I	II
ADAPTATION (not necessarily reducing emissions)	III	IV

Finally, despite the remaining uncertainty in both science and climate policy, it is important to remember that it is possible to substantially improve the *climate capacity* of social agents, as in the case of Catalonia, with the knowledge we already have. In fact, better forecasts or regional modelling does not necessarily translate into agents' greater capacity to deal effectively with climate change. The process of climate mitigation and adaptation must be understood as a *social learning process* aimed at enhancing social agents' capacity to anticipate and transform. A systematic perspective (capable of integrating and dealing with several problems at the same time in an integrated manner) must be applied, and one of social learning aimed at transforming the system of relationships that we main-

tain with our social and biophysical surroundings, through changes in our institutions and our lifestyles. Here the policies aimed at restructuring the labour market, the production system and time organisation are fundamental, like those aimed at avoiding *useless trade*. It is also important to avoid individual strategies aimed at adapting to climate change in the short term (such as concentrating agricultural production, increasing water infrastructures, abandoning unproductive agricultural or forest areas or increasing refrigeration systems) transferring the problem of adaptation to mitigation, making this more difficult, in other more vulnerable social contexts or on broader time scales. A learning process involving very different wills, knowledge, interests and skills, and also ways of interpreting and framing the problems and their priorities in a very different manner. A process, however, that does not depend so much on the *need* to learn (adapt and mitigate) as on the collective *will* to do so. In the end we will do what we have to do, or we will learn what we have to learn, not because we 'have' to learn it (many past civilisation never learnt what they had to learn) but because in any case we are freely and consciously motivated and take the collective decision to do so.

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¹¹ I have dealt with some of the arguments outlined in both the introduction and the conclusion of this article in other places. Given the socio-scientific and political nature of this work, designed to support students and social agents interested in these matters, I find it appropriate to include some references from my latest research in this field which has not been quoted on the previous pages. These concern the politics, the perception and the participation of the public regarding climate change, and the social learning involved in managing water resources and sustainability.

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This monograph contains a series of recent studies on the media coverage and public perception of climate change in Catalonia, and provides an analysis of the implications of the climate policy in Catalonia. According to quantitative data (n = 500), global warming is one of the main environmental issues that Catalan society is concerned about. Despite this, the main *natural risk* people perceive is flooding, a fact that is possibly explained by the higher incidence of news coverage, greater exposure and the potential losses that come with these hazards, and a lower inclination to accept situations that used to be regarded as 'normal'. An analysis of the contents of the daily press during the 1990-2006 period shows a dramatic increase in news articles on the climate since 2003. Meanwhile, the coast is still not perceived as an interconnected, fragile and complex system, which stops it from being managed satisfactorily, though new information tools are starting to change this situation. With regard to the political analysis, reductions in the emissions of greenhouse gases to the tune of 1.5-2% per year are proposed, for a minimum of 20 years, complemented by adaptation policies. These are necessary for us to benefit from the economic and innovation opportunities and the social transformation that will arise from living in a world where causing pollution and consuming non-renewable resources will become increasingly expensive.

Keywords: climate change, the media, flooding, public perception, coastal systems, global warming.

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