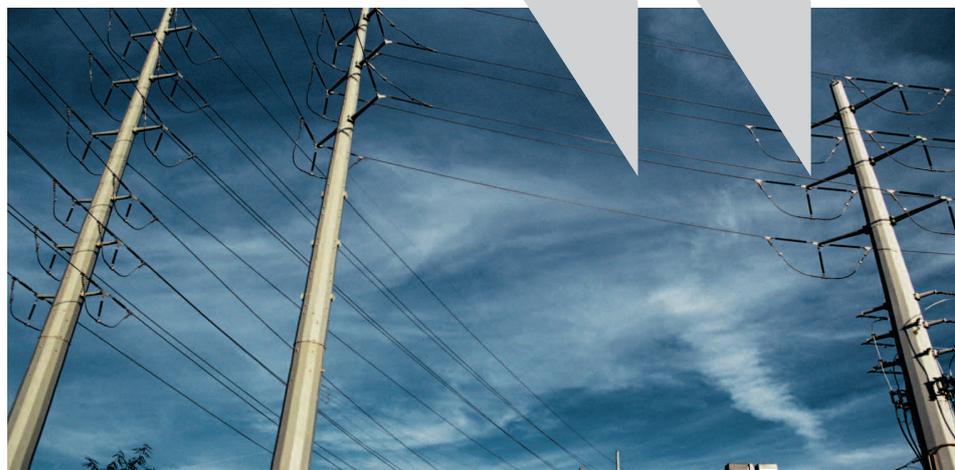


OECD Studies in Risk Management

France

POLICIES FOR PREVENTING AND COMPENSATING
FLOOD-RELATED DAMAGE



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OECD STUDIES IN RISK MANAGEMENT

France

POLICIES FOR PREVENTING AND COMPENSATING FLOOD-RELATED DAMAGE



ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT

Foreword

The OECD Futures Project on Risk Management Policies aims to assist OECD countries in identifying the challenges of managing risks in the 21st century, and contributing to their reflection on how best to address those challenges. Its focus is placed on the consistency of risk management policies and on their ability to deal with the challenges, present and future, created by systemic risks. It is designed in two phases. In Phase 1, the countries participating in the project propose specific themes as case studies of their risk management policies. For each proposal, the OECD Secretariat prepares an overview of the issue covering both recent international developments of interest and the national policy context. In addition, the Secretariat elaborates a tool for self-assessment and review, consisting of one or several questionnaires following the methodological framework of the project. This prepares the ground for Phase 2 in which an in-depth review of the risk management issues will be conducted by a team of experts for those countries that wish it. Self-assessments will be used as the basis of these reviews. At the end of phase 2, a cross-country report will bring together the lessons learned from the project, and identify opportunities for sharing best practices and improving risk management.

In the framework of the OECD Futures Project on Risk Management Policies, the French Ministry of Ecology and Sustainable Development has proposed a case study on risk management policies related to flooding in France. More specifically, the Ministry requested that the study focus on “identifying an economic and social optimum for prevention and compensation policies” for flood damage. Flood risk is managed at different geographical levels, by actors ranging from mayors to decentralised government services, insurance companies and the people who are exposed to flood risks. As the approach is to identify a social optimum, questions as to the consistency and effectiveness of the system formed by these initiatives and its ability to produce a level of collective risk that is deemed acceptable are warranted. The aim of this study is to assemble the information needed to analyse these questions, primarily by drawing on the tools of economic theory in order to lay the groundwork for a potential review of prevention and compensation policy for flood-related risks in France in the Phase 2 of the Project.

This study was prepared by Reza Lahidji from the OECD’s International Futures Programme. The author benefited from comments by Antoine Boisson, Annie Erhard-Cassegrain, Louis de Gimel and Emmanuel Massé of the French Ministry of Ecology and Sustainable Development and from the guidance of the Project Steering Group. The study is issued under the responsibility of the Secretary General of the OECD.

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Introduction

Of all natural hazards, flooding causes the greatest damage in OECD countries, particularly in France. According to data gathered by the Centre for Research on the Epidemiology of Disasters (CRED), flooding resulted in the loss of more than 85 000 lives and USD 180 billion worldwide over the period 1995-2004.¹ Moreover, statistics from a range of different sources suggest that the losses incurred have tended to rise steadily since the beginning of the 1980s² at least.

It would appear that the same factors are behind the increase in the number of disasters in the majority of OECD countries. The first of these is the higher concentration of people and assets in flood plains, in valleys and along the coast as well as the increase in the value of assets damaged, which, in turn, is related to higher standards of living. Often, too, urbanisation and land use and development in rural areas result in soil erosion and greater rainwater runoff and, so, contribute to the increased frequency of floods. Lastly, the possibility of a higher probability of extreme climactic events linked to climate change is increasingly becoming an issue.

Governments facing these trends towards an increase in flood risk have a wide range of measures that they can use to better protect the population: improved knowledge about risk, information campaigns, flood defence infrastructures (embankments, dams, maintenance of watercourses, etc.), definition of flood plains, limitation of new building, subsidies towards the reduction of vulnerability of existing buildings, declaration of easements up to and including expropriation, reinforcement of flood monitoring and alert systems, developing rescue capabilities, spreading the cost of damages through insurance and reinsurance mechanisms, etc.

However, the use of these instruments raises a certain number of questions. In which cases should central government intervene? What should be the limits of its action and what level of risk should it aim at? What should its priorities be? Since the aim is to establish the “economic and social optimum” for risk management policies, the answers we supply to these questions must be satisfactory from the standpoint of society. Economic theory provides a formal framework for doing so. This study describes that framework (Part 1), applies it to the French system for managing flood-related risk (Part 2) and tries to draw some lessons from it (Part 3).

¹Source: “EM-DAT: The OFDA/CRED International Disaster Database”. Université catholique de Louvain, Bruxelles, Belgique. Internet site: www.em-dat.net.

² See, for example, EM-DAT database, or Munich Re (2005).

The main limitations of the exercise should be pointed out from the outset.

Firstly, “flood risk” covers a range of very different phenomena: slow-rising floods in floodplains, torrential flooding (spates or flash floods), runoff flooding, floods caused by dam or embankment failures, etc. Across France, floods represent a multitude of distinct local risks. A large part of any detailed study of flood risk management policies, should therefore cover the study of the specific aspects of each situation. However, this report is concerned only with the general aspects of flood risk.

Secondly, this report proposes a framework for the analysis of risk management policies based on the existing literature, an approach which is necessarily reductionist. It does not aim to make a complete assessment of France’s risk management system, but rather to open up a few avenues for discussion. It purposely does not address aspects that are better understood by technical, legal or institutional analyses, etc.

1. Objectives of risk management policy: the economic theory approach

Today it is generally agreed that society's response to risk must be seen as a whole in which, for instance, prevention efforts have an influence on, and are influenced by, crisis management. Within the framework of the OECD Project, risk management policies are seen in the wider context of the risk management system, which encompasses all of the elements of society's co-ordinated response to the existence of risk, whether provided by public or private agents.³

While public policy is only one among many such elements, we need to consider its role and how it intersects with private behaviour. Economic theory provides a framework which allows us to do so, welfare economics, which focuses on the competitive equilibrium of the economy and on the conditions under which that equilibrium would equate to the social optimum. Under this framework, the role of public policy is to intervene only when those conditions are not met and/or when government action would produce a better outcome than leaving the situation up to the free play of individual decisions on consumption, production and trade (see box 1).

Actually, private agents factor many risks into their day-to-day decisions without anyone thinking that government action is necessary. Why the situation should be different for natural catastrophes, like flooding, can be put down mainly to two factors. The first is that many "goods" necessary for dealing with risks are public goods, be it information regarding a given hazard and its possible impact, tools for prevention or for responding to adverse events. The second is that natural catastrophe risks raise insurability problems.

This part of the study analyses these two factors and their implications for public policy in the quest for the social optimum. Section 1 identifies those risk management measures that have the characteristics of public goods. As such public goods are often local in nature, the role of supplying them has to be shared by central government and local authorities. This issue is addressed in Section 2. Section 3 analyses measures that government can take to improve risk insurability. Each section starts with an overview of the existing economic literature, which it then applies to the risk of flooding.

³ See OECD (2003a). This definition of the risk management system is the definition given by the International Standards Organisation, the only difference being that, in French, we prefer the term "gestion" to "management" (see ISO, 2002).

Box 1 - The role of central government in seeking the optimum according to economic theory

In economic theory the concept of optimality refers primarily to the Pareto criterion, which states that an action is efficient if it makes at least one person better off without making anyone worse off, and that the situation is optimal if it can make no-one better off without making someone else worse off. Any Pareto-efficient initiative thus has the unanimous support of society, by definition, while from a Pareto-optimal situation no change in the distribution of resources can be unanimously decided.

The fundamental theorems of welfare economics propose that, given certain assumptions, a state of competitive equilibrium on markets is actually Pareto-optimal (first theorem) and, conversely, that a Pareto-optimal state can be achieved through free competitive market forces accompanied, where necessary, by the reallocation of resources (second theorem). Hence, individual decisions and trading can achieve a balance where the role of government is limited to establishing *ex ante* conditions in which the market is able to function (property rights, control of financial operations, etc.) and to *ex post* redistribution of the wealth generated (through taxes and subsidies which do not introduce distortion into agents' decisions).

However, these theorems are valid only under very strict conditions: all markets exist (current and contingent upon various future world states,⁴) full information is available to all agents, there is perfect competition, and (second theorem) indifference curves for both individuals and production functions are convex. Government intervention becomes necessary when one of the above assumptions has to be discarded, for instance because there is insufficient information or asymmetry of information, imperfect competition or even market failures (existence of externalities or public goods, absence of contingent markets, etc.).

These limitations on the applicability of the theorems of welfare economics can provide the theoretical justification for government intervention in areas as diverse as regulation (for example, health regulation), market surveillance (political, competitive, prudential, etc.), support for the existence of markets (emissions trading, compulsory insurance, etc.), direct provision of certain activities (from policing to space research) and even partnerships with the private sector (for example, in the research and development field). A great deal of public economics has to do with targeting these measures, with their efficiency and with the dysfunctions that they, in turn, can cause.

A second major limitation of welfare economics has to do with the concept of optimum itself, in the sense meant by Pareto, and more specifically to the impossibility of comparing individual utility. Not being able to compare utility in fact means that, in many cases, the Pareto criterion does not allow the ranking of the different possible states; the application of the criterion restricts the government's scope of action solely to those policies that have unanimous support, which is clearly too limiting. Criteria based on comparing and aggregating individual utilities allow a fuller ranking to be established, giving public policy a much broader scope. One example of this, the maximin principle proposed by Rawls results in the choice of a policy that maximises the utility of the agent who had the lowest *ex ante* utility level.

1.1. Flood risk management as public good(s)

1.1.a. Overview of the literature

In economic theory there are two criteria for establishing whether a good is a public good: the first is that no-one can be excluded from using it; the second is that its consumption is non-rivalrous. A typical example of a pure public good is national defence: all citizens benefit from it but its availability is not in

⁴Arrow (1953) demonstrated that this condition could be narrowed down to the existence of all current markets and some contingent markets, such as insurance and securities markets.

any way reduced by the fact that everyone uses it. In contrast, the use of a pure private good is exclusive and reduces the quantity of the good available.⁵

Since they are non-exclusive and non-rivalrous, the provision of public goods, at equilibrium, is lower than would be desirable from the social standpoint. This is because the risk of opportunistic consumer behaviour reduces a private agent's incentive to develop the supply, as users could refuse to pay the full price for the benefit they get (*free riding*). At this point, government intervention becomes necessary to ensure adequate provision.

Although pure public goods do exist, more often goods are partly pure public and partly pure private.

Determining the supply of public goods poses practical problems whatever form the intervention takes (direct provision, delegation to the private sector, public/private partnership). This is because the desirable level of production of a public good is such that the marginal cost of production equals the sum of individual willingness to pay for one extra unit of that good.⁶ However, willingness to pay is not observable, nor are individuals very inclined to reveal their willingness to pay, if they can benefit but pay less. The provider of public goods therefore has resort to techniques for revealing user preferences.⁷

1.1.b. Application to flood risk management

Flood risk management policy encompasses a range of measures that come into play both before (risk assessment, prevention, etc.) and after (evacuation, compensation, etc.) the occurrence of an adverse event. The methodological approach adopted in the OECD Project breaks risk management down into eight layers:⁸ risk assessment; policy decision-making; framework conditions (legislative and regulatory); protection and mitigation; alert and early warning; rescue; recovery; and experience feedback. This holistic approach is designed so that no interaction that could elucidate society's response to risk is dismissed out of hand.

In the case of flood risk, many component parts of the system have the characteristics of public goods in economic theory terms.⁹ These include:

⁵ For a full analysis of risk management as public good provision, refer to Guesnerie (2003).

⁶ In contrast to a private good, for which the marginal cost of production must equal the marginal willingness to pay of a representative person.

⁷ Laffont (1986).

⁸ The methodology of the Project is explained in OECD (2003a).

⁹ Boyce (2000).

- research into risk and the scientific and technical means of reducing it (risk assessment);
- information on risk: historical floods, flood plains, level of hazard, etc. (risk assessment);
- general planning standards, particularly as regards land use (legal and regulatory);
- construction and maintenance of flood defences: embankments, dams, etc. (protection and mitigation);
- surveillance: meteorology, flood observation (early warning and alert);
- alert (early warning and alert);
- evacuation (rescue);
- emergency medical treatment (rescue).

Each of the above activities benefits the entire population exposed to the risk, no one can be excluded from the benefits of the activity and their use by one individual does not restrict its availability to others. In some cases, for instance with structures that protect an entire flood plain, the non-exclusiveness of access to such goods is technical in origin. However, it more usually has a moral and legal basis, as in any situation in which inadequate goods or services would in itself be enough to endanger the safety of the public. The non-rivalrous nature of the use of these goods, on the other hand, varies with the activity: while the expected benefits of historical data on floods, weather forecasts, land-use regulations, or the existence of embankments do not diminish as the number of beneficiaries increases, the same cannot be said for rescue, re-housing and medical services, which all have saturation thresholds.

Hence, according to economic theory, government intervention is necessary in order to ensure adequate production of these goods from a social standpoint. However, as stated in the introduction, it is important to note that flooding is not a homogenous hazard that affects the entire population, but a multitude of hazards (not necessarily correlated throughout the country, in a country such as France) each of which affects a limited geographical zone. Hence risk management activities essentially benefit only the population exposed to a particular risk within a given perimeter. They are local public goods and it is essential to give some thought to the appropriate level for government intervention.

1.2. How should roles be shared between central government and local authorities?

1.2.a. Overview of the literature¹⁰

The economic literature on local public goods has its basis in the seminal article by Tiebout,¹¹ which stressed the benefits of competition between local authorities in a world in which individuals have different preferences and “vote with their feet”, when they make the choice to settle in a location where the rates of taxes and the supply of public goods best suits them. The “decentralisation theorem”¹² states that in the absence of economies of scale and of inter-jurisdictional externalities, the supply of an optimal level of public goods in each local jurisdiction represents a welfare gain over the centralised provision of public goods, whatever the level provided. This gain seems to be a function of the costs of producing the goods and of individual preferences among different localities.¹³ The advantages of decentralisation are particularly clear when the supply of public goods is saturated beyond a certain threshold. Each local authority can therefore “calibrate” its supply to meet its needs.¹⁴

In theory, of course, central government could provide local public goods differentially to allow for these divergences, but in practice it would run up against two kinds of problems. Firstly, central government would have less access to information on the state of production and demand for public goods than local authorities. This asymmetry of information may simply be a result of the fact that local information is of greater value to the latter than to the former.¹⁵ Secondly, it is often the case that central government is politically (or constitutionally) bound to treat all citizens in the same way country-wide.

Thus, although people’s mobility was an important factor in Tiebout’s reasoning, later economic studies demonstrated that the key argument in support of decentralising the provision of public goods was the variability of the costs and benefits of public goods from one locality to another. The optimal level of government intervention is the level at which all costs and benefits can be taken into consideration in determining the supply of public goods.

¹⁰ This part discusses economic theories of local public goods and fiscal federalism. However, it does not address redistribution issues (either between regions or between individuals), which are a major part of these theories but are not directly relevant to the analysis of flood risk management policies.

¹¹ Tiebout (1956).

¹² Oates (1972).

¹³ Gains from decentralisation are also dependent on demand elasticity for the public good, inasmuch as for uniform production costs, the more inelastic the demand, the greater the loss of utility for any divergence between the desired level of public good in a specific locality and the overall level proposed by a central authority (see Oates, 1997).

¹⁴ Buchanan (1965).

¹⁵ Cremer, Estache and Seabright (1996).

However, in practice, the decentralisation approach can run into difficulties of application. The provision of public goods often offers economies of scale, in the technical expertise it necessitates, for instance. Moreover, there is no reason why the geographical boundaries of local authorities should systematically coincide with the area that benefits from the existence of those public goods. Frequently, provision by a local authority results in positive spillovers beyond the boundaries of its jurisdiction.¹⁶

Above all, for decentralisation to be optimal, taxes must reflect the “price” of the public good as related to the benefits derived from it. In actual fact, local authorities frequently do not have the appropriate fiscal instruments with which to levy such a tax. When there is any distortion between the benefits of a public good and its cost to individuals or companies (in terms of taxes, restrictions on activity, etc.) the mobility of the latter once again becomes a determining factor: in reality every authority has an incentive to curb costs so that it will be more attractive and this can lead to a “downward spiral” that ends with an inadequate level of supply of public goods.¹⁷

In extreme cases of imperfect local supply, centralised provision, whether by central government or by local authorities under central government mandate, may again become the most efficient solution. This said, more often than not, the best solution is for the two tiers of government to share roles as this would enable them to capture the gains of decentralisation while correcting its deficiencies. In order to do so, central government must either employ a system of taxes and subsidies which allows local authorities to internalise all of the costs and benefits of their decisions or transfer tax revenues to them to fund the provision of public goods. The first type of intervention is analogous to quantity control and the second to price control.¹⁸

Public choice theory has questioned the “ideal” behaviour attributed to authorities (both central and local) by these approaches. This school of thought has proposed that instead of assuming that the aim is to maximise utility for constituents, behaviour should be assumed to be more self-interested, aimed, say, at maximising the budget in order to increase political power. Often, the assumption in this context is that local authorities are subject to closer scrutiny by their constituents, which is of course a further argument in support of decentralisation. However, some authors have pointed out the dangers of decentralisation owing

¹⁶ More specifically, both the positive and (if applicable) negative externalities of intervention by one local authority on others have to be taken into account.

¹⁷ Gordon (1983), Inman and Rubinfeld (1996).

¹⁸ Inman and Rubinfeld (1997).

to the potential for local finances to drift when central government subsidies or fiscal resources are made available to local authorities.¹⁹

Lastly, in some cases, provision by central (or federal) government may be more in the nature of protecting against local shocks. When this is the case, it can generate a moral hazard since it would mean that local authorities and their electorates have less incentive to provide against shocks themselves. In order to reduce the moral hazard at the local level, there are various solutions depending on the institutional set-up.²⁰ One would be to centralise prevention, or at least ensure that it can be observed by the authorities which provide the insurance cover; a second would be to provide only partial risk cover at the central level, leaving local authorities to cover the remainder. Using partial exposure to risk is similar to the classic use of a “deductible” in insurance policies as a means of controlling moral hazard (see also section 1.3.a.).

Overall, sharing the roles in the provision of goods between central and local authorities is, according to economic theory, a difficult trade-off between economies of scale and the capacity of government to control moral hazard and the risks of budget drift at local level, on the one hand, and the capacity of local authorities to satisfy the differing needs of their constituents on the other. This can be seen as a reworking of the subsidiarity principle that operates between the European Union and its Member countries as enshrined in the Maastricht Treaty.

1.2.b. Application to flood risk management

Although the methods of sharing the organisation of risk management policies between national and local levels should be determined to suit the circumstances, some broad guidelines appear to have emerged.

- The provision of public goods must be the responsibility of central government when it is subject to major externalities or economies of scale (including in terms of transaction costs). This is notably the case when major scientific and technical resources are required (research on risk, technical expertise in defence structures, satellite observation, weather forecasts, etc.) or when differentiated provision might lead to major transaction costs (different construction standards and land-use regulations in different regions).

¹⁹ Prudhomme (1995).

²⁰ Persson and Tabellini (1996).

- Conversely, local authorities should be given more room for manoeuvre when the conditions determining provision vary widely from one locality to another.²¹ Hence, differences in opportunity costs from one locality to another when economic activity has to be restricted or urbanisation controlled can be a factor in favour of the differential management of these activities. Prohibiting building on flood plains could actually generate very high or very low opportunity costs, depending on whether or not there is a local shortage of building land.
- Moreover, the advantages of local authorities as regards access to information may win out over externalities and economies of scale (closeness to citizens for locating and informing exposed populations, verification of compliance with legislation or applicable standards, etc.).
- Lastly, local provision also has an advantage where services may become saturated by demand (rescue services).²²
- Local provision must be financed by local taxes when these can be levied on benefits or when there is little risk of tax-base mobility, otherwise it must be financed by a transfer from central government.²³
- With reference to managing risks in cases where prevention can play a crucial role, it is always important that decentralisation of responsibility or public finance is accompanied by means of controlling the moral hazard that can ensue.

1.3. Insurability problems

1.3.a. Overview of the literature

The existence of an insurance market that functions well is one of the most critical conditions for an optimal competitive equilibrium.²⁴ This is because insurance allows each individual to transfer the risks they face (to the extent that they are risk averse) to an agent who, in turn, will mutualise them among a

²¹ In this case, these are essentially differences in the costs of production of public goods. It would be problematic to study the feasibility of decentralised risk management in the light of differences in individual preferences and, in particular, of their aversion to risk, in view of the ethical, theoretical and empirical issues involved. For a critical discussion on the concept of risk aversion, see Rabin and Thaler (2000).

²² Referring to fire-fighting services in the United States, Duncombe and Yinger (1993) show that relatively small communities (of around 10 000 or so) may be better off setting up their own services.

²³ It is important to note that the redistribution of wealth among communities, which could be justified, for example, where there are large disparities in their capacity to finance the provision of public goods is not addressed in this study.

²⁴ Cass, Chichilnisky and Wu (1996).

sufficiently large number of individuals. Transfer and mutualisation of risk are possible only if the individual risks are weakly correlated; if one has reasonable estimates of the probability that the hazard will occur and of the scale of the damages that would ensue for the purpose of calculating premiums; if the insurer has sufficient reserves to cover higher than average claims or is able to call on a re-insurer.

In addition to these conditions are the two classic problems of insurance: moral hazard and anti-selection.

Moral hazard, as mentioned above, arises when the insured is able to control the level of risk by taking preventive measures, but the insurer is unable to observe them. The very fact of having insurance can reduce the policy-holders' incentive to take preventive measures and thus lead to an aggravation of the risk.²⁵

The problem of anti-selection arises when individual risks are not homogenous: if it is not possible to single out individual profiles according to risk level, low-risk individuals may judge that premium levels (which are calculated on the basis of the average risk) are too high and stop paying insurance, thus weakening the insurers' portfolio, driving premiums up and triggering a gradual process of restricting the market to the individuals with the highest exposure to risk.²⁶

The insurance sector has developed tools which enable it to resolve some of these problems, such as the application of deductibles, caps or uncertainty premiums, the use of sophisticated risk analysis methods, securitisation, financial market tools, etc.²⁷

Overall, the insurability of a risk is dependent on the capacity of the insurance/reinsurance sector to provide cover which people exposed to the risk consider affordable and worthwhile. It is therefore a relative concept, which is conditional upon the criteria listed above, but also upon competitive conditions in the sector. When insurability is low, in other words, when a significant portion of the population is likely to be excluded from insurance cover, government can step in to establish better conditions. The most common forms of intervention are:

- The introduction of compulsory insurance, in order to eliminate adverse selection;

²⁵ Shavell (1979).

²⁶ Rothschild and Stiglitz (1976).

²⁷ For a comprehensive review, see Faure and Hartlief (2003).

- The appointment of a public body as the insurer of last resort, or the creation of a reinsurance mechanism backed by a government guarantee, or the provision of additional finance for the most serious disasters, in order to resolve problems with the diversifiability of risk or insufficient capacity;
- The development of technical regulations and standards, which, by making prevention measures observable, will afford better control over moral hazard.

1.3.b. Application to flood risk management

Even more than for other types of natural disasters, flood insurability is considered to be low: the increasing number of questions raised about the probability of occurrence (or frequency) of such events relate to the effects of global warming in particular (see also 3.2.a.); the moral hazard is significant; and, most importantly, the relative concentration of flood plains can pose a problem of anti-selection. In most member countries of the OECD, the risks are unevenly distributed throughout the country; floods with a return period of one to two hundred years concern only a small portion of the total stock of property. This means that the vast majority of the population may not be interested in cover against flooding, while insurance limited to high-risk areas would mean prohibitive annual premiums.²⁸

It is estimated that floods are responsible for half the victims and a third of the economic losses due to natural catastrophes world wide, but account for only 10 per cent of insured losses.²⁹ Even in OECD Member countries, there is little insurance cover for flood risks, except where there has been government intervention. Where the government has intervened, insurance has been made compulsory (Spain, France), a limited guarantee has been offered to insurers by the government (United States) or a public reinsurance system (or system of last resort insurance) has been set up (Spain, France).³⁰

One solution frequently proposed in the economic literature as a means of reducing moral hazard is to make better use of the synergy between government and insurance companies.³¹ These latter could make the rate of cover conditional upon compliance with regulations or recommendations on risk prevention (building codes, etc.). By doing so, they would benefit from the economies of scale that accrue from having a system of common standards. The provision of insurance cover could be made conditional upon inspection procedures (by insurance companies) and certification and, if need be, upon the adoption of

²⁸ Swiss Re (1999).

²⁹ OECD (2003a).

³⁰ For a description of these schemes, see OECD (2003c).

³¹ See, for example, Kunreuther (1997).

measures to limit losses. Government authorities could also use the insurance sector to improve individual and corporate compliance with regulations.

2. The French system of flood risk management

This part gives a description of the main elements of the French system of flood risk management and how they have developed over the past ten years under the impetus of several major reforms (the Act of 2 February 1995, which strengthens environmental protection, reform of the compensation scheme for victims of natural catastrophes 1999, the Act of 30 July 2003 on the prevention of technological and natural risks and reparation for damages). The description follows the methodological approach of the Project, which has identified eight layers of risk management.

As in part one, the focus is on prevention, damage compensation and the division of responsibilities between central government and local authorities. A summary list of the main players in the system is given in Annex 1. A list of the main legislation and regulations applicable is given in Annex 2.³²

2.1. Risk assessment

In France, the government has a statutory responsibility to evaluate flood hazards, gather upstream information and ensure that it is passed down the line. The Ministry for Ecology and Sustainable Development is the principal party concerned with risk evaluation and is in charge of analysing historical data on floods and gathering scientific input from disciplines such as hydrology and geology. It is also responsible for encouraging research into flood risks; the impact of climate change, for example. The Ministry also assesses existing flood defences (embankments, dams, etc.). However, there appears to be no mechanism for the systematic collection of information on the condition of these structures.

The Ministry produces information on hazards for each catchment area, which is made available to the other public actors through the network of Regional Environment Directorates (DIREN).

All of the information available on risk is provided in a summary document drafted by each Prefect and issued to the mayors of each *commune* (municipality) in the relevant *Département* (province). The mayor, in turn, drafts an information document summarising all of the safeguards provided to deal with the risk inside the boundaries of the *commune*. Both documents are available in town halls for consultation by the public.

³² Sources: Internet site of the Ministry for Ecology and Sustainable Development www.ecologie.gouv.fr, information sites www.prim.net et www.legifrance.gouv.fr, and the Institut Supérieur de Planification d'Urgence (2003).

On this basis, the Act of 30 July 2003 on Technological and Natural Risk Prevention and Reparation of Damages introduced new provisions aimed at more proactive communication on flood risks. Among other things, it made it compulsory for the mayors of any *commune* subject to a Risk Prevention Plan (RPP)³³ to keep citizens informed, and required that the situation of property in respect of natural risks be stated for any transactions or rental contracts, even for seasonal rentals. Central government (the Ministry of the Interior and the Ministry of Ecology and Sustainable Development) is required to provide support for local authorities to implement their communication policy and to ensure that it is sufficiently proactive. The Act also requires that information on risks be free of charge.

2.2. Decision-making concerning risk management

At the local level, risk management is mainly the responsibility of the mayor. Under the legislation on local authorities (*Code général des collectivités territoriales*),³⁴ the purpose of the municipal police is to ensure public order, security, safety and health. This includes: (...) 5° Due care to take appropriate precautions to prevent and bring to a halt accidents, disasters and pollution of any kind such as fires, floods, embankment failures (...). These responsibilities are confirmed in the Town Planning Code and the Act of 22 July 1987 on civil defence.

The Prefect, as the representative of the government in the *Département*, has the authority to take the place of the mayors if necessary to ensure public safety. The Prefect also chairs the Commission on Large-scale Natural Risks (*Commission départementale des risques naturels majeurs*). The Commission, composed of representatives of elected officials, statutory agencies, trade organisations, emergency services, etc., delivers opinions with a view to furthering the understanding of, and improving, risk management. The Prefect relies on the support of decentralised government services and organises co-operation between them at *Département* level.

Risk management measures are co-ordinated within the perimeters of each basin by the catchment area co-ordinator, a Prefect. The latter liaises with the *Département* Prefects (Act of 30 July 2003).

At the national level, the overall flood risk management policy is established by central government and transmitted to the local level by decentralised government services (Regional Environment Directorates, Departmental Public Works Directorates, Departmental Agricultural and Forestry Directorates). Risk Prevention Plans (RPPs) have been the main policy instrument since 1995.

³³ For more details on RPPs, see section 2.4.

³⁴ Article L 2212-2.

Risk Prevention Plans replaced the Risk Exposure Plans that were set up by the Act of 13 July 1982 in order to reduce the vulnerability of areas exposed to risk, but the short-comings of the latter (in terms of the time taken for implementation and planning) were revealed by a series of catastrophes in the early 1990s, particularly the flooding in Vaison-la-Romaine (September 1992).

When drafting an RPP, central government determines the natural phenomenon or phenomena causing the risk, evaluates the hazard, identifies the exposed areas and specifies town planning, construction and management requirements for new and existing buildings. These may include the prohibition of new construction of any kind and the imposition of building use and operating requirements, the implementation of general preventive and defence measures and safeguards (organisation of rescue services, measures to ensure personal safety, etc.) and requiring alterations to existing buildings up to a cost ceiling of ten per cent of the value of the property.

A public enquiry and discussions with local elected representatives are held on these issues and other local actors, both public and private, may also participate. The aim is to determine an acceptable level of risk and the role of each of the parties in prevention and protection. The draft RPP is then approved by order of the Prefect and can be relied upon against third parties.³⁵ The *Communes* also have to incorporate the measures in their Local Development Plans. Some of the measures may be made compulsory after five years; the Prefect may have them implemented at the expense of the owner. Failure to comply with the RPP regulations is punishable by fines and even criminal sanctions.³⁶ It should be noted that the responsibility for enforcing the legislation and regulations on land use (covered by RPPs or otherwise) lies with central government.

RPPs are a means of providing a framework for local risk management. Their elaboration is largely the responsibility of central government and their implementation is the responsibility of the *communes*. The consultation and negotiation process between central government and local actors must allow for adaptation of the overall objectives, determined at central level, to each specific context.

³⁵ RPPs may also be applied early, on the decision of the Prefect. These provisions can then be relied upon against third parties for a period of three years. The cease to be so if they have not been included in the approved RPP, and are suspended if the RPP is not approved within a three-year period.

³⁶ *Code de l'urbanisme*, article L 480-4.

2.3. Legal framework and compensation

Flood insurance in France falls under the scheme for the compensation of victims of natural catastrophes, as do most other natural events on a major scale (landslides, avalanches, earthquakes, drought,³⁷ etc., with the notable exception of storms in metropolitan France). The Act of 13 July 1982, which set up this scheme, makes it compulsory for insurance companies to provide unlimited cover against such risks and to finance it by an extra premium on insurance policies for property and vehicles.³⁸ In return, the law allows insurers to take out reinsurance with the state-owned reinsurer, the Caisse Centrale de Réescompte (CCR), which has a government guarantee under the following conditions: “quota share” of risk and additional premiums ceded to the CCR with a stop-loss contract for major claims.³⁹

With the extent of population coverage and the satisfactory compensation that it ensures, the French natural catastrophe insurance scheme is generally considered very effective. For several years, however, the scheme has been experiencing a financial drift. In 1999, the reserves of the CCR fell to a record low and the government had to provide financial support in the form of an appropriation of EUR 450 million.

Various hypotheses have been put forward to explain this underlying increase in the costs borne by the scheme, including the following.

- The sheer weight of drought-related claims. Since these were first covered in 1989, claims rose to the point where they accounted for half the compensation paid out for natural catastrophes in the 1990s! The inclusion of drought-related damage in the scheme is questionable.⁴⁰ Indeed, this risk does not seem to present the same difficulties in terms of insurability as other natural catastrophes and so does not warrant government intervention. It even seems that in numerous cases, the damage incurred brought to light faults in foundations and hence come under the ten year construction guarantee. In any case, the inclusion of drought risks in the natural catastrophe scheme seems to be in the nature of a public subsidy for insurance companies, which should have compensated those affected.

³⁷ The risk of subsidence, i.e.; shrinkage of clay following changes in soil humidity (generally due to drought), has been covered since 1989.

³⁸ The additional premium for natural catastrophes accounts for 50 % on multi-risk house insurance policies 35 % on corporate insurance, and 15 % on car insurance policies.

³⁹ In other words, the insurance company transfers a share of its premiums and claims to the reinsurer (set at 50 per cent since 2000) and the latter pays the entire claim beyond a certain threshold (claims higher than twice the amount of premiums collected).

⁴⁰ More specifically, cracks in buildings caused by repeated large fluctuations in groundwater levels and the ensuing contraction and expansion of clay soils.

- Particularly favourable reinsurance conditions for insurers. While the costs of acquiring, administering and managing the claims that insurance companies deduct from the total premiums collected do not appear to be excessive (compared with other branches of the insurance sector),⁴¹ the reinsurance mechanism, conversely, was very profitable for insurance companies in the second half of the 1990s, given the sharp increase in claims ceded while premiums remained largely the same. Insurers were thus able to benefit from cover at constant prices during a period of sharply deteriorating risk. In the course of the period 1994-1997, insurance companies' equalisation provision increased regularly while the CCR's plummeted, an indication that the risk was not equally shared.
- Increased risk: increased frequency and/or severity of catastrophes; increased value of assets insured; improvement in rate of cover for holiday homes.
- Lastly, and more worryingly, the possibility that in offering the same terms of insurance to all, regardless of their degree of exposure to risk, the scheme does not give sufficient incentives to prevent damage. Of course, insurance terms were linked to a certain extent to the prevention measures defined at *commune* level under Risk Prevention Plans, since failure to comply with the RPP regulations after five years could free insurers to waive some of their obligations under the guarantee. However, the link seems too tenuous to constitute a genuine prevention incentive proportionate to the scale of the scheme (see section 3.2.b.).

In 1999, various measures for improving the financial position of the scheme on a longer term basis were negotiated with insurance companies:⁴²

- the additional premium rate increased from nine to 12 per cent on property damage policies, which works out to an overall increase on premiums collected of close to 29 per cent;
- higher deductibles and the introduction of a specific deductible for drought risks, in order to exclude minor damage;

⁴¹ These costs accounted for 23 per cent of the additional premium for natural catastrophes at the end of the 1990s, as opposed to 35 per cent for professional and agricultural asset insurance. See Ministry of Ecology and Sustainable Development (2002).

⁴² These measures were adopted for the period 2000 to 2004, and have since been extended.

- stricter terms of reinsurance with the CCR: rate set at 50 per cent for quota share cessions; reinsurance broadened to include the insurance company's entire portfolio, in order to limit the risks of adverse selection; removal of the reinsurance commission traditionally paid by the reinsurer to cover the commercial and management costs of insurance companies, which can be interpreted as an increase in the cost of reinsurance;
- more stringent requirements for declaring a state of natural catastrophe in the event of drought;
- supervision of claims assessment conditions by insurers in order to ensure fair treatment;
- introduction of a sliding scale applicable to the deductible payable for *communes* which do not have a Risk Prevention Plan, based on the number of natural catastrophe decrees issued by the *commune* over the five previous years, as a partial response to the problem of moral hazard in the insurance system.

On the financial level, the impact of these reforms has not been as hoped. The objective of the financial aspect of the reforms was to enable the CCR to build up reserves of two to three times the total premiums collected. At the end of 2003, after a series of very costly events, the CCR's equalisation provision fell to EUR 340 million, i.e. to barely more than half its turnover.⁴³ This is a modest sum compared with, say, the estimated losses related to a 100 year return interval flood in the Paris region, which would amount to more than EUR 5 billion.

Nevertheless, the reforms have produced some major results. The adoption of new criteria for declaring a state of drought cut the number of applications accepted by half. Moreover, the introduction of a sliding scale for deductibles convinced a number of *communes* to speed up the adoption of an RPP (see section 3.2.a.).

2.4. Protection and mitigation

The Risk Prevention Plans contain, at least in principle, a full range of prevention measures in areas exposed to risk, up to and including expropriation in cases of major natural risks endangering human life. Until 2003, however, these plans did not cover activities that were located upstream from exposed areas and that contributed to aggravating the flood risk, for example by increasing runoff and soil erosion. The Act of 30 July 2003 partially corrected this deficiency by enabling the central government and local

⁴³ Vallet (2004).

authorities to establish easements in the public interest in order to retain flood waters or manage changes in a watercourse. It also made it possible for *communes* (and groups of *communes*) to expropriate land in cases involving a serious threat to human life, a power that had previously been reserved to the central government.

In order to finance any compensation for easements⁴⁴ that might be decided under RPPs, the Fund for the Prevention of Large-Scale Natural Risks was set up by the Act of 2 February 1995. The Act of 30 July 2003 broadened the use of this fund so as to include prevention measures such as the acquisition of goods by mutual consent, the detection and filling of underground cavities, the studies and work on goods made mandatory by the RPP and information campaigns.

This fund is an ambitious concept, but its resources are limited, being raised through a two per cent charge on the product of premiums for the guarantee against natural disasters. The Act of 30 July 2003 made it possible to adjust this rate by decree, but within the limit of four per cent of premiums.

Responsibility for the maintenance of flood-defence infrastructure and watercourses lies primarily with the central government and this responsibility is exercised by the prefect in charge of co-ordination of the catchment area, the departmental prefects and decentralised services. However, the local authorities (*communes*, groups of *communes*, *départements* and regions) can build infrastructure and carry out work when this is in the public interest, following a public enquiry. The Act of 30 July 2003 broadened the scope of these types of intervention and facilitated them during emergencies, in particular by waiving the public enquiry requirement.

The dissemination of information on good practices in the field of prevention and mitigation (housing construction and maintenance techniques) and the planning of catchment areas (agricultural practices, urban runoff, etc.) are the responsibility of the relevant ministries (Ministry of Ecology and Sustainable Development [MEDD], Ministry of the Interior, Ministry of Infrastructure, Ministry of Agriculture).

The relative dispersion of responsibilities and approaches prompted the government to establish, through a circular dated 1 October 2002, the Flood Prevention Action Programmes (*Programmes d'Actions de Prévention des Inondations*, PAPI), which enable the various services of the central government and local authorities to co-operate on comprehensive basin-wide projects. The purpose of these programmes is to

⁴⁴ I.e. compensation paid in connection with the safeguards imposed by government (work carried out, restrictions on use, expropriation, etc.).

promote an integrated approach to prevention and mitigation focussing simultaneously on the upstream regulation of the rate of flow of watercourses, protection of housing, reduction of vulnerability and the provision of prevention information at a more relevant level than that of administrative units. Following an initial call for projects, some 42 PAPI were adopted for the 2004-2008 period, covering nearly one quarter of French territory, at a total cost of EUR 500 million. An initial evaluation of these programmes is to be conducted in 2006.

Lastly, the Advisory Council for the Prevention of Large-Scale Natural Risks (*Conseil d'orientation pour la prevention des risques naturels majeurs*) was created on 1 August 2003 and placed under the supervision of the Minister responsible for ecology and sustainable development in order to “give opinions and make proposals in the field of natural risk prevention” (Decree n° 2003-728). Its members are drawn from all ministries concerned, insurance companies, local governments, the National Assembly and the Senate.

2.5. Flood alert and early warning

The Ministry of Ecology and Sustainable Development has a network of flood forecasting services (*services de prévision des crues*, SPC)⁴⁵ responsible for gathering information in real time on water levels (rainfall, hydrometry, radar imaging), for anticipating floods and alerting the other central government departments and prefects in their geographical area. The prefects are then responsible for sending warnings to mayors and citizens. The SPCs also establish flood warning maps that they disseminate to the general public and local authorities (via the Operational Centre for Interministerial Crisis Management).

The SPCs also receive the technical and scientific support of the Central Service for Hydrometeorology and Support for Flood Forecasting (*Service Central d'Hydrométéorologie et d'Appui à la Prévision des Crues*, SCHAPI), created in June 2003. The SCHAPI also runs a 24-hour hydrometeorological watch service for catchment areas subject to rapid flooding and is planning to publish a flood warning map for the general public starting in July 2006.

The National Weather Service *Météo France* provides the public with weather warning maps twice daily. Local authorities have also developed their own early warning systems in some cases (for example, when there is a risk of sudden or flash floods).

⁴⁵ The SPCs are replacing the Flood Warning Services (*Services d'Annonce des Crues*), which mainly concerned areas where flooding would have major consequences. They should be operational nationwide by July 2006. However, each SPC will only cover the main watercourses in the area for which it is responsible.

Under the Act of 30 July 2003, the prefect in charge of co-ordination of the catchment area is responsible for establishing a basin-wide flood warning plan in order to ensure that the central government, government agencies and local authorities have consistent systems within the catchment area.

2.6. *Rescue*

The organisation of civil protection is the responsibility of the Ministry of the Interior and at the local level, of the prefect. The procedures used are summarised in the plans for analysing and covering risks, which identify the communes threatened, the resources available, the means of action to be used, etc.

In a crisis situation, the Orsec plan defines the organisation of the command post that supervises the response. Each command post is divided into six sections (police, information/relief, rescue, medical assistance, co-operation/transport, public relations and communications) which bring together representatives of the relevant public and private services.

The prefects are also responsible for communicating the information provided by the central government and ensuring emergency communication with the media.

Lastly, as was indicated above, the general police powers of mayors within the communes require them to take the necessary steps to protect people and property.

2.7. *Recovery*

The central government is responsible for ensuring that the situation returns to normal after a disaster has struck through the immediate assistance provided to victims, the mechanism for compensating victims of natural disasters, infrastructure and investment programmes and other specific initiatives determined on an ad hoc basis.

2.8. *Feedback*

Feedback is ensured through the investigations conducted by the General Inspectorate of the Administration (*Inspection Générale de l'Administration*, Ministry of the Interior), the General Council for Bridges and Roads (*Conseil général des ponts et chaussées*, Ministry of Infrastructure), the General Council for Rural Engineering, Water and Forests (*Conseil général du génie rural, des eaux et des forêts*, Ministry of Agriculture) and the General Inspectorate for the Environment (*Inspection générale de l'environnement*, Ministry of Ecology and Sustainable Development) after each major incident and through the inspections carried out by the decentralised central government services of these same entities.

In addition, commissions of enquiry can be set up on an *ad hoc* basis by the National Assembly and Senate.

There is no institutional mechanism that makes it possible to identify, discuss and systematically implement the changes that might be required in the light of this feedback.

3. Making risk management policies more effective towards achieving an economic and social optimum

The framework for analysis presented in the first part of this report provides a means of shedding light on certain aspects of the French system of flood risk management, as it has been described in the second part and in the main analyses conducted in recent years.

This system is characterised firstly by a high level of public intervention. The supply of public goods is generally considered to be satisfactory, particularly with regard to crisis management activities (flood alert, early warning and rescue). However, there seem to be some deficiencies regarding certain aspects of knowledge about the risk. There is reason to wonder whether the recent efforts to gather information on risks and communicate this information to citizens are sufficient to create a genuine “risk culture”.

Public intervention through the system for compensating victims of natural disasters ensures a complete insurance cover and, beyond strictly economic considerations, expresses national solidarity with the victims. The organisation of the natural disaster scheme also makes it possible to compensate victims in a manner that is generally considered to be rapid. However, the insurance cover system appears to lead to problems of moral hazard, which might be detrimental to the collective risk prevention effort.

The sharing of roles between the central government and local authorities is characterized by the effort to strike a balance between decentralisation and central government control, *at least in principle*. The provision of “pure” public goods (and those that require special scientific and technical expertise) is centralised. The central government also lays down broad policies in the field of prevention, responses to adverse events and compensation through which it establishes a framework for local risk management. The responsibility of local governments (chiefly mayors) is emphasised when access to information and local contact with citizens are the prime consideration. This organisation is reflected in the design of the Risk Prevention Plans. It remains to be seen to what extent it is actually being implemented.

This last part of the study provides a more detailed analysis of these questions on the basis of recent evaluation and investigation reports prepared by French authorities, and seeks to explore possible responses. The first section focuses on the issues of information, communication and risk culture; the second examines prevention and the problems of moral hazard; and, lastly, the third addresses the sharing of responsibilities between the central government and local authorities.

3.1. Knowledge and risk culture

3.1.a. Knowledge of all components of risk

For management to be effective, the risk must firstly be clearly identified and analysed, and this information must be provided to all stakeholders in society to the extent that they are concerned. All components of the risk must be known, i.e. the hazard and the potential impact in terms of human lives and health, economic and environmental assets, etc.

Knowledge of flood hazards is based on historical data, analytical and modelling tools (hydrological, geomorphological, etc.), and on the monitoring of the condition of flood defence infrastructures such as embankments and flood-control dams. Two main questions arise in this regard.

Firstly, the representativeness of historical data might be called into question by possible shifts in rainfall patterns because of climate change. It is increasingly recognised that in the coming decades the average increase in temperatures on the earth's surface will be accompanied by an increase in precipitation and greater frequency of extreme weather conditions.⁴⁶ However, the role of climate change in the apparent increase in the number of climate-related natural disasters in recent years and its impact on the various regions of the world are still subject to major uncertainties.⁴⁷ Consequently, these issues constitute a crucial subject of research for the future of flood risk management. In an opinion issued in June 2002 regarding the general lessons learnt from the feedback on catastrophic floods gathered since 1999, the bodies responsible for this feedback recommended that “research on the impacts of climate change on flooding be encouraged”.⁴⁸

Secondly, there seems to be insufficient knowledge about flood defence infrastructures, their condition and the possible dangers of failure. The opinion mentioned above also highlighted the lack of information in this field and proposed that legislative and regulatory measures be developed requiring infrastructure owners to ensure that flood defence structures are checked and if necessary reinforced and designating appropriate managers when owners are no longer able to assume their responsibilities.⁴⁹ Uncertainties about the condition of many structures give even greater cause for concern since a lack of confidence in their reliability is often a factor that increases the level of risk (see Section 3.1.b.).

⁴⁶ IPCC (2001).

⁴⁷ OECD (2003b).

⁴⁸ *Inspection Générale de l'Administration* et al. (2002), p. 5.

⁴⁹ op.cit., p.9.

With regard to evaluating the potential impact of flooding, this requires having information about the populations, assets and activities exposed to flood risks and assessing the losses that might be caused by a flood. However, the knowledge regarding this component of risk seems to be sometimes fragmentary in France. When RPPs are prepared, the potential impact of flooding is not assessed as the focus is primarily on the hazard. It is also significant that the average amounts of damage observed after certain floods are much higher than the estimates made beforehand by insurance companies.⁵⁰ More generally, estimates of the cost of an event can differ sharply even months after it occurred, depending on the sources and hypotheses chosen. This argues in favour of adopting a unified and consistent method of collecting and analysing data both for economic⁵¹ and ecological impacts.⁵²

When an adequate knowledge of the potential impact is lacking, there is reason to fear that risk management decisions will be based on a partial evaluation of this impact and will therefore contain a bias, the magnitude and direction of which cannot be known beforehand. This means that the failure to take the potential impact sufficiently into account can lead decision-makers to focus entirely on the probability of events occurring and therefore to allocate excessive resources to managing events that occur frequently but have limited consequences, while overlooking events that are less probable but more destructive. However, the lack of reliable data on the potential impact can also prevent decision-makers from making any attempt to compare the risks and the resources allocated to managing them; in such cases, research on behaviour with regard to risks has shown, since the Allais paradox,⁵³ that decision-making tends to overemphasise low-probability events that have major consequences.

Lastly, because of this lack of information, national and local decision-makers do not have an accurate idea of the changes occurring in the potential impact of flood risks, particularly in the light of urbanisation in flood-prone areas.

3.1.b. Communication on risks and risk culture

Knowledge about risks also affects risk communication and risk culture – areas in which the deficiencies have been highlighted repeatedly in recent years. On 10 September 2002, in Aramon, in the *département* of Gard, an embankment broke causing a flood in which five people died. The areas flooded included housing plots, an institution for the elderly and a fire station, all of which had been recently built. Incidents like this illustrate how flood-defence infrastructure such as embankments can increase risks by giving the

⁵⁰ *Mission d'expertise sur les crues de septembre 2002* (Expert mission on the floods of September 2002) (2003), p. 91 and Annex B.

⁵¹ Ledoux consultants (2003).

⁵² *Mission d'expertise sur les crues de septembre 2002* (2003), Annex B.

⁵³ Allais (1953).

population (including those in charge of risk prevention) an excessive feeling of security. Many investigation reports have stressed the need to better communicate the risk of flooding in areas that flood frequently or that are protected by flood defence infrastructures.

As has been indicated, the Act of 30 July 2003 contains important provisions regarding the need to provide information on flood risks. However, as this act limits the information requirement to the areas covered by RPPs, it raises the issue of how well RPPs coincide with the actual exposure of areas to risks (also see Section 3.2.a.). In addition, it would no doubt be useful to evaluate the contribution of these legal provisions to the information received by citizens in the *communes* concerned and any change in behaviour with regard to risk.

Communication must also cover the incidents that actually occur, i.e. the magnitude of the costs borne each year by society. According to the evaluation report on the floods of September 2002, floods have caused on average ten deaths and roughly EUR 150 million in damage since 1988 in the Languedoc-Roussillon region alone. The report considers that the “growing awareness of this cost by each public and private decision-maker should lead to a change in the attitude to prevention”.

It is all the more necessary to provide this information because the financial costs resulting from floods in France are spread over the entire territory and are covered by a charge that can be described as “painless” at the individual level. The lack of information about the aggregate costs of floods can therefore lead to a collective preference for compensation rather than prevention, thereby worsening the problems of moral hazard posed by the natural disaster system.

3.2. Inadequacy of prevention and problems of moral hazard

3.2.a. RPPs, the keystone of prevention

Through the uniform rates paid throughout the country, the scheme for compensating victims of natural disasters spreads the risks between relatively well-protected areas and areas that are more exposed to disasters, embodying a system of national solidarity.

At the same time, however, by making the terms of insurance (premiums, deductibles, exclusion clauses) independent of the degree of the policyholder’s exposure and vulnerability, the scheme has fostered, at least until the reforms of recent years, “a lack of responsibility on the part of policyholders and indifference on the part of insurers,” according to the public report issued by the French Court of Accounts (*Cour de Comptes*) in 1999. As was indicated in the first part of this study, the individual moral hazard has its

counterpart in the relations between the central government and local authorities, since the fact that there is a national insurance system enables the latter to externalise some of the costs related to the risky choices that they make.

The reforms undertaken since 1995 have tended to make the Risk Prevention Plans the privileged tool for controlling both these aspects of the moral hazard, and ultimately the keystone of prevention policy. As has been said, the introduction of a link between the deductible paid by policyholders and the adoption of an RPP by their commune in which they reside has prompted many municipalities to introduce an RPP rapidly. The total duration of the procedure for adopting RPPs (from the initial requirements to final approval), which was estimated at three to five years in 2001,⁵⁴ has been shortened considerably with the introduction of the sliding scale. By 1 May 2004, RPPs had been approved in 4 250 communes, implemented early in 253 (by decision of the prefect), and requirements had been specified for 5 943 communes. These figures should be compared with an initial objective of 5 000 RPP adopted by the end of 2005, and a total number of communes exposed to a major risk of approximately 15 000.⁵⁵

Through these Plans, the central government hopes to have better control of the prevention efforts made by communes and individuals. When these plans are prepared, the central government's representative defines the requirements regarding any new construction, requests the alterations required for existing buildings and imposes protection and safeguard measures. The Plan's provisions are annexed to the *commune*'s land-use plan and can be imposed on any public or private person after five years have elapsed.

3.2.b. Is the overall prevention effort adequate?

However, RPPs, as they are currently being prepared and implemented, do not seem able to ensure the adequate prevention of flood-related risks, for three main reasons.

Firstly, the RPPs seem to have been designed in order to reduce the risks to human lives to the greatest possible extent. As a result, they are based on an approach to prevention that is necessary but not sufficient. For example, they have a limited role in reducing the vulnerability of existing buildings except when it has been shown that there are immediate risks to human life.

For this reason, RPPs do not constitute a systematic guarantee of the control of urbanisation in flood-prone areas. The problem seems particularly serious in regions where demographic and economic pressures lead

⁵⁴ *Commission d'enquête du Sénat sur les inondations de la Somme* (Senate Commission of Enquiry on the Floods of the Somme) (2001), p. 92.

⁵⁵ *op.cit.*, p. 88.

to the continuous expansion of business and residential areas. In the four *départements* of l’*Aude*, le *Gard*, le *Hérault* and *Pyrénées Orientales*, some 384 100 people (17 per cent of the population) lived in flood-prone areas in 2002, 321 000 of whom (14 per cent of the population) lived in areas where the risk of flooding is ranked as “high to very high”.⁵⁶ According to the evaluation report on the floods of September 2002, urbanisation in flood-prone areas has continued to expand in this region over the past decade (albeit at a slower rate than in the past), and to judge by the existing projects, “several hundred additional housing units might be built in flood-prone areas in the Languedoc-Roussillon region (...)”.

As was observed during the events of September 2002 in Languedoc-Roussillon,⁵⁷ RPPs do not prohibit construction in “blue” flood-risk areas, i.e. areas where there is no direct risk to human life (although precautionary measures are generally imposed). As a result, the RPPs allow the foreseeable costs of future flood damage to be transferred from the owners of these buildings to the natural disaster system, i.e. to the national community. In short, through RPPs, prevention policy focuses mainly on risks to human life, while the compensation regime exclusively covers material losses.

Secondly, the protection of human lives itself remains insufficient in some cases. The experiences of recent floods shows that the boundaries set for blue and red zones in RPPs may be overly optimistic.⁵⁸ The lack of precision in setting the boundaries of lower risk areas is sometimes a result of the scientific uncertainty inherent in this type of exercise, but it is mostly due to pressure from local elected officials and residents, who in some cases succeed in obtaining a change in the original boundaries. A report by the bodies in charge of feedback pointed out in 2002 that “wherever human lives are threatened, (...) banning construction should be the norm in RPPs”, which therefore does not always seem to be the case. The same report recommended that the Ministry of Ecology and Sustainable Development should indicate that “when RPPs are being prepared, the hazard is not negotiable”.⁵⁹ The process of consultation and negotiation between the central government and local stakeholders will be treated more fully in the following section.

Lastly, compliance with RPPs is hampered by the lack of adequate incentive mechanisms. The effective implementation of the relevant measures is based on the central government’s monitoring capacity, which may prove to be extremely costly. In October 2001, the report of the Senate Commission of Enquiry on the Floods of the Somme raised doubts about the physical capacity of central government to conduct the “administrative mission of monitoring” whether individuals and local authorities are implementing the

⁵⁶ Source: Regional Directorate for Infrastructure of Languedoc-Roussillon, cited by the *Mission d’expertise sur les crues de septembre 2002* (2003), p.76.

⁵⁷ *Mission d’expertise sur les crues de septembre 2002* (2003), p. 78.

⁵⁸ *Mission d’expertise sur les crues de septembre 2002* (2003), p.86.

⁵⁹ *Inspection Générale de l’Administration* et al. (2002), p. 8.

measures recommended by RPPs. In fact, it appears that the right to receive compensation from the natural disaster scheme is not conditional, as it should be, upon enforcing the requirements of RPPs within a five-year period.⁶⁰

With regard to the role that insurers might play in this regard, the comment of the Court of Accounts in 1999 still remains valid: “Insurance companies, which consider, not without reason, that this task is the responsibility of the administrative monitoring mission of the central government, do not monitor the implementation of the measures specified in risk exposure plans, but in fact only act as mere financial intermediaries.”⁶¹

Consequently, various solutions have been proposed to take additional steps to reduce the moral hazard. The first consists of facilitating the enforcement of the existing regulations by broadening the possibility of adjusting the insurance premium when a policyholder has not complied with the requirements of an RPP within a five-year period.⁶² The second is to allow a greater difference in the cost of cover by the scheme, in particular at the individual level, using various procedures: variability of additional premiums and deductibles; regulatory oversight and greater involvement of insurance companies (by changing the terms of reinsurance granted by the CCR in the light of their risk portfolio and encouraging companies to pass on any savings or additional costs to their policyholders).⁶³ The differentiation of the terms of insurance might be based on a more systematic practice of safety audits for companies,⁶⁴ as well as on certification of flood-prevention work undertaken by private parties.⁶⁵

In terms of institutional organisation, the prevention and compensation of damage could be better co-ordinated, since these are currently the responsibility of two completely separate actors. The system for the compensation of victims of natural disasters is supervised by the Ministry of Economic Affairs and Finance, while prevention measures are the responsibility of the Ministry of Ecology and Sustainable Development.

Thought should also be given to the priority assigned to the prevention of flood risks at the national level. The lack of data on the magnitude of national prevention efforts is significant in this regard, since it makes

⁶⁰ *Mission d’expertise sur les crues de septembre 2002* (2003), p. 91.

⁶¹ *Cour des Comptes* (1999).

⁶² *Commission d’enquête de l’Assemblée nationale sur les causes de inondations répétitives ou exceptionnelles* (Commission of Enquiry of the National Assembly on the Causes of Repeated or Exceptional Floods) (2001), p. 129.

⁶³ *Commission d’enquête du Sénat sur les inondations de la Somme* (2001), pp. 150-152.

⁶⁴ Recommended by the *Inspection Générale de l’Administration* et al. (2002), p. 8.

⁶⁵ Recommended by the *Commission d’enquête du Sénat sur les inondations de la Somme* (2001), p. 154.

any evaluation of these efforts impossible, for example with regard to the cost of disasters to society. It would therefore be advisable to organise the systematic collection of data on the expenditure on prevention made by the central government, the local authorities and private actors. This could provide a basis for the allocation of sufficient human and financial resources on a lasting basis for the national prevention effort, in particular by broadening the scope of the Fund for the Prevention of Large-Scale Natural Risks.⁶⁶

3.3. Co-operation between the central government and local authorities

3.3.a. The limitations of the consultation process

In addition to the issue of moral hazard, it is the negotiation and elaboration process of RPPs that appears to produce inadequate results, while RPPs should ensure the balance between central government control and decentralisation within the risk management system. As has been shown, during the phase of consultation with local elected officials, RPPs can be “neutralised” in the elaboration stage. It also appears that, even after a Plan has been implemented, the sharing of roles between the various actors is not always clearly established.⁶⁷ As a result, the dialogue between the central government and local stakeholders does not always make it possible to establish a common vision of objectives and a division of responsibilities shared by the various actors.

These shortcomings seem to confirm the fears expressed by the “Bourrelier Report” in 1997: “Doubts arise because of the fact that the initiative, which came from the top, has essentially remained limited to the central government and is not shared by society. (...) As a result, the strengthening of the national prevention system, which might initially seem to be a positive indicator, is becoming identified with increasingly authoritarian measures on the part of the central government; it was not designed to be shared; it can trigger confrontation more than collective action and lead to great confusion about responsibilities and a lack of visibility regarding objectives and resources: has not the central government, by broadening its own powers, diminished the responsibility of local governments and individuals?”⁶⁸

The consultation and negotiation process, which is aimed at determining the locally acceptable risk within the limitations set by the central government, does not in fact provide a consistent framework for achieving this goal. As we have seen, the approach is focused on the hazards and on implementing restrictions that are determined in a centralised manner. The potential impact of a disaster is only taken into account

⁶⁶ Erhard-Cassegrain et al. (2004) propose in this regard that “a genuine risk manager and public insurer” be created as an interface between insurers and the CCR (pp. 23-26).

⁶⁷ According to the *Mission d’expertise sur les crues de décembre 2000 et janvier 2001 en Bretagne* (p.83): “The difficulty in identifying owners is only the practical, concrete consequence of the reluctance of institutions to assume primary responsibility for the initiatives that must be taken.”

⁶⁸ Bourrelier (1997).

summarily. The possible alternatives to the initiatives envisaged (regarding construction, use and/or prevention) are not included. Thus, there is no systematic consideration of some of the determinants of the acceptable risk. For example, would it not be best to recognise in the very process of developing prevention policy the fact that land-use and economic pressures (hotel and tourist activities, etc.) and the opportunity cost of closing areas to development vary across regions? Would it not also be best to support the control of urbanisation in flood-risk areas by exploring existing alternatives in areas not exposed to risk (agricultural land, protected areas, abandoned housing, etc.) and taking into account the related costs?

On these points the Technological Risk Prevention Plans, which are the counterparts to RPPs for industrial risks introduced by the Act of 31 July 2003, differ from the latter since they are based on an estimate of the potential impact, a comparison of hazards and potential impacts and on complementary investigations, in particular regarding the costs of implementing land-use measures. The objective, which might provide a basis for the future evolution of RPPs, is to provide “all necessary information to the various stakeholders concerned (...) in order to choose the various orientations of the plan”.⁶⁹

3.2.b. A framework for negotiation between local authorities and the central government

Consequently, consultation and negotiation between the central government and local stakeholders would stand to gain from being based on an objective and complete framework for the evaluation and discussion of collective choices. To achieve this, economic theory provides decision-support tools such as cost-benefit analysis, which is aimed at determining the effectiveness of a given action by measuring its contribution to social welfare in order to guide public policies towards an optimum as effectively as possible (box 2).

Box 2 – Principles and limitations of cost-benefit analysis

The principle of cost-benefit analysis (CBA) is to quantify the options available to decision-makers by attributing a value (generally monetary) to each of the possible (present and future) consequences of a choice.⁷⁰ These values are supposed to measure the variation in social welfare associated with each consequence, and they are weighted by the probability of the specific consequence occurring. These values may be based on market prices, or on valuation methods used for non-market goods, such as shadow prices or willingness to pay. The future events are assigned a discount factor, which reflects the rate of time preference. The risk parameters, like the probabilities of occurrence, are based on available records and the opinions of scientific experts. Whatever their nature, their time horizon and probability, all factors that are relevant from the standpoint of decision-making can then be uniformly incorporated into a single measurement, such as the net present discounted value (the difference between benefits and costs). The solution that provides the highest value for this measurement is the one that can be considered as the most beneficial to society.

CBA contains many theoretical and practical difficulties, but only those that are most relevant to the analysis of risk management will be presented here.⁷¹

⁶⁹ Ministry of Ecology and Sustainable Development and Ministry of Transport, Infrastructure, Tourism and the Sea (2005).

⁷⁰ For a technical presentation, see Drèze and Stern (1987).

⁷¹ See Adler and Posner (1999) for a very complete review.

CBA is very tricky to use when there are imperfect markets (spillovers, etc.), for it must then integrate the relevant ripple effects on the economy, which means collecting a considerable quantity of data (which for the most part are only known with a large margin of error).⁷²

It is also difficult to use when there are major uncertainties, as may be the case in managing a risk, since there are frequently determining factors of the risk that are not perfectly known, as was shown by the discussion on the knowledge of the risk. The uncertainty may concern measuring the phenomena (in the case of economic factors, for example) or even understanding them (certain ecological factors). This uncertainty can be taken into account if it is relatively limited, particularly if it can be represented by a reasonably small statistical interval. On the other hand, when the magnitude of the uncertainty increases, the usefulness of the CBA declines rapidly. One of the basic assumptions of CBA is that all possible events in the future can be described and quantified (i.e. represented by a finite number of states affected by probabilities).

CBA is also based on assumptions about individual behaviour (expected utility maximisation) that have largely been invalidated by empirical studies, particularly when risk is involved. In addition to the Ellsberg paradox (aversion to ambiguity) and the Allais paradox (overweighting of low-probability events), it is observed that individuals attach importance to aspects of risk that cost-benefit analysis does not take into account, such as whether the risk-taking is voluntary, how much control individuals have over the risk (which leads them to be more willing to tolerate risks related to road accidents than cancers caused by polluting activities) and how the benefits and the costs of the risk are distributed between individuals.⁷³

Lastly, certain assumptions commonly made in CBA raise ethical questions that scientific knowledge and economic tools cannot answer. This is especially the case when a valuation of human life must be made, whether the approach used is that of human capital or that of so-called “subjective” methods (willingness to pay).

Despite these many limitations, CBA is an important tool used to support public decision-making in some countries, especially in the field of risk management. It is interesting that the first use of CBA in public decision-making dates from 1936, when the US Congress asked the agencies in charge of flood control projects to approve them if their benefits outweighed their costs⁷⁴. This became the general practice with President Clinton’s Executive Order 12866 in 1993 and then with the adoption of the Regulatory Right to Know Act by Congress in 2002. Currently, the White House Office of Management and Budget is mandated to evaluate systematically the regulatory activity of the country’s federal agencies using cost-benefit analysis. Although the importance of CBA in public decision-making in the United States is part of a long tradition specific to this country, it nevertheless indicates the potential usefulness of this tool.

In the French context, the contribution of a reasoned use of CBA would be to meet the need for a consistent framework of analysis and evaluation of decision-making in the field of risk management. In the past, CBA was often used as a black box that, once the necessary data had been entered, would provide a “scientific” verdict regarding the best approach to use. As was shown in box 2, this practice is

⁷² On the other hand, in a general equilibrium framework, only the direct effects of the measurement have an impact on overall welfare (see Starrett, 1988).

⁷³ Slovic (1987).

⁷⁴ Dasgupta and Pearce (1972).

inappropriate in many cases. The main advantage of CBA, and of alternative methods of analysing decision-making (cost-effectiveness analysis, multifactorial analysis, etc.), is to help frame the problem and to show the preferences of the different stakeholders.

For example, since the Nîmes disaster in 1988, the feedback reports following a major flood have systematically recommended “giving priority to removing from flood-risk areas buildings that are particularly critical in a crisis”, such as emergency centres. With regard to these issues and the more general problems of controlling urbanisation, these tools might contribute to involving stakeholders in a dialogue on risk management and acceptable risks by providing a rational framework for this process. Various local experiments in using decision-support tools in this way have been conducted in the past, and seem to have produced convincing results, as is shown by the example of the analysis initiated in 1998-99 by the multidisciplinary team “*Loire grandeur nature*” on the Veurdre dam project.⁷⁵ They provide a basis of experience and expertise that might be used as a means of revitalising the process of dialogue between the central government and local stakeholders in the field of flood risk management.

⁷⁵ For a full discussion of the use of economic decision support instruments in flood prevention in France and other OECD countries, see Ledoux Consultants et al. (2004).

Summary and conclusions

The human and financial cost of floods raises some fundamental questions in OECD countries with regard to risk sharing, control of urbanisation and land use, the magnitude of global warming and sustainable development. To this must be added the intrinsic complexity of risk management in this sector due to the wide range of stakeholders and levels of intervention and the intermingling of different approaches and objectives. In France, private individuals, mayors, local authorities, various central and decentralised services of the central government and insurance and reinsurance companies are all involved in at least one of the phases of flood risk management.

In a complex environment in which major interests are at stake, it is legitimate to reflect upon the optimal approach of the central government to ensuring social welfare. Basing its analysis on the tools of economic theory, this study has identified three fields in which public intervention is necessary to ensure the appropriate management of flood risks: the provision of a certain number of public goods, the improvement of the insurability of the risk and a suitably organised decentralisation of risk management policies.

Analysed from this point of view, the French system of flood risk management has some evident qualities: a high level of provision of public goods in fields such as emergency response, very broad insurance coverage and an effort to strike a balance between the responsibilities of the central government and local authorities. However, these qualities have their negative sides: less focus on the knowledge of risks and risk culture, prevention efforts weakened by serious problems of moral hazard and a collective preference for compensation for damage and difficulties with effective co-operation between public actors.

This report has reviewed some possible solutions to these shortcomings, not by seeking to innovate but rather by casting new light on recommendations that are in some cases long-standing. With regard to the three subjects mentioned, the ideas proposed often build on the reforms introduced over the past ten years.

The new balance towards which the French flood risk management system seems to be moving would consist of accepting the risks of construction and development in flood-risk areas up to a certain threshold to be determined through a well-informed dialogue between the central government and local stakeholders (although cases in which human life is endangered would be excluded without exception) while “internalising” the costs of future damage into the construction and development costs (at least within the limits of a reference event). In this system, private actors would of course have to be fully informed and

aware of the risks so that they could take all steps to prevent damage that they thought necessary. As can be seen, the improvements required in terms of knowledge about risks and risk culture, incentives in the field of prevention and consultation with local stakeholders are inextricably intertwined and must go hand in hand if this new balance is to be achieved.

Bibliography

- Adler, M. D. and E. A. Posner (1999), 'Rethinking Cost-Benefit Analysis', *Yale Law Journal*, vol. 109, pp.165-247.
- Allais, A. (1953), '*Le comportement de l'homme rationnel devant le risque: critique des postulats et axiomes de l'école américaine*', *Econometrica*, 21 :4.
- Arrow, K. J. (1953), 'The Role of Securities in an Optimal Allocation of Risk-Bearing', *Actes du colloque sur les fondements et applications de la théorie du risque en économétrie*, CNRS, Paris.
- Bourrelier, P.-H. (1997), *La prévention des risques naturels – Rapport d'évaluation*, Comité interministériel de l'évaluation des politiques publiques, La Documentation Française, Paris.
- Boyce, J. K. (2000), 'Let Them Eat Risk? Wealth, Rights, and Disaster Vulnerability', *Disasters*, vol.24, n°3.
- Buchanan, J. M. (1965), 'An Economic Theory of Clubs', *Econometrica*, vol.32, pp.1-14.
- Cass, D., G. Chichilnisky and H.-M. Wu (1996), 'Individual Risk and Mutual Insurance', *Econometrica*, vol.64, pp.333-41.
- Commission d'enquête de l'Assemblée nationale sur les causes de inondations répétitives ou exceptionnelles* (2001), *Report*.
- Commission d'enquête du Sénat sur les inondations de la Somme* (2001), *Report*.
- Cour des comptes* (1999), *Public Report 1999*.
- Cremer, J., A. Estache and P. Seabright (1996), 'Decentralizing Public services: What Can We Learn from the Theory of the Firm?', *Revue d'Economie Politique*, vol. 106, pp.37-60.
- Dasgupta, A. K. and D. W. Pearce (1972), *Cost Benefit Analysis: Theory and Practice*, MacMillan Press, Basingstoke.
- Drèze, J. and N. Stern (1987), 'The Theory of Cost-benefit Analysis', in A. Auerbach and M. Feldstein (editors), *Handbook of Public Economics*, North Holland, vol. 1, pp 909-89.
- Duncombe, W. and J. Yinger (1993), 'An Analysis of Returns to Scale in Public Production, with an Application to Fire Protection', *Journal of Public Economics*, vol. 52, pp.49-72.
- Erhard-Cassegrain, A., E. Massé and P. Momal (2004), '*Evolution du régime d'indemnisation des catastrophes naturelles*', *Document de travail*, Ministère de l'écologie et du développement durable, Direction des études économiques et de l'évaluation environnementale.
- Faure, M. G. and T. Hartlief (2003), *Insurance and Expanding Systemic Risks*, contribution to the OECD Project on Emerging Systemic Risks, reissued in Policy Issues in Insurance, No. 5, OECD, Paris.
- Gordon, R. (1983), 'An Optimal Tax Approach to Fiscal Federalism', *Quarterly Journal of Economics*, vol.97, pp.567-86.

- Guesnerie, R. (2003), *Kyoto et l'économie de l'effet de serre*, Rapport du Conseil d'analyse économique n°39, La Documentation Française, Paris.
- Inman, R.P. and D. L. Rubinfeld (1996), 'Designing Tax Policy in Federalist Economies: An Overview', *Journal of Public Economics*, vol.60, pp. 307-34.
- Inman, R.P. and D. L. Rubinfeld (1997), 'Rethinking Federalism', *Journal of Economic Perspectives*, vol.11, pp.43-64.
- Inspection Générale de l'Administration, Conseil Général des Ponts et Chaussées, Conseil Général du Génie Rural, des Eaux et des Forêts, et Inspection Générale de l'Environnement (2002), *Avis délibéré sur les retours d'expérience des inondations catastrophiques et les inspections des services déconcentrés en charge des risques naturels réalisés depuis l'année 1999*.
- Institut Supérieur de Planification d'Urgence (2003), *Etude comparative des législations en matière de gestion des risques majeurs dans les 26 pays membres de l'Accord du Conseil de l'Europe EUR-OPA risques majeurs*. Final Report to the Council of Europe, Strasbourg, 30 November 2003.
- IPCC (2001), *Climate Change 2001: The Scientific Basis*, Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change.
- ISO (2002), *Risk Management – Vocabulary – Guidelines for Use In Standards*, Guide 73, International Organisation for Standardisation, Geneva.
- Kunreuther, H. (1997), 'Rethinking Society's Management of Catastrophic Risks', *The Geneva Papers on Risk and Insurance*, 83, pp. 156-176.
- Laffont, J.-J. (1987), 'Incentives and the Allocation of Public Goods', in Auerbach, A. J. and M. Feldstein (editors), *Handbook of Public Economics*, vol.2, Elsevier Science Publishers, New York.
- Ledoux Consultants (2003), *Estimation quantitative et qualitative des dommages économiques dans le Gard à la suite des inondations des 8 au 10 Septembre 2002*, Report to the Ministry of Ecology and Sustainable Development.
- Ledoux Consultants, Cereve and Cemagref (2004), *Synthèse des évaluations socio-économiques des instruments de prévention des inondations*, Report to the Ministry of Ecology and Sustainable Development.
- Mission d'expertise sur les crues de décembre 2000 et janvier 2001 en Bretagne* (2001), *Report*.
- Mission d'expertise sur les crues de septembre 2002* (2003), *Retour d'expérience des crues de septembre 2002*.
- Munich Re (2005), *Topics Geo – Annual Review: Natural Catastrophes 2004*, Munich Re, Munich.
- Oates, W. (1972), *Fiscal Federalism*, Harcourt, Brace, Jovanovich, New York.
- Oates, W. (1997), 'On the Welfare Gains from Fiscal Decentralization', *Journal of Public Finance and Public Choice*, vol.2-3, pp.83-92.
- OECD (2003a), *A Methodological Framework for Evaluating Risk Management Policies*, working document, first meeting of Project Steering Group, 3 November 2003.

- OECD (2003b), *Emerging Risks in the 21st Century – An Agenda for Action*, OECD, Paris.
- OECD (2003c), *Environmental Risks and Insurance*, Policy Issues in Insurance, n°5, OECD, Paris.
- Persson, T. and G. Tabellini (1996), ‘Federal Fiscal Constitution: Risk Sharing and Moral Hazard’, *Econometrica*, vol.64, pp.623-46.
- Prudhomme, R. (1995), ‘The Dangers of Decentralization’, *World Bank Research Observer*, vol.10, pp.201-20.
- Rabin, M. and R. H. Thaler (2000), ‘Anomalies: Risk Aversion’, *Journal of Economic Perspectives*, vol.15, pp.219-32.
- Report to the Ministry of Ecology and Sustainable Development (2002), ‘Analyse macroéconomique du régime d’indemnisation des catastrophes naturelles’, Internal Note.
- Report to the Ministry of Ecology and Sustainable Development and Ministry of Transport, Infrastructure, Tourism and the Sea (2005), *Plan de prévention des risques technologiques – Guide méthodologique*.
- Rothschild, M. and J. Stiglitz (1976), ‘Equilibrium in Competitive Insurance Markets: The Economics of Markets with Imperfect Information’, *Quarterly Journal of Economics*, vol.90, pp.630-49.
- Samuelson, Paul (1954), ‘The Pure Theory of Public Expenditure’, *Review of Economics and Statistics*, vol.36, pp.387-9.
- Shavell, S. (1979), ‘On Moral Hazards and Insurance’, *Quarterly Journal of Economics*, vol.92, pp.541-62.
- Slovic, P. (1987), ‘Perception of Risk’, *Science*, vol.236.
- Starrett, D. A. (1988), *Foundations of Public Economics*, Cambridge University Press, Cambridge.
- Swiss Re (1999), *Floods: An Insurable Risk?*, Swiss Re, Zurich.
- Tiebout, Ch. (1956), ‘A Pure Theory of Local Expenditure’, *Journal of Political Economy*, vol.64, pp.416-24.
- Vallet, S. (2004), *The French Experience in the Management and Compensation of Large-Scale Disasters*, working document, OECD Conference on Catastrophic Risks and Insurance, 22-23 November.

Annex 1: Flood risk management policies in France

This annex provides a brief presentation of the main public actors in charge of flood risk management in France. It follows the Project's methodological approach, which distinguishes eight phases of risk management.

Layers	Actions	Authorities
Assessment	Knowledge of risk	<ul style="list-style-type: none"> • Ministry of Ecology and Sustainable Development (MEDD) • Network of DIREN
	Risk communication	<ul style="list-style-type: none"> • Mayors • Prefects
Policy decision-making	Preparation of Risk Prevention Plans	<ul style="list-style-type: none"> • MEDD
	Municipal police	<ul style="list-style-type: none"> • Mayors • If necessary, prefects
Framework conditions (legal and regulatory, compensation)	Compensation	<ul style="list-style-type: none"> • Insurance companies • Reinsurance by the <i>Caisse Centrale de Réassurance</i>
	Monitoring	<ul style="list-style-type: none"> • Ministry of Economic Affairs and Finance
Protection and information	Declaration of easements in the public interest	<ul style="list-style-type: none"> • Central government or local authorities
	Implementation of RPPs	<ul style="list-style-type: none"> • Mayors
	Maintenance of flood-defence infrastructure	<ul style="list-style-type: none"> • Ministry of Infrastructure • Local authorities
	Dissemination of information on good practices	<ul style="list-style-type: none"> • Ministry of Ecology and Sustainable Development • Ministry of Interior • Ministry of Infrastructure • Ministry of Agriculture
	General guidance	<ul style="list-style-type: none"> • <i>Conseil d'Orientation pour la Prévention des Risques Naturels Majeurs</i>
Alert and early warning	Flood watch and warnings	<ul style="list-style-type: none"> • Ministry of Ecology and Sustainable Development • Météo France • In some cases, local authorities
	Co-ordination	<ul style="list-style-type: none"> • Prefects in charge of co-ordinating catchment areas

Rescue	Civil protection	<ul style="list-style-type: none"> • Ministry of Interior • Prefects
	Municipal police	<ul style="list-style-type: none"> • Mayors
Recovery	Local	<ul style="list-style-type: none"> • Mayors • Prefects
	National	<ul style="list-style-type: none"> • Ministry of Infrastructure • Ministry of Ecology and Sustainable Development • Ministry of Interior • Ministry of Agriculture
Feedback	Government departments	<ul style="list-style-type: none"> • <i>Inspection de l'Administration</i> • <i>Conseil Général des Ponts et Chaussées</i> • <i>Conseil Général du Génie Rural, des Eaux et des Forêts</i> • <i>Inspection Générale de l'Environnement</i>
	Parliament	<ul style="list-style-type: none"> • Parliamentary commissions of enquiry

Annex 2: Main legislative and regulatory texts

Code général des collectivités territoriales – Livre II, Titre Ier, Chapitre II (police municipale) [General Code for Local Authorities – Book II, Title I, Chapter II (Municipal Police)]

Code de l'environnement – Livre Ier, Titre II (information et participation des citoyens) et Livre V (prévention des pollutions, des risques et des nuisances) [Environmental Code – Book I, Title II (information and participation of citizens) and Book V (prevention of pollution, risks and nuisances)]

Code des assurances, Première partie – Livre I, Titre II, Chapitre V (assurance des risques de catastrophes naturelles) [Insurance Code, Part I – Book I, Title II, Chapter V (insurance against natural disaster risks)]

Code de l'Urbanisme, Première partie – Livre Ier, Titre II, Chapitre Ier (dispositions générales communes aux schémas de cohérence territoriale, aux plans locaux d'urbanisme et aux cartes communales) [Urban Planning Code, Part I – Book I, Title II, Chapter I (general provisions common to territorial consistency schemes, local urban development plans and communal planning maps)]

Loi du 13 juillet 1982 relative à l'indemnisation des victimes de catastrophes naturelles (JO du 14 juillet 1982, pp.2242-3) [Act of 13 July 1982 on the compensation of victims of natural disasters (Official Gazette of 14 July 1982, pp.2242-3)]

Loi du 22 juillet 1987 relative à l'organisation de la sécurité civile, à la protection de la forêt contre l'incendie et à la prévention des risques majeurs (JO du 23 J juillet 1987, p. 8200 et suivantes) [Act of 22 July 1987 on the organisation of civil protection, protection against forest fires and the prevention of large-scale risks (Official Gazette of 23 J July 1987, p. 8200 et seq.)]

Loi du 2 février 1995 relative au renforcement de la protection de l'environnement (JO du 3 février 1995, p. 1840 et suivantes) [Act of 2 February 1995 on the reinforcement of environmental protection (Official Gazette of 3 February 1995, p. 1840 et seq.)]

Loi du 30 juillet 2003 relative à la prévention des risques technologiques et naturels et à la réparation des dommages (JO du 31 juillet 2003, p. 13021) [Act of 30 July 2003 on the prevention of technological and natural risks and the repair of damage (Official Gazette of 31 July 2003, p. 13021)]

Décret du 11 octobre 1990 relatif à l'exercice du droit à l'information sur les risques majeurs, pris en application de l'article 21 de la loi du 22 juillet 1987 (JO du 13 octobre 1990, pp. 12415-6) [Decree of 11 October 1990 on exercising the right to information on major risks, issued pursuant to Section 21 of the Act of 22 July 1987 (Official Gazette of 13 October 1990, pp. 12415-6)]

Décret du 5 octobre 1995 relatif aux plans de prévention des risques naturels prévisibles (JO du 11 octobre 1995, p. 14804 et suivantes) [Decree of 5 October 1995 on plans for the prevention of foreseeable natural risks (Official Gazette of 11 October 1995, p. 14804 et seq.)]

Décret du 17 octobre 1995 relatif à l'expropriation des biens exposés à certaines risques naturels majeurs menaçant gravement des vies humaines, ainsi qu'au Fonds de prévention des risques naturels majeurs (JO du 19 octobre 1995, p. 15256 et suivantes) [Decree of 17 October 1995 on the expropriation of property exposed to certain major natural risks seriously endangering human lives and on the Fund for the Prevention of Major Natural Risks (Official Gazette of 19 October 1995, p. 15256 et seq.)]

Décret du 4 janvier 2005 relatif aux schémas de prévention des risques naturels [Decree of 4 January 2005 on natural risk prevention plans]

Décret du 4 janvier 2005 modifiant le décret n° 95-1089 du 5 octobre 1995 relatif aux plans de prévention des risques naturels prévisibles [Decree of 4 January 2005 amending Decree n° 95-1089 of 5 October 1995 on plans for the prevention of foreseeable natural risks]

Décret du 12 janvier 2005 relatif à la création des comités locaux d'information et de concertation en application de l'article L. 125-2 du code de l'environnement [Decree of 12 January 2005 on the creation of local information and consultation committees pursuant to Article L. 125-2 of the Environmental Code]

Décret du 12 janvier 2005 pris en application des articles L. 564-1, L. 564-2 et L. 564-3 du code de l'environnement et relatif à la surveillance et à la prévision des crues ainsi qu'à la transmission de l'information sur les crues [Decree of 12 January 2005 issued pursuant to Articles L. 564-1, L. 564-2 and L. 564-3 of the Environmental Code and concerning the monitoring and forecasting of floods and the communication of information on flooding]

Décret du 12 janvier 2005, modifiant le décret n° 95-1115 du 17 octobre 1995 relatif à l'expropriation des biens exposés à certains risques naturels majeurs menaçant gravement des vies humaines ainsi qu'au fonds de prévention des risques naturels majeurs [Decree of 12 January 2005, amending Decree n° 95-1115 of 17 October 1995 on the expropriation of property exposed to certain major natural risks seriously endangering human lives and on the Fund for the Prevention of Major Natural Risks]

Décret du 7 février 2005 portant application des articles L. 211-7 et L. 213-10 du code de l'environnement et de l'article L. 151-37-1 du code rural [Decree of 7 February 2005 implementing Articles L. 211-7 and L. 213-10 of the Environmental Code and Article L. 151-37-1 of the Rural Code]

Décret du 7 février 2005 relatif aux servitudes d'utilité publique instituées en application de l'article L. 211-12 du code de l'environnement [Decree of 7 February 2005 on easements in the public interest pursuant to Article L. 211-12 of the Environmental Code]

Décret du 7 février 2005 relatif à la prévention de l'érosion et modifiant le code rural [Decree of 7 February 2005 on the prevention of erosion and amending the Rural Code]

Décret du 15 février 2005 relatif à l'information des acquéreurs et des locataires de biens immobiliers sur les risques naturels et technologiques majeurs [Decree of 15 February 2005 on the provision of information regarding major natural and technological risks to those purchasing or leasing real property]

Décret du 14 mars 2005 pris en application de l'article L. 563-3 du code de l'environnement et relatif à l'établissement des repères de crues [Decree of 14 March 2005 issued pursuant to Article L. 563-3 of the Environmental Code on the establishment of flood level marks]

Circulaire du 1er octobre 2002 relative au plan de prévention des inondations et à l'appel à projets [Circular of 1 October 2002 on the flood prevention plan and the call for projects]

Annex 3: Members of the Steering Group

DENMARK:

Niels JACOBSEN
Head of Section
Danish Emergency Management Agency

Niels MADSEN
Senior Advisor
Danish Emergency Management Agency

Dorte JUUL MUNCH
Head of Section
Civil Sector Preparedness Division
Danish Emergency Management Agency

Henrik Grosen NIELSEN
Head of Division
Emergency Management Division
Ministry of the Interior and Health

Signe RYBORG
Head of Unit
Ministry of the Interior and Health

FRANCE:

Geneviève BAUMONT
Secrétaire du Comité de la Prévention et de la Précaution
Direction des études économiques et de l'évaluation environnementale
Ministère de l'écologie et du développement durable

Antoine BOISSON
Bureau de l'évaluation des normes et de la sécurité environnementale
Direction des études économiques et de l'évaluation environnementale
Ministère de l'écologie et du développement durable

Annie ERHARD-CASSEGRAIN
Bureau de l'évaluation des normes et de la sécurité environnementale
Direction des études économiques et de l'évaluation environnementale
Ministère de l'écologie et du développement durable

Emmanuel MASSE
Bureau de l'évaluation des normes et de la sécurité environnementale
Direction des études économiques et de l'évaluation environnementale
Ministère de l'écologie et du développement durable

ITALY:

Andrea SANTUCCI
Directorate for Environmental Protection

Ministry of the Environment and Land Protection

Maria GRAZIA COTTA
Directorate for Soil Defence
Ministry of the Environment and Land Protection

Francesco TORNATORE
Basin Authority of Po river

Donato DI MATTEO
Head of Division for Industrial Risks
Directorate for Environmental Protection
Ministry of the Environment and Land Protection

Alicia MIGNONE
Science Attaché
Permanent Delegation of Italy at the OECD

JAPAN:

Kotaro NAGASAWA
Director of Europe Office
Infrastructure Development Institute

Yoshiyuki IMAMURA
Programme Specialist,
Division of Water Sciences, UNESCO

Takashi NAKAJIMA
Deputy director of Europe Office
Infrastructure Development Institute

Kazuo UMEDA
Director of 2nd Research Department
Infrastructure Development Institute

Masaru KUNITOMO
Assistant Director for International Affairs,
River Planning Division, River Bureau
Ministry of Land, Infrastructure and Transport

Hideki HIRAI
Counsellor for Disaster Management
Cabinet Office

NORWAY:

Dagfinn BUSET
Adviser, Emergency Planning Unit
Rescue and Emergency Planning Department
Norwegian Ministry of Justice and the Police

Hilde Bostrøm LINDLAND
Project Manager
Directorate for Civil Protection and Emergency Planning
Ministry of Justice and the Police

Stein HENRIKSEN
Directorate for Civil Protection and Emergency Planning
Ministry of Justice and the Police

Terje-Olav AUSTERHEIM
Directorate for Civil Protection and Emergency Planning
Ministry of Justice and the Police

SWEDEN:

Ulf BJURMAN
Head of Department/Director
Swedish Rescue Services Agency

Alf ROSBERG
Project Leader
Swedish Rescue Services Agency

Jim SANDKVIST
Director
SSPA

Oskar HANSSON
Principal Administrative Officer
Swedish Emergency Management Agency

Maria MONAHOV
Research Co-ordinator
Swedish Emergency Management Agency

Louise SIMONSSON
Research Co-ordinator
Swedish Emergency Management Agency

SWITZERLAND:

Rudolf A. MÜLLER
Conseiller scientifique
Secrétariat d'Etat à l'économie

UNITED STATES:

Larry W. ROEDER, Jr.
Policy Advisor on Disaster Management
Bureau of International Organisations
US Department of State

OECD Studies in Risk Management

France

POLICIES FOR PREVENTING AND COMPENSATING FLOOD-RELATED DAMAGE

Looking back on the disasters of recent years alone (the Indian Ocean tsunami disaster, Hurricane Katrina, terrorist attacks in New York, Madrid and London, avian flu, the 2003 heat wave in Europe), one could be forgiven for thinking that we live in an increasingly dangerous world. A variety of forces are helping to shape the risks that affect us, from demographic evolutions to climate change, through the development of mega-cities and the rise of information technology. These changes are clearly a major challenge for risk management systems in OECD countries, which have occasionally proved unable to protect the life and welfare of citizens or the continuity of economic activity.

The OECD Futures Project on Risk Management Policies was launched in 2003 in order to assist OECD countries in identifying the challenges of managing risks in the 21st century, and help them reflect on how best to address those challenges. The focus is on the consistency of risk management policies and on their ability to deal with the challenges, present and future, created by systemic risks. The Project covers a range of risk management issues which were proposed by the participating countries and together form three thematic clusters: natural disasters, risks to critical infrastructures, and the protection of vulnerable population groups. In the first phase of the Project, the OECD Secretariat prepared a case study for each issue. The studies cover both recent international developments of interest and the national policy context, and come with a tool for self-assessment to be used later in the Project in order to review the national policies in question.

This work is now published as the OECD Studies in Risk Management.

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