

OECD Studies in Risk Management

Japan

FLOODS



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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 in Selected OECD Countries (RMP), the Japanese Cabinet Office and the Ministry of Land, Infrastructure and Transport (MLIT) have proposed a Phase 1 case study on risk reduction strategies for large-scale floods. The study would lay the ground for self-assessment and review of Japan's flood disaster preparedness system, with the objective, as stated by the Cabinet Office and MLIT to "review and evaluate how the current system works and point out the need to improve the existing measures; assess new measures being proposed by the MLIT, "National Strategy for Risk Management of Large-scale Flood Disasters"; and to recommend/suggest further measures to be incorporated and future courses."

In recent years, Japan has witnessed a significant increase in precipitation levels and in the frequency of extreme climatic events such as typhoons, which have raised the likelihood of flood disasters. Meanwhile, increasing concentration of people and economic assets has led to an escalation of financial costs of disasters. The rapid ageing of the population can also be a factor of vulnerability if the specific needs of older people in emergency situations are not appropriately addressed. One of the aims of this report is to help raising awareness about the importance of risk management in Japan and in other OECD countries, in order to prioritise and support prevention and preparedness policies.

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Yoshiyuki Imamura, at the UNESCO, Masaru Kunitomo, at the River Bureau (MLIT), Kazuo Umeda, at Infrastructure Development Institute (IDI), as well as from the guidance of the Steering Group to the OECD Futures Project (see the list of Steering Group members in Annex 2). The study is issued under the responsibility of the Secretary General of the OECD.

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Introduction

Floods and flood-related disasters, such as landslides, are a traditional and serious risk in Japan. In the 1940s and 50s, after flood disasters took thousands of lives, the creation of a comprehensive flood risk management programme led to a dramatic reduction in human casualties. However, in recent years, changes in climate and several socio-economic drivers have on the one hand increased the probability of flood events, especially urban floods, and on the other hand increased vulnerability to floods, because of population density and concentration of economic assets. As a result, the probability that a flood event develops into a disaster has to a certain degree increased.

This study will firstly look at the local context in Japan, and the measures that the authorities have so far taken to prevent and mitigate flood risk. The second part will assess a number of trends which can be expected to affect flood risk management in the future. Finally, the third part looks at the possible policy consequences of the trends discussed in part two, with emphasis on non-structural measures.

The study leaves aside the technical and scientific issues related to flood prevention and mitigation, and focuses on policy-making and interactions between the different levels of government, and between the public and private sectors (non-government organisations, businesses and individuals). Annex 1 to the study gives an overview of the main features of the Japanese flood disaster management system following the project's methodological framework.¹ Based on further information and discussions, the next draft of the paper will include two additional annexes. Annex 2 lists the main laws and regulations applying to earthquake disaster management. Annex 3 presents the self-assessment questionnaires. Finally, Annex 4 provides a list of the members of the Steering Group to the OECD Futures Project on Risk Management Policies.

¹ See OECD, 2003.

Part 1: Large-scale floods in Japan

Presentation of the general context in Japan:

Japan has a geographic area of about 378 000 square kilometres, which is divided between four main islands. The country has a temperate climate, subject to extensive regional variation, with three periods of heavy precipitation. The country is exposed to a series of natural hazards – geo-seismic (earthquakes and volcanic activity, with the subsequent risk of tsunamis), as well as hydro-meteorological events – typhoons occur frequently in September and October. Floods are frequent events and have caused great damage in the past. The country is fairly mountainous, and rivers are relatively short and steep.

With a population of 127 million, population density is very high. Most residential and industrial areas tend to be located in lowland areas, along rivers; these areas are highly flood-prone. According to a 1985 study, 48.7 percent of the population and 75 percent of holdings are located within flood-prone areas.² Considering the population growth in the Kanto Plain, in which Japan's second longest river, Tone, is located, these shares are probably higher today. In the eastern part of the Greater Tokyo Area, several wards and cities find themselves below the water level of several rivers, most importantly the Arakawa and Edo Rivers.

Experiences with floods

Japan is exposed to all types of floods, in particular:³

- Storm surge: Water pressed to shore (coast or large seas) by strong winds, which, when coinciding with tide, can create considerable rise in sea levels.
- River floods: Such floods are the result of heavy rainfall over several days and over large area. The water level rises when the soil is saturated.
- Flash floods: Caused by intense rain over a small area. The soil is not saturated but the rainfall exceeds the infiltration rate and runs off the surface.
- Tsunamis: waves generated by large volumes of water being displaced (by earthquakes, landslides or volcanic eruptions). Tsunamis can travel through the open sea for hundreds of kilometres without losing their energy and increase in height when they reach shore – up to ten metres. In Japan, risks

² Japanese Ministry of Land, Infrastructure and Transport (MLIT) and the Cabinet Office, 2005.

³ Definitions from Munich Re.

related to tsunamis are, however, addressed as part of earthquake preparedness, and will therefore not be further considered in this paper.

The worst flooding in modern Japanese history was caused by the Ise-wan typhoon in 1959, which took more than 5 000 lives. It occurred at the end of a period of twenty-five years of extreme climatic conditions: in the years between 1934 and 1959, there were six flood disasters, mainly caused by typhoons, which killed between 1 000 and 3 000 persons each. In recent years, there have been several flooding events in Japan, including the Tokai Heavy Rain in 2000, as well as several events in 2004 related to the many typhoons which hit the country, most notably the typhoons Songda and Tokage (see table 1).

Table 1: Significant flooding events in Japan, 2000-2004

Event	Description	Economic loss		Human loss
		Insured loss	Total damage	
Tokai Heavy Rain, September 2000	Floods and landslides in the Nagoya area	USD 990 million (2001 value)	USD 7 billion**	18
Fukui Niigata-Fukushima Torrential Rain, July 2004	More than 12 500 hectares damaged, 5 800 homeless	USD 279 million	USD 1.95 billion	20 dead, 1 missing
Typhoon Songda/No. 18, September 2004	Winds up to 212 km/h, torrential rain	USD 3.59 billion*	USD 7.17 billion	41 dead, 4 missing*
Typhoon Meari/No. 21, September, 2004	Winds up to 160 km/h, rain, floods, landslides	USD 291 million	USD 798 million	26 dead, 1 missing
Typhoon Ma-On/No. 22, October 2004	Winds up to 162 km/h, rain, floods	USD 241 million	USD 603 million	7 dead, 4 missing
Typhoon Tokage/No. 23, October 2004	Winds up to 229 km/h, 23 210 houses destroyed	USD 1.12 billion	USD 3.2 billion	94 dead, 3 missing

** Figures from Japan Institute of Construction Engineering, n.a.
Source: Swiss Re, 2001 and 2005.

Decentralisation and cooperation between local and central government

The political administration of Japan consists of the central government, 47 prefectures and more than 2 000 municipalities. The relationship between local and central government and the allocation of tasks have changed considerably in the last decade. Measures have been taken to make regions and municipalities both politically and economically more independent, in an effort to make public spending

more efficient and adapted to local needs. The decentralisation process started with the Decentralisation Promotion Law in 1995, which had three main objectives:

- Clarify and better allocate the roles and responsibilities of central and local government
- Revitalise regional communities across Japan
- Develop measures to increase the self-reliance of local government

After a review of the current institutional structure, the Decentralisation Package Law was adopted in 1999, which supported the preparation and development of related laws to promote decentralisation. Main focus areas were the clarification of the roles of central and local government; and the abolition of the system of delegation of national government administrative functions to local government. The reform was carried out in 2000.

The share of local government spending of total government expenditure was about 40 percent in 2003, whereas local government revenue accounted for 30 percent of the total (revenue defined as direct and indirect taxes as well as non-tax revenues received by regional and local governments).⁴ Local government debt had increased from 15 percent of GDP in the early 1990s to 40 percent in the financial year of 2003. Intergovernmental transfers accounted in 2003 for 37 percent of total local government revenue. Such transfers comprise mainly block grants and earmarked funds. Local allocation tax is part of the block grants and serves in part as regional redistribution.⁵ In order to increase local autonomy and streamline intergovernmental transfers to improve fiscal stability, a fiscal decentralisation reform was announced for the fiscal years 2004-06. The so-called Trinity reform focuses on three main issues:⁶

- the reduction of earmarked grants (JPY 3.2 trillion for the period 2004-06)
- decrease in block grant funds, allocated through the Local Allocation Tax (JPY 1.2 trillion in 2004, total amount up to 2006 not yet decided)
- Increase of sub-national taxing powers (transfer of some national tax revenues to the local governments, amounting to about JPY 3 trillion for 2004-06). The right to set local tax bases is broader than in many OECD countries, but the use of the taxing power has been relatively limited.⁷

⁴ OECD, 2005a, p. 104.

⁵ OECD, 2005b, p. 127.

⁶ OECD, 2005b, p. 126.

⁷ OECD, 2005a, p. 105.

Local government spending responsibilities include education, social services, health care services, waste collection and disposal, infrastructure (roads, river management, sewers), public housing and police and fire services. Some of these areas (education, welfare) are subject to norm-setting by the central government and receive ear-marked grants, something which should be affected by the above-mentioned Trinity Reform. Prefectures perform tasks which cover a wider geographic area than municipalities, such as the management of upper secondary schools and the disposal of industrial waste.⁸ In the fiscal year 2002, 71 percent of expenditure for land development and preservation was carried by local government.⁹

Until 1999, urban planning was an agency-delegated function of the state to be carried out by local government. The historical purpose of such planning was to focus on basic infrastructure and boost urban functions to encourage industrial development.¹⁰ A paradigm shift came in the 1990s, with the economic downturn and a population increasingly focused on life quality and improved living conditions. But even before that, in 1980, a district unit planning system was introduced (as opposed to city unit) which opened up for some public consultation.¹¹ Prefectural governors and mayors of designated cities are responsible for identifying city areas in need of improvement, development and maintenance, and for specifying which urban areas should be systematically developed to promote urbanisation, as well as which should be controlled. All development is subject to the approval of prefectural governors or the mayors of designated, core, or special cities. Mayors are responsible for formulating city plans, which are subject to public hearing as inspection, and to screening by city planning committees held at the prefectural level, before they are finally approved.¹²

Flood risk management

Flood risk management can be seen as the mix of daily and exceptional activities, *i.e.* it includes the management of rivers, coastal defence and water discharge systems in urban areas (drainage and sewerage) as well as flood disaster management. These tasks are all shared between central and local government. The main actor is the Ministry of Land, Infrastructure and Transport (MLIT), and in particular its River Bureau. The River Bureau is responsible for: planning related to river basins and coastal areas; preparedness against disasters caused by floods, storm surges and sediment slides; and the supply of

⁸ OECD, 2005a, p. 107.

⁹ OECD, 2005a.p. 108.

¹⁰ Nakai, 2002, p. 17.

¹¹ *Ibid.*, p. 19.

¹² Japanese Council of Local Authorities for International Relations, 2004, pp. 21-23.

drinking water and other water resources. Its budget for the fiscal year 1995 amounted to JPY 2 281 billion or EUR 18.67 billion (1995 value), including JPY 1 318 in prefectural expenditures.¹³

Flood risk management is supported by a range of laws. The River Law, the Flood Fighting Law, the Law for Prevention of Disasters Due to Collapse of Steep Slopes, to mention some. The most pertinent to our review seem to be the River Law and the Flood Fighting Law, which will be presented quickly in the following section. The Ise-wan typhoon of 1959 triggered the creation of the “Flood Control Special Accounting Law” (1960), and the “First Five Year Plan for Flood Control” which began securing continual national budget allocation for flood control. The "River Law" was then finally drafted in 1964. 109 river systems are designated according to the River Law as especially important from the view of land conservation and national economy. These river systems are managed by central government in accordance with the principle of consistent management of a whole river system even under the ongoing trend of decentralisation. Management is mainly concerned with controlling flooding and ensuring water supply for daily and industrial use, with an increasing focus on environmental issues.

According to the River Law, there are four categories for river planning: First and second class rivers (class A and B), other rivers to which the River Law applies (class C); and ordinary rivers exempt from the River Law. First class rivers are rivers in the above-mentioned 109 river systems managed either by MLIT or by prefectural governors etc.; second class rivers by prefectural governors; and the remaining rivers to which the River Law applies by municipal mayors. Flood fighting and preparedness are regulated under the Flood Fighting Act, and the Specified Urban River Inundation Prevention Act.

The Flood Fighting Act, which lays down the locus of responsibility and the matters pertaining to flood fighting activities, was first enacted in 1949 after severe flooding and typhoon damage in the 1940s. Amendments in the 1950s extended the Act to include the designation of rivers with flood forecasting and flood fighting warning services to make it obligatory to transmit information concerning smooth flood fighting activities. Furthermore, a Flood Fighting Committee system was introduced. The latest amendment in 2005 incorporated water-related disaster mitigation measures in medium/small rivers vulnerable to localised torrential rainfall in order to enhance local ability to cope with this frequent phenomenon. The amendment takes into account the frequent occurrence of localised rainfall, the suffering of those who need help in evacuation and the weakening of local community's mutual assistance system.

The Flood Fighting Act lays down the following in relation to flood risk management:

¹³ Japanese Ministry of Land, Infrastructure and Transport, n.a.

- Flood fighting is part of local government's general affairs, with municipalities assuming a primary responsibility.
- In case of floods, quick and smooth operation of flood fighting is ensured by issuing flood fighting warning which instructs "stand-by" or "action" to the municipalities concerned, granting R/W (right-of-way) to flood fighting vehicles, designating flood fighting warning zones, etc. Moreover the act imposes annual flood fighting drills for the preparedness system in normal time, systems for flood fighting cooperating bodies and severance pay to the part-time staff of flood fighting corps.
- The act also touches on information requirements to local residents to reduce human losses. The national government and prefectures provide flood forecasting or information of river water levels, which serve as guidelines for evacuation in rivers where flood forecasting is technically difficult. The national government and prefectures designate the estimated area of inundation, which is then transmitted to the municipalities concerned, so that these can prepare flood hazard maps with added evacuation routes and refugees etc. The map is made known to public. If facilities used or inhabited by the elderly population and underground facilities etc. are located within the estimated area of inundation, precise modes of communication for flood forecasting have to be decided.

When it comes to flood control in urban areas, *Comprehensive Flood Control Measures* were developed in the 1970s to mitigate the effects of rapid urbanisation on flood risk. A three-prodded strategy was developed: Upgrade of rivers through improved water control; improvement of river basins to maintain water retention and drainage capacities; and damage mitigation measures taking into account flooded buildings. Based on these principles the Comprehensive Flood Control Measures were established in 1978. They apply to rivers that are located in one of the top three urban centres or one of the major regional centres, which meet certain criteria of basin area; rainfall accommodation levels; and levels of current and future urbanisation and population density. The measures are applied by a Council specific to each river, which consists of representatives from the regional construction bureaus of the national government, and bureaus and offices of the affected prefectures and municipalities which are responsible for the river and urban planning (housing, land use). The councils must prepare basin improvement plans (to be approved by the concerned parties); which outline the sharing of work to upgrade the downstream and basin area.

Despite the voluntary nature of the Comprehensive Flood Control Measures, they responded to a certain extent to the rapid urbanisation. However, urban flooding has been getting more and more frequent due to localised heavy rainfall in affected river basins and the continued urbanisation along rivers, and it has become evident that conventional river improvement methods are no longer feasible. Under these circumstances, the Specified Urban River Inundation Prevention Act was enacted in 2003 and went into

effect in 2004, aiming at reinforcing river basin measures through the clear definition of the roles of river administrators, sewerage administrators, prefectures and municipalities.

The Act provides for effective river basin measures: rainwater storage and infiltration facilities built by river administrators, drainage pump operation rules, approval system for activities that would prevent rainwater infiltration, notification procedure for acts on regulating reservoirs which are often clogged, publication of inundation area of both river flooding and inland waters, etc.

Recent developments in flood risk management in Japan include the adoption of the “National Strategy for Risk Management of Large-Scale Flood Disaster”.¹⁴ This strategy introduces, in addition to traditional ‘hard’ structural measures, a series of new measures such as simulation of socio-economic impact and target setting, and improved cooperation and communication with citizens. The objective of the latter measures would be to improve local and individual ability to prepare against and respond to floods. Furthermore, MLIT has suggested an “Emergency Action Plan for torrential rain disaster management”. The plan consists of five main elements:

- Improve disaster information services
- Ensure the sharing of disaster information
- Maintain and improve the functions of disaster prevention facilities
- Rebuild local disaster management capacity
- Thorough review of disaster preparedness.

Deadlines and numerical targets have been established for each policy.

Disaster management

Disaster management is carried out at the central level by the Cabinet Office, which has a dedicated Minister of State for Disaster Management. The other main body is the Central Disaster Management Council, which is chaired by the Prime Minister and comprises the cabinet, directors of major Japanese institutions (Red Cross, Bank of Japan, etc.) and outside experts, and which has the main coordinating and decision-making role when it comes to promoting comprehensive countermeasures. Main tasks of the Central Disaster Management Council and its secretariat include among other things the formulation and promotion of the nation-wide preparedness plans (Basic Disaster Management Plan).

¹⁴ Japanese Ministry of Land, Infrastructure and Transport (MLIT) and the Cabinet Office, 2005.

At the prefectural and municipal level, the respective Disaster Management Councils are responsible for elaborating disaster management plans adapted to their jurisdictions, and implement national measures, the prefectures also having a coordinating task. In other areas pertaining to disaster preparedness (citizen safety, land use, fire brigades, etc.), municipalities elaborate their own policies and carry thus the main responsibility for day-to-day activities.

The central government needs a legislative mandate to intervene in local affairs. In disaster management, this is given by a number of acts of which the most important is the Disaster Countermeasures Basic Act of 1961. It defines the jurisdictions and responsibilities for all areas pertaining to disaster management: disaster prevention plans; disaster prevention; disaster emergency measures; rehabilitation; state of emergency; and financial measures. The disaster preparedness structure described above is laid down in the Disaster Countermeasures Basic Act. In addition there is the Disaster Relief Act, which regulates the provision of relief services on an emergency basis in cooperation with local public entities, the Red Cross, and other actors.

Disaster relief and compensation mechanisms

The cost of disasters is shared by individuals, the government and the insurance industry. In accordance with the Disaster Relief Act, local public bodies are required to set aside a specific amount of money as a disaster relief fund, which is managed by the prefecture. The Act Concerning Support for Reconstructing Livelihood of Disaster Victims stipulates the financial assistance for reconstructing livelihoods available for disaster victims. Flood insurance is optional and bundled with fire insurance, with relatively high penetration rates of approximately 49 percent for dwellings, and 35 percent for household property.¹⁵ It seems that deductibles are restrictive (30 percent), and that there is a co-insurance requirement of 30 percent on the remaining 70 percent of the insured loss amount.¹⁶ The government does not act as reinsurer. It is quite common in Japan that individuals carry an important part of the economic loss of disasters.

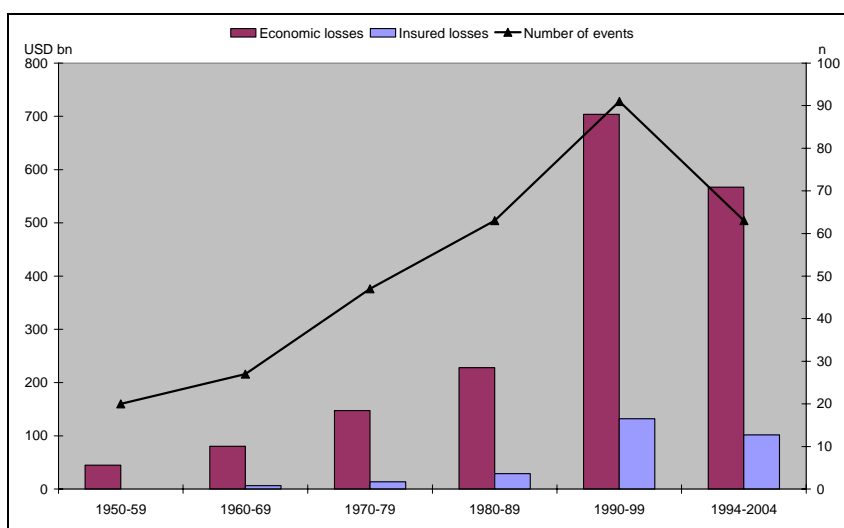
¹⁵ Paklina, 2003, p. 6.

¹⁶ US Chartered Property Casualty Underwriter, 2001.

Part 2: Areas of concern for the future

The costs of natural catastrophes have been on the rise for several decades. Some estimates indicate a seven-fold increase for economic costs since the 1960s (see figure 1). Mega-events such as the 2004 Indian Ocean Tsunami or the 2005 Hurricane Katrina are only illustrations of a general trend which affects both developing and OECD countries. Regarding the latter, the same factors seem to be responsible for the rise in damage in all countries: first, more frequent and intense natural hazards, possibly related to the climate change; second, higher geographic concentrations of people, assets and economic activities in hazard-prone areas, such as sea shores and flood plains; third, increased vulnerability in specific segments of society or the economy. This section will review these drivers globally, with specific attention to flood risks in Japan.

Figure 1: Great natural catastrophes¹⁷, 1950-2004



Source: Munich Re, 2005, p. 14.

Climate change

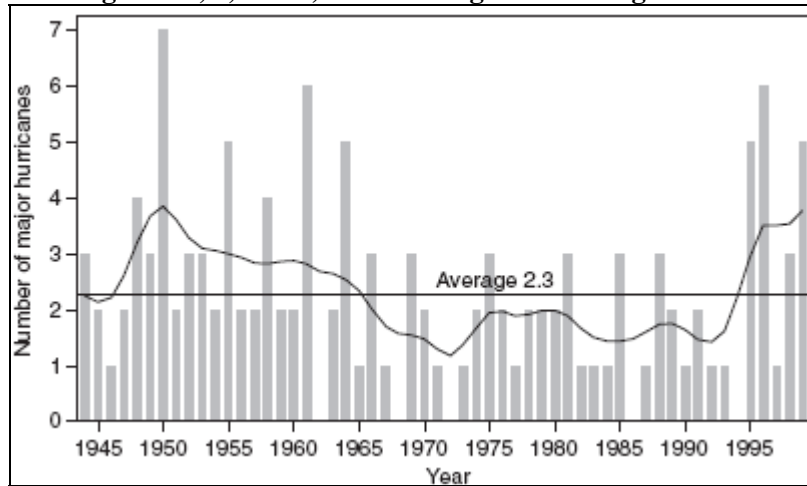
There has been a marked change in weather patterns the last ten to 15 years. The climate in the last decade has probably been the warmest since modern measuring began (nine of the ten last years have been the warmest since 1861).¹⁸ This has been accompanied by increased precipitations and storm activity in

¹⁷ United Nations' definition: Natural catastrophes are considered 'great' if the affected regions' ability to help themselves is clearly overstretched and supranational or international assistance is required.

¹⁸ IPCC, 2001, p. 3.

Europe, the Americas and Asia. In 2004, Florida was exceptionally hit by four hurricanes, and Japan was hit by ten typhoons (the previous record was six).¹⁹ At the same time, there is great regional and temporal variation in weather patterns. For instance, the 1970s and 80s were a calm period in the United States regarding hurricane activity compared to the precedent and subsequent decades.

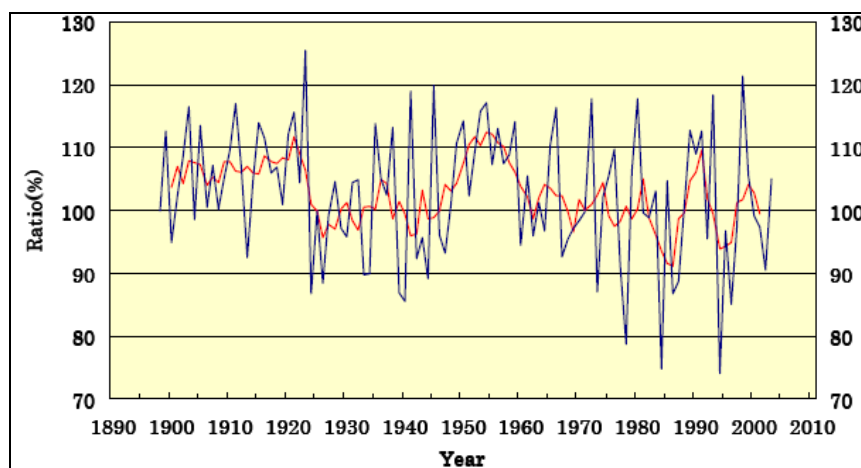
Figure 2: Interannual variability in the number of major hurricanes (Saffir-Simpson categories 3, 4, and 5) and the long-term average across the North Atlantic



Source: IPCC, 2001.

Equally, figure 3 shows how precipitation levels in Japan were above normal (normal period=1971-2000 average) for sustained periods between 1900 and 1950. Reportedly, in the period 1941-1950 the Tone river basin near Tokyo had precipitation levels which surpass those of later decades by 30-60 percent.

Figure 3: Annual precipitation ratios from 1898 to 2003 over Japan*



*The blue line indicates ratios of annual precipitation to the normal (1971-2000) average. The red line indicates 5-year running mean.

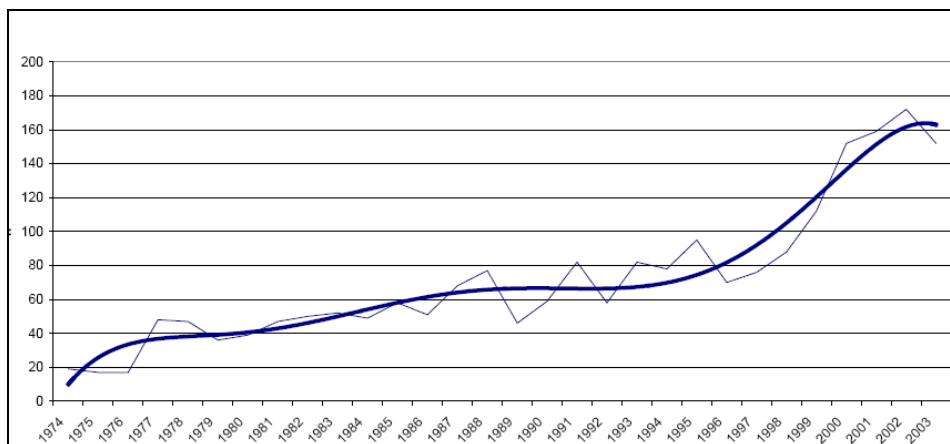
¹⁹ Munich Re, 2005.

Source: Japanese Meteorological Agency, 2004.

This is one of the reasons why the discussion of climate change is subject to uncertainty. However, it remains very likely that the global temperature increase of the decades will be within the projections of the Intergovernmental Panel for Climate Change: 0.8 - 2.6 (Celsius) temperature increase between 1990 and 2050. There are still questions concerning the regional repartition of temperature change, and also whether extreme climatic events observed today are due to the global warming.

Climate change impacts modern societies in at least two main ways. First, climate change, through the rapid emergence of 'new' weather (stronger and more frequent storms, precipitation, drought, etc.) increases the risk of disasters. Indeed, figure 4 indicates an eightfold increase in annually reported flood disasters between 1975 and 2002, from 20 to 160. Second, climate change challenges society's ability to adapt to new circumstances. Societal preparedness and protection systems (building codes, insurance systems, etc.) rely on the (slow) adaptation to and tolerance of a certain type of weather, and it is vulnerable even to minor changes. Storm damage does not increase in proportion to the severity of an event - if the storm exceeds the tolerance thresholds of design codes, the construction risks to collapse.²⁰

Figure 4: Total number of reported disasters²¹ caused by floods, World, 1974 – 2003, n = 2,156



Source: EM-DAT: The OFDA/CRED International Disaster Database. www.em-dat.net, UCL, Brussels, Belgium

²⁰ Swiss Re, 1998, p. 5.

²¹ Disaster defined as event where at least one of the following has occurred: 10 or more people killed; 100 or more people reported affected; a call for international assistance; and/or declaration of a state of emergency. (Centre for Research on the Epidemiology of Disasters (CRED)).

It is very difficult to formulate a pro-active public policy under the current circumstances. For one, the constant breaking of historic weather records makes it hard to rely on historical figures in risk assessments for planning and insurance purposes. Second, land use legislation and building codes are not retroactive, so even if policy-makers responded quickly by adopting new legislation, the results would come very slowly.

Lacking adaptation can be costly. The increase in weather-related disasters in the 1990s took the insurance industry by surprise and contributed to the problems experienced by insurance and reinsurance companies in the late 1990s and early 2000s. Costly natural disasters, in addition to the high insured losses of the New York terrorist attacks in 2001, put a heavy burden on a relatively small number of global reinsurance companies, something which threatened to destabilise the entire global financial system. The situation was further worsened by low return of investment. Today, the insurance and reinsurance sector have recovered to a certain degree, mainly by increasing premiums. This, however, makes insurance less affordable and threatens to shift costs and risks over to individuals and the government.

Another consequence of lacking, or slow, societal adaptation to climate change is the creation of new, indirect, or interrelated risks. One example is the interaction between new weather patterns, floods more specifically, and toxic releases from industrial plants, often situated on flood plains. The risk posed by industrial facilities to the neighbouring population is not new, but the potential of flooding is clearly a complicating and risk-enhancing factor, which was not accounted for in original land use zoning plans and considerations. In the 2002 floods in Germany and the Czech Republic, several events of chemical spills or 'almost-accidents' were recorded. The same happened in the Great New Orleans Flood, triggered by Hurricane Katrina, with a number of industrial releases and spills.

Increasing concentration of wealth and population

The explosion in disaster costs is partly related to a greater accumulation of wealth, and concentration of people, assets and activities.

Japan, in particular, experienced dramatic increases in its population and economic wealth, as well as sustained urbanisation, throughout the 20th century. The population doubled between 1930 and 1985, reaching 120 million, most of which now live in urban areas. The city agglomerations of Tokyo, Osaka and Nagoya are home to more than a third of the entire population. In these areas, population density may easily surpass 1 000 inhabitants per square kilometre. When it comes to corporate wealth, it is estimated that about one quarter of the 1.5 million enterprises in Japan have their head offices in Tokyo and Osaka

prefectures.²² The commercial property value is difficult to assess, but private industry estimates for New York suggest that within a 1 000 metre radius of a hypothetical ‘ground-zero’ in lower Manhattan, there is close to USD 50 billion (2002 value) in insured commercial property value.²³ A similar situation could be imagined for some areas of Tokyo.

Increasingly concentrated assets and people are exposed to flood risks. Underground spaces are more intensely exploited than they used to be. Formerly (or currently) exposed coastal or riverine areas are increasingly used for residential or industrial purposes. For instance, the population on the Southeast coast in the United States has increased by 58 percent between 1980 and 2003, almost twice that of the average national growth rate.²⁴ In Florida, the population increase for the same period reached almost 75 percent.²⁵ In the United States, coastal counties have a higher median income than non-coastal households – a difference that amounts to 17 percent on average.²⁶ Such developments are driven by a series of different factors – property prices, rising individual wealth, short-term political goals, moral hazard, reduced risk awareness among individuals, etc. Furthermore, expensive technological equipment and other valuables are stored in basements; basements are in addition increasingly used as living space or for commercial activity (underground shopping malls in Japan). The increasing density of cars in urban areas has led to a growth in underground parking lots - in Paris it is estimated that there are 600 000 parking spaces underground. Finally, structural defences have made the occurrence of a flood much less likely, but the impact of a flood, should it happen, has become devastating. One example is the UK government’s plan to build 120 000 new homes in the Thames Gateway, a known flood plain, which is protected by the Thames Barrier. The Thames Barrier is constructed to resist a millennium flood, but if the defences should break, the UK Environmental Agency has estimated that the costs of a major flood in London could exceed USD 50 billion.²⁷ Structural defences, when they have allowed a loss of flood risk awareness in the general population, have sometimes aggravated risks.

Until 2005, there had been few examples of large-scale urban flood disasters. Historical flood and more recent events include the storm surge disaster in Southeast England and London and in the Netherlands in 1953 and the Tokai heavy rain in Nagoya in 2000. However, the September 2005 Great New Orleans

²² Japan Statistics Bureau, 2005.

²³ Risk Management Solutions (RMS), 2002, p. 6.

²⁴ US National Oceanic and Atmospheric Administration, 2004, p. 3

²⁵ *ibid.*

²⁶ *ibid.*, p. 12.

²⁷ UK Environmental Agency (n.a.).

Flood is the first flood ‘mega-disaster’ when it comes to economic loss and impact on national and international economy. Loss estimates for Hurricane Katrina exceed USD 125 billion (USD 40-60 billion are insured), of which the Great New Orleans Flood accounts for at least half of the total economic losses, and USD 15-25 billion of the insured losses.²⁸ Almost 1 000 persons were killed, and hundreds of thousands made homeless. The Great New Orleans Flood had the now typical characteristics of other large-scale disasters, such as the numerous secondary effects – breakdown of critical infrastructures (water, sewage, transport, telecommunications), releases of hazardous materials and fires, which significantly slowed down the relief work and contributed to driving up the economic and human losses. The losses of the disaster will mainly be shared between the insurance industry and the government. It has been reported that the insurance density was relatively low (compared to Hurricane Andrew in 1992), something which may demand huge government transfers. Public relief transfers have already amounted to more than USD 60 billion (by end of September 2005), an amount which will probably increase in the following months.²⁹

These rising costs of natural disasters, including floods, are increasingly difficult to bear and could become a threat to economic sustainability. This is particularly the case for developing countries, but it is also becoming a burden for developed countries, which experience lagging economic growth and are facing a number of fiscal challenges in the coming years. Yet, the concentration of assets may lead to a situation of lock-in, in the sense that the cost of physical withdrawal is too high to be taken into consideration. The response is continued investment in costly mitigation measures, which, due to the scientific uncertainty discussed above, are difficult to determine and which cannot guarantee safety. However, the measures may create a false feeling of safety and invite to continued habitation growth.

Increasing vulnerability in parts of the population

Certain parts of the population are more vulnerable than others in disasters. This vulnerability takes different shapes. It may be geographical - the area in which persons live is more exposed to the hazard than the surrounding areas; it may be economic, *i.e.* the person lacks the means to insure him/herself, evacuate, or to recover from a disaster. The flood disaster in New Orleans showed the significance of income on vulnerability. Not only were low-income groups concentrated in the lower-lying areas of New Orleans which were geographically more exposed to flooding, but these groups also lacked the means to evacuate.

²⁸ Risk Management Systems (RMS), 2005.

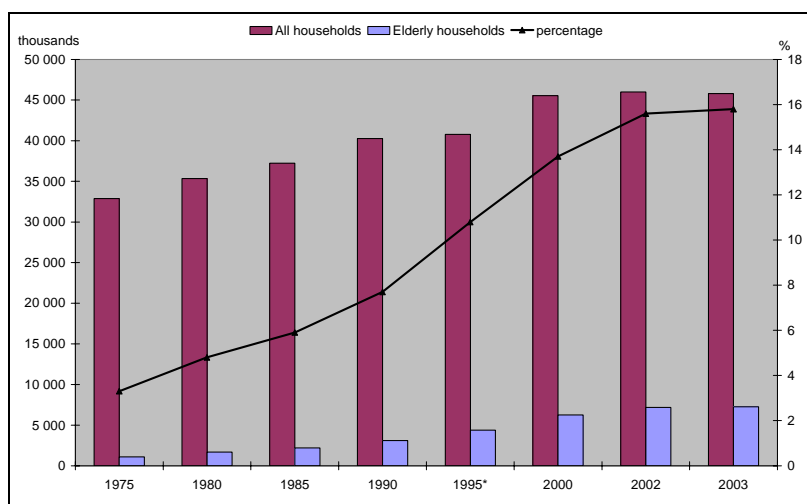
²⁹ US Congressional Research Service, 2005.

Vulnerability may be physical: the person is impeded by a physical condition – illness or lack of strength to escape from a danger (debris flow, etc.). Or vulnerability can be cultural, social or cognitive: the person lacks the cultural capabilities (including language skills) to interpret danger signals and emergency information and behave correctly. In today’s society, vulnerability is increasing along all these indicators. First, when it comes to geographic vulnerability, pressures of urbanisation have opened up for the habitation of land areas which are more exposed to floods than others. It is typically associated with informal urbanisation in mega-cities in developing countries, but it may also concern richer residential areas. In the meantime, economic vulnerability is rising as income differences are growing in all OECD countries. The growth in ‘physical’ vulnerability is justified by the rising share of the elderly in the population. Finally, cultural vulnerability is also growing, with a rising share of immigration (legal and illegal) and tourism. It could also be argued that the increasing use and dependency of Information and Communication Technology (ICT) creates a cognitive vulnerability, *i.e.* creates barriers for those who are not used to handling modern technology.

The multiple vulnerability of elderly women is used as an illustration. In Japan, the number of elderly households (defined as households consisting of individuals aged 65 or older, with or without unmarried dependents below the age of 18) has risen sharply between 1975 and 2003, from 3.3 percent to 15.8 percent of all households (see figure 5).³⁰

Figure 5: Increase of Elderly Households in Japan, 1975-2003

In thousands



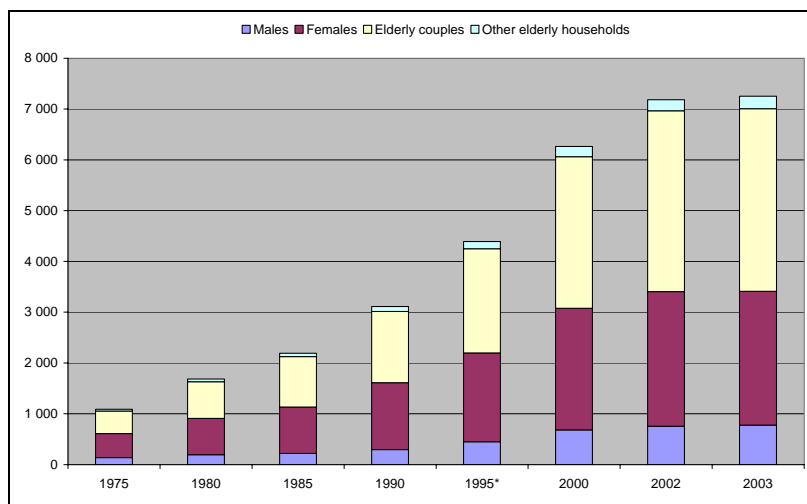
Source: Japanese Statistics Bureau, 2005.

³⁰ Japanese Statistics Bureau, 2005, p. 20.

Within these elderly households, the number of one-person households has increased five-fold since 1975, from 610 000 to 3.41 million, the majority of which consists of women (figure 6).

Figure 6: Composition of Elderly Households in Japan, 1975-2003

In thousands



Source: Japanese Statistics Bureau, 2005.

It should be noted that elderly living on their own, in particular women, are among the most economically vulnerable in the population – especially in Japan. OECD figures from the mid 1990s indicate that more than three quarters of women aged more than 75 years, living on their own, are in the lowest income quintile of the adult population.³¹ Table 2 shows that this share is higher than in other OECD countries.

Table 2: Percentage of the elderly who are in the lowest income quintile, mid 1990s

Percentage of each category in the lowest income quintile of the adult population (18+)

	All older old (75+)	Single women living alone	Women living with spouse only	Single persons living with others (and the person is not the household head)
Canada	33.9	60.9	20.2	6.9
Finland	43.2	75.2	19.8	9.6
Germany	30.8	42.7	14.8	..
Italy	23.2	43.3	15.9	11.6
Japan	33.5	78.7	58.5	18.2
Netherlands	43.4	50.6	40.6	..
Sweden	31.6	38.1	21.6	..
United Kingdom	38.5	47.4	39.3	12.6
United States	34.9	56.4	22.8	18.8

³¹ This refers to the 20 percent of the population with the lowest earnings.

Source: OECD, 2001.

The elderly in general and elderly women in particular are also more exposed than other during disasters. In the Kobe earthquake in 1995, the population aged 65 and more had a much higher mortality than other groups, especially elderly women.³² This was partly explained by the fact that many elderly lived in traditional, low-cost residential areas consisting of wooden houses – constructions which performed very badly during the earthquake and which were ravaged by fire afterwards. After the earthquake, the elderly without the financial means or family support to move were left in the shelters, and later in the provisional housing, without the support of their habitual community network.

The suffering of elderly is not exclusive to earthquake disasters. In recent flood disasters in Japan, the majority of victims were elderly. In Europe, the vulnerability of elderly as a group was underlined in the 2002 heat wave, which claimed the lives of more than 30 000 persons.³³

³² Tanida, 1996.

³³ Kosatsky, 2005.

Part 3: Consequences for risk management policy

From a risk management standpoint, the possibility of permanent climate change, increasing costs of disasters and new emerging vulnerabilities in the population have far-reaching consequences. Translated into preparedness policy options, this implies first to find ways to improve quantitative and qualitative risk, cost and vulnerability assessments; second, focus on cross-sectoral capacities of flood mitigation and cost-reducing measures; third, improve evacuation procedures; fourth, increase awareness and responsibility among citizens; fifth, achieve an efficient and fair sharing of risks; and sixth, start to address the strategic challenges which might well become increasingly pressing in the coming years. Issues and possible responses reviewed in this section will need to be further explored in the second phase of the Project:

Improvement of risk and vulnerability assessments

Traditionally, risk assessments consist of the assessment of threat, vulnerabilities and the identification of assets. In the case of flood disaster preparedness, there is uncertainty along all these three factors. When it comes to the threat, there is as earlier mentioned, unclear to which extent climate is changing, and which effect this will have on global and local weather patterns; on the strength and frequency of tropical storms and precipitation. While waiting for improved knowledge in this area, reinsurance companies have started to go away from probability assessments based on historic data and rather apply prospective techniques. It is also possible to integrate uncertainty into GIS modelling to a greater degree than what is currently the case. A range of possible scenarios could then be presented, if carefully identified as more or less probable. Risk assessments contain under all circumstances a certain element of uncertainty and should only be considered a guiding tool to decision-making. As such, current practices would not change dramatically.

Another issue when it comes to risk assessment improvement is the quality of the data used and the detection of possible risks. Data from the United States show that 57 percent of the flood hazard maps are 20 years old.³⁴ Improvement of current models when it comes to damage estimations may give more certainty as to what the economic consequences of a flooding could be. In the UK, a leading insurance company has in cooperation with the national Environment Protection Agency created a very accurate tool which can assess flood risk down to property level, not only postcode.³⁵ Finally, efforts must be made to make sure that all possible flood risks are accounted for – to which extent are private installations identified as possible flood hazard facilities at the local or regional level?

³⁴ US Federal Emergency Management Agency, 2005, p. 4.

³⁵ Munich Re, 2004, p. 21.

The data of vulnerability assessments also need to be improved and updated regularly. Research on public preparedness policies shows that it is normally not a problem of awareness, but that there are many obstacles which impede the use of certain information or data in the assessment and planning process. For instance, among local preparedness officials in six major cities in the world, there was only limited knowledge of and access to social data.³⁶

A third point related to risk and vulnerability assessments is the need to identify long-term trends and detect changes. Since weather patterns and socio-economic factors can change quickly (as was the case in the last 10-15 years), it is important to identify the implications of changes that have already taken place – for instance, has habitation patterns and increased prevalence of flood led to an increased exposure to industrial accidents? One example of increased research in this area is the UK Foresight Unit's report: *Flood and coastal defence in Britain until 2100*. Uncertainty is integrated into the study through the use of four scenarios, with system of governance and social values as the changing variables. For long-term planning, it is a challenge to integrate uncertainty into the forecasts and projections in a careful manner - it may be useful to apply non-quantitative methods.

Holistic flood disaster prevention

There is a growing realisation that floods cannot be avoided, and that the destructive potential of floods is growing, something which has led to the quite radical decision in several European countries to 'give land back to water'. This has been expressed in strategy documents in the UK, the Netherlands and Germany, and is also the main message of guidelines from the United Nations Economic Commission for Europe. Germany, in its new Flood Control Act of 10 May 2005, prohibits the planning of new house areas in flood plains (although subject to exceptions – if nine requirements are met, all which have to be fulfilled in each individual case).³⁷ The Flood Control Act also obliges the German Länder to designate more areas as flood plains than before. It should be noted that floods in intra-urban areas may need to be mitigated differently, because the chances of retaining, storing or draining water is more limited in urban spaces (see box 1).

Measures are also needed in mitigation. For one, cross-sectoral cooperation could contribute to preventing and mitigating flooding and its destructive consequences. This is one of the conclusions of a report of the United Nations Environmental Programme after the Tokage Typhoon in 2004 and its consequences in

³⁶ Wisner, 2003, pp. 189-192.

³⁷ German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2005a.

Toyo-oka city (Hyogo prefecture). It was found that more interlinkages are needed between environmental management and disaster preparedness. Environment management was in this respect defined to comprise waste and debris management, land use management, forest management, river basin management, and so on.³⁸ The responsible ministries in Japan for these different areas are Ministry of Land, Infrastructure and Transport (MLIT) for land use, Ministry of Agriculture and Forestry for forest management; and the Ministries of Environment and Health, Labour and Welfare for waste and debris management.³⁹ One concrete example in this respect was how the timely clearing of culled trees could prevent these from being carried away by torrential water, clogging rivers and creating physical damage.⁴⁰

Box 1: Urban flood mitigation issues

There are some particular challenges when it comes to intra-urban flood mitigation.

First, the absence of pervious soil and materials make cities particularly vulnerable to flash floods, which can occur very quickly and be localised events, yet very harmful – for these reasons, it is difficult to carry out satisfactory risk assessments, and calculate probabilities of an event.

Second, the risk of indirect effects of flooding will be more pronounced in cities. Since an urban flood is often caused by an insufficient drainage or sewage system, the flood water would be mixed with sewage, something which increases the risks to human health and the costs of damages to property. The interaction of flood and critical infrastructure breakdown will have to be studied very carefully, because business interruption costs could grow quickly if several infrastructures fail and cannot be restored quickly. There are further complications when it comes to evacuating and informing city populations. The population tends to be more diverse than in rural areas, with a higher share of marginalised groups (poor, homeless) without means of transportation.

While other sectors may affect flooding, floods and heavy rain can also have secondary effects. Typhoon Tokage led to a number of landslides, and furthermore, it is believed that it contributed to the exceptionally high number of landslides after the Niigata-Chuetsu earthquake, which occurred only a few days later. Furthermore, as noted earlier, European floods and the Great New Orleans Flood have triggered releases of

³⁸ UNEP, 2005, p. 10.

³⁹ Ibid., p. 10.

⁴⁰ Ibid., p. 12.

hazardous material. Floods can also have an impact on critical infrastructures and lead to the loss of telecommunications or electricity supply, as well as seriously damage the transport infrastructure. It seems important to take all these possible aggravating and secondary effects into account and integrate flood disaster preparedness and management into a range of different policy areas. There are, however, few examples of how this has been implemented into national policy. There is evidence of precautions taken when it comes to hazardous releases at earthquakes in California, but this does not pertain to floods. It is possible that the Great New Orleans Flood will trigger more legislative activity in this area, due to the high number of secondary effects suffered at this disaster.

One last point when it comes to interlinked policies and increased needs for cooperation is the necessity to manage river and water systems in a holistic manner, something which was also part of the UNECE guidelines for a sustainable flood prevention systems. It is therefore important that the different river authorities (for river systems of varying size and importance) are in close contact with each other to discuss and coordinate river management measures in a broader context than flood control, to make sure that the entire catchment area is managed in a consistent matter.

Evacuation

The evacuation of exposed population is to a certain degree linked to improved flood risk information and communication. Yet, more must be done to understand the underlying reasons why persons choose not to evacuate. A low evacuation rate was observed at the Typhoon Tokage, and also during the Great New Orleans Flood. One possible reason is that the exposed population has a wrong conception of risk – it may be based on experience which is too short to correctly take into account the cyclical nature storm patterns, or it may be due to lack of experience (for tourists, or recent migrants). Studies in the United States show that there is a great difference in evacuation rates depending on the language used in the evacuation announcement – whether it is ‘mandatory’ or ‘recommended’ – and that ‘mandatory’ evacuations are more respected.⁴¹

Widespread problems when it comes to evacuation announcements are first the inherent uncertainty of the announcement. The chances of achieving a full evacuation increase the earlier the announcement is made, but in that case it is subject to great uncertainty, and if it is incorrect, it may lead to a higher degree of non-compliance at the next storm. Second, governments must consider what to do in case of non-compliance.

⁴¹ Urbina & and Wolshon, 2003, p. 262.

When it comes to US regional and local authorities, some of them do not have the legal mandate to remove persons by force.⁴²

Second, persons may decide to defy evacuation orders because do not want to leave, or because they cannot leave their home. Research shows how pet owners are more reluctant to evacuate, because they do not know what kind of facilities are in place for their pets in shelters. Reportedly, during the Typhoon Tokage, persons chose to stay because they wanted to protect their home and property – the UNEP study on disaster response reports that 4 000 evacuated out of a city of 42 000 inhabitants.⁴³ There are also groups, such as certain elderly, the disabled and the poor which do not have the means to leave independently. Special measures must be taken to take care of such groups and provide assistance and dedicated transport facilities.

Individual responsibility and risk sharing

Risk management is increasingly considered as the coordinated response of society, with its various components, to a threat – as opposed to a field of governmental policy alone. In this regard, the increased implication of individuals and firms in flood management and preparedness is important for different reasons. First, the rising costs of disasters may be reduced if necessary mitigating measures have been taken – such as securing property or creating business continuity plans. Second, in recent flood disasters, there have been some worrying signs that evacuation orders are not followed. All in all, there is a need for a society-wide discussion of how to accept the risk of flood disasters, what to do with the residual risk, and how this should be financed.

It is widely acknowledged that individuals need to take more responsibility when it to comes to mitigating against flood disasters. Incentives can be created in different ways. One possibility, which is increasingly common among OECD countries, is to raise awareness of the flood risk by publishing flood risk maps and informing about ways to protect property. The German government, for instance, published, after large-scale floods in 1995, an appeal to citizens in high-risk areas to protect themselves better. The brochure provided practical advice, such as installing indoor heating systems and power and telecommunication systems as high as possible; using water-resistant building material, etc.⁴⁴ If this approach is used, it is, however, important to make sure that the level of uncertainty is communicated in an adequate manner, and

⁴² Urbina & Wolshon, 2003, op. cit.

⁴³ UNEP, 2005, p. 6.

⁴⁴ Dutch Ministry of Transport, Public Works and Water Management, 2000, p. 20.

that the different terms common to flood management are explained properly – what the probability of occurrence is of a 100-year flood, for instance. The Japanese government is actively encouraging local municipalities to publish flood hazard maps, and experience has shown that this has had some positive effect on citizen evacuations.

It is also possible to give economic incentives. This may include loans and tax cuts, measures which are for instance used by the Japanese government when it comes to encouraging seismic retrofit, and insurance.

Risk-sharing mechanisms

Flood insurance schemes often face two serious problems: adverse selection and moral hazard. Adverse selection stems from the fact that in any country, only a fraction of the population is highly exposed to floods. Because of the large difference in risk exposure, “low-risk” individuals will find insurance policies unattractive, and the insurance coverage will gradually concern only the “high-risk” part of the population. Insurance companies will have reduced possibilities of diversification, and risk premiums will be very high. In short, flood risks are often considered not insurable *per se* in the absence of governmental intervention. In order to limit adverse selection, it is either possible to bundle the peril with other perils (fires, earthquakes, etc.), which is the case in Japan, and/or to create a compulsory scheme (France, Spain, the UK).

Moral hazard describes the possibility that the insurance-holder adopts a more risk-taking behaviour knowing that he/she is covered under all circumstances, which again drives up costs. The response would be to increase the deductible. A supplementary measure could be the linkage of the deductible to mitigative measures. This applies for instance to earthquake insurance in California.

If the peril is present over a large territory, the insurance industry may still claim that the cost potential is too high – in which case the State may choose to go in as a reinsurer – an action which is triggered at a certain loss amount. The insurance schemes in France and Spain are examples of this. Finally, the relief expenditure of government also act as kind of insurance. In the case of France, individuals who are not insured will nevertheless be reimbursed for the suffered losses – large-scale public relief expenditure is also common in the United States. This also increases the risk of moral hazard – not only at the level of individuals, but also with local government, which may choose to underinvest in risk mitigation, knowing that the potential damage will be paid by the central government. Equally, the insurance industry

sometimes accuses the government of underinvesting in risk mitigation, because a large share of the population is insured.

Governments may also give legal incentives to mitigate against disasters. The German Flood Control Act, which states that “[...] Any person potentially affected by a flood is obliged to undertake adequate measures to prevent flood-related risks and to reduce flood damage, particularly to adjust the land use to a possible risk created for humans, the environment or material assets through floods.”⁴⁵ When it comes to the private sector, businesses may be required to have business continuity plans, as is the case in California.

It should finally be noted that the Japanese population has traditionally carried a relatively heavy burden compared to other OECD countries, when it comes to economic loss of natural disasters. Flood insurance concerns approximately half of the dwellings, and a third of household property.⁴⁶ Public transfers to victims are relatively modest compared to other countries: direct transfers to victims who lost their houses after the Kobe earthquake amounted to only USD 1 000-1 500 per household.⁴⁷ This might be one of the explanations for the high level of precautionary savings among Japanese household, at around 40 percent of total saving.⁴⁸ However, this might also indicate a higher exposure of economically vulnerable groups to hazards, which, in the context of rising flood risks, would call for the development of risk-sharing mechanisms in the Japanese society.

Strategic issues

Flood disaster management faces a number of long-term challenges for which might well become increasingly pressing in the coming years:

- How deal with low probability-high impact risks? Structural measures have led to a decrease in flooding probability. This has further enabled an expansion of properties and industrial facilities in known flood plains, and it may also have led to reduced risk awareness among individuals and companies, because ‘small’ floods become less frequent. The loss potential thus increases if the flood should take place.

⁴⁵ German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2005b.

⁴⁶ Paklina, 2003.

⁴⁷ Sawada & Shimizutani, 2005, p. 23.

⁴⁸ Horioka *et al.*, 2002, p. 5.

- How carry out cost-benefit analyses and risk assessments when not only the probability but also the consequences of the event are uncertain or unknown? Climate change, due to natural fluctuations or global warming, has created doubts about the validity of current climate models; definitions of ‘normal’ weather and calculations of probability of future weather events. What happens when 100-year events occur each year? Furthermore, must the destructive potential of urban floods be reconsidered after the flood disaster in New Orleans? There is only limited knowledge about the possible economic and losses of such disasters, since the scale of the event and length of the breakdown period depend on the interaction of several infrastructures.
- How deal with secondary impacts, and in particular how protect critical infrastructures? What are the safety obligations of a critical infrastructure owner or provider, be it public or private? Do they match with the acceptable risk from society’s standpoint? If not, how bridge the gap?
- How can government come up with a consistent programme to achieve quantified targets in this setting?

Conclusion and proposal for the second phase of the Project

The study has looked at Japanese efforts to mitigate against floods, in an environment which is increasingly subject to rapid change, not least because of climate change, urbanisation and concentration of economic assets, as well as ageing and increasing vulnerability in some segments of the population. Notwithstanding Japan's successes in reducing and mitigating flood disaster risks in the past, these trends will challenge the country's risk management and preparedness structures. The effects of recent institutional and political developments, in particular decentralisation, have to be considered in this context.

In this changing environment, a number of challenges face policy-makers in their duty to protect populations and public welfare: the reliability of risk and vulnerability assessments, cross-sectoral flood prevention and mitigation, evacuation issues, promoting awareness and responsibility, sharing risks efficiently and fairly, protecting critical infrastructures.

It is proposed to further investigate these issues in the second phase of the Project, based on a self-assessment of flood disaster management procedures by the Japanese government. To conduct the self-assessment, two questionnaires have been developed, and are presented in Annex 3 to this study.

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Annex 1: Overview of Japan's flood risk and disaster management system

Functional layers	Actions	Authorities
Assessment		<ul style="list-style-type: none"> • Ministry of Land, Infrastructure and Transport • Prefectures • Municipalities
Policy decision-making	Resource allocation (and cost-benefit considerations)	<ul style="list-style-type: none"> • Ministry of Land, Infrastructure and Transport • Prefectures • Municipalities • Affected Ministries
	Strategic co-ordination and supervision	<ul style="list-style-type: none"> • Cabinet Office • Central Disaster Management Council • Ministry of Land, Infrastructure and Transport
Framework conditions	Building codes, land use	Ministry of Land, Infrastructure and Transport
	Legal and regulatory framework	<ul style="list-style-type: none"> • Ministry of Land, Infrastructure and Transport
Protection	Create, improve and adapt protective mechanisms	<ul style="list-style-type: none"> • Ministry of Land, Infrastructure and Transport • Prefectures • Municipalities
	Research and development	<ul style="list-style-type: none"> • Ministry of Land Infrastructure and Transport
Information and early warning	Awareness-raising among public and private actors and general public	<ul style="list-style-type: none"> • Ministry of Land, Infrastructure and Transport • Prefectures • Municipalities
	Warning	<ul style="list-style-type: none"> • Japan Meteorological Agency • Ministry of Land, Infrastructure and Transport • Prefectures • Municipalities

Evacuation and rescue		<ul style="list-style-type: none"> • Prefectures • Municipalities • Private organisations • Police • Fire Brigades • Defence Agency • Ministry of Health, Labour and Welfare • Medical Services
Recovery enhancement		<ul style="list-style-type: none"> • Ministries Concerned • Insurance Sector
Feedback and organisational change		<ul style="list-style-type: none"> • Ministry of Land, Infrastructure and Transport • Affected Ministries

Annex 2: The related legal and regulatory framework

Legislative framework	Enforcement authority
Disaster Countermeasures Basic Law	Cabinet office
River Law	Ministry of Land, Infrastructure and Transport
Flood Fighting Act	Ministry of Land, Infrastructure and Transport
Specified Urban River Inundation Prevention Act	Ministry of Land, Infrastructure and Transport
Sediment Disaster Countermeasures for Sediment Disaster Prone Areas Act	Ministry of Land, Infrastructure and Transport

Legislative frameworks listed here are the ones that are referred to in the text.

Annex 3: Questionnaire

Based on the analysis, the study has identified a number of challenges for the various phases of flood management in the coming years. It is proposed to further investigate these issues in the second phase of the Project, based on a self-assessment of flood management procedures by the Japanese government. To conduct the self-assessment, two questionnaires will be developed for public administrations to self-assess and take stock of their flood preparedness policies:

- A general questionnaire on the institutional organisation of flood preparedness policies at the state level, focusing on clarity and consistency of the legal framework when it comes to defining roles and responsibilities, and on coordination with other administrative and private actors.
- A questionnaire to the prefectures and municipalities, with particular focus on existing resources and capabilities of elaborating and maintaining a viable flood preparedness policy.

Each layer will be scrutinised with regard to coherence of organisation (definition of roles and responsibilities, communication and co-ordination between the major players, links with other pertinent layers, etc.), effectiveness in achieving objectives (adequate consideration of all tasks, use of relevant tools, etc), and openness on external sources (communication with stakeholders, international cooperation).⁴⁹ For each layer, the questionnaire will also address the major orientations of the Japanese flood risk management policy, as overviewed in the first part of the study, as well as the challenges identified in the third part.

⁴⁹ See complete evaluation criteria in OECD, 2003.

A. General Questionnaire

A.1. Risk assessment

Main actors: Ministry of Land, Infrastructure and Transport

A.1.a. Roles and responsibilities in flood risk and vulnerability assessment

- Please describe the role and responsibilities of your organisation with regard to the assessment of the following points:
 - risk of different types of flood (flash flood, river flood, etc.)
 - vulnerability of physical structures to floods (including structural flood defences)
 - Vulnerability of industrial structures to flood
 - vulnerability of population groups to floods
 - secondary effects of floods and its ensuing risks and vulnerability
 - integrating the results of the identified risks and vulnerabilities in a central cost and damage assessment
 - other
- Please describe the way in which your organisation is structured and the resources it devotes in order to fulfil this role. In support of your reply, please provide organisational charts, statistics, activity reports and any other information deemed useful.
- Which other actors cooperate with your organisation in assessing flood risk and vulnerability at the State level? At prefecture level? At municipality level? Private and non-government actors? Please describe the coordination and communication channels.
- Does the current legislation create any obligations to monitor the points identified above?

A.1.b. Risk assessment methods

- Please describe existing programmes aimed at
 - Identifying, monitoring and evaluating the different types of flood risk
 - Detecting physical vulnerabilities (installations, topographic particularities, etc.)
 - Detecting and monitoring new and existing vulnerable groups in the population
 - Identifying secondary effects of floods, including business interruption costs
 - Integrating different types of risk and vulnerability data
- How is data collected for the above categories? (From where, how often, etc.)
- Are there any obstacles to the collection of data? (confidentiality issues, privately-owned information, etc.)? If so, please elaborate your answer.
- Please describe ongoing or planned research programmed regarding flood risk and vulnerability assessment tools.
- Please describe any other method or tool used to assess flood risk and vulnerability.

A.1.c. Self-assessment

- How do you evaluate the Japanese population's exposure to floods, taking into consideration
 - changing weather and precipitation patterns the last 20 years
 - increasing population density in flood plains
 - changes in land use (more use of underground space)
 - societal developments in the last 10-20 years (ageing populations, changes in income, etc.)
 - technological developments, with increasing interdependence of critical infrastructure, etc.)

A.2. Principles of strategic decision-making

Main actors: Ministry of Land, Infrastructure and Transport; other affected ministries; Cabinet Office; Central Disaster Management Council

A.2.a. Roles and responsibilities in decision-making

- Please describe the roles and responsibilities in designing and implementing national strategies for flood risk reduction and flood vulnerability reduction (of physical structures, the elderly population, etc.)
- What are the coordination and communication channels between the different decision-making organisations?

A.2.b. The decision-making process

- How are priorities defined and targets set at the national level?
- What are the programmes and implementation plans related to these targets?
- What are the overall public resources devoted to flood risk and vulnerability reduction?
- What is the share of these resources of the total spending on overall natural disaster risk and vulnerability reduction?
- Which stakeholders are consulted during the decision-making process, and how?
- At what stage, if any, are the costs, benefits and risks of alternative solutions considered?
- How are financial resources allocated to the measures in support of flood risk and vulnerability assessment? Please make a distinction between the various levels of government (State, prefecture and municipality) and between sources of funding (State or local taxes, earmarked funds, etc.)

A.3. Framework conditions

Main actors: Ministry of Land, Infrastructure and Transport; affected ministries

A.3.a. Land use policies and legislation

- Please describe the roles and responsibilities for formulating and implementing land use policies and legislation in Japan?
- Which are the land use criteria defined by the Ministry of Land, Infrastructure and Transport and others, in relation to flood risk?
- Please describe recent positive/negative evolutions in land use in Japan and possible measures taken by the State to support/discourage this development.
- How is the formulation of land use policies linked to flood risk assessment and lessons learnt from previous floods in and outside Japan? Please indicate coordination and communication channels.
- Which are the mechanisms for enforcing national land use policies in Japan (if existing)?

A.3.b. Building code

- Please describe the roles and responsibilities in designing and implementing building code in Japan?
- Does Japanese building code include provisions to protect against floods and flood damage in
 - private housing
 - public buildings
 - industrial facilities
 - underground facilities
 - critical infrastructures
 - other
- Is the formulation of building code linked to flood risk assessment and lessons learnt from previous floods in and outside Japan?

A.4. Protection

Main actors: Ministry of Land, Infrastructure and Transport

- Please describe the roles and responsibilities in designing and implementing structural flood protection systems in Japan.
- Please describe the resources your organisation devotes in order to fulfil this role in this area. In support of your reply, please provide organisational charts, statistics, activity reports and any other information deemed useful.
- Please describe the major structural and non-structural protection systems and activities in Japan.

- Please describe the coordination of policies concerning structural and non-structural measures flood protection measures. Which share of the overall flood protection is devoted to structural measures? Which share is devoted to non-structural measures?
- Has the underlying policy of protection changed with the increasing frequency of floods and the increase in costs? Which effect, if any, has this had on the formulation and type of flood protection measures?

A.5. Information and early warning

Main actors: Ministry of Land, Infrastructure and Transport; Japan Meteorological Agency

A.5.a. Awareness-raising among the general public

- Please describe the role and responsibilities of your organisation with regard to awareness-raising activities vis-à-vis the general public
- Please describe the way in which your organisation is structured and the resources it devotes in order to fulfil this role. In support of your reply, please provide organisational charts, statistics, activity reports and any other information deemed useful.
- Which other actors cooperate with your organisation with regard awareness-raising activities at State level? At prefecture level? At municipal level? Please describe the coordination and communication channels.

A.5.b. Awareness-raising among public and private actors

- Please describe the resources and policies devoted to raising awareness of flood risk and vulnerability and possible mitigation measures among public and private actors (local and regional government, public and private infrastructure operators, etc.)
- Are there forums for information exchange among the different stakeholders concerning topics related to flood risk management (warning procedures, contingency planning, etc.)?

A.5.c. Warning

- Please describe your role and responsibilities with regard to flood risk warning, and your communication channels to
 - central government
 - prefectures
 - municipalities
 - other actors (private, public)
- Please describe the warning routines

A.6. Evacuation and rescue

Main actors: Private Organisations, Fire Brigades, Police, Defence Agency, Ministry of Health, Labour and Welfare, Medical Services

- Please describe your role and responsibilities with regard to evacuation and rescue of populations and structures in flood disasters?
- Please describe the main coordination and communication channels with other organisations participating in evacuation and rescue.

A.7. Recovery enhancement

Main actors: Affected Ministries, Insurance Sector

A.7.a. Damage compensation and insurance

- Please inform about government policies and legislation in Japan aimed at reimbursing flood damage to private citizens and businesses.
- What is the coverage of flood insurance in Japan?
 - among private house owners
 - among small and medium-sized enterprises
 - among big firms
- What is the coverage of business interruption insurance in Japan?
 - among small and medium-sized enterprises
 - among big firms

A.7.b. Contingency planning

- Is contingency planning promoted and encouraged by the central government towards local government and actors – if so, which are the tools employed, and to whom are they directed (municipalities, small- and medium-sized enterprises, critical infrastructure operators, etc.)? (legislation, campaigns, etc.).
- Does the government and its ministries participate in forums with critical infrastructure operators and other actors where contingency planning is discussed and promoted?

A.8. Feedback and organisational change

Main actors: Ministry of Land, Infrastructure and Transport; Affected Ministries

- Please describe the existing routines for analysing past events and reporting the findings to other actors (in central government, local government and private organisations)
- Is there a mechanism for policy and legislative revision, taking into account past experiences (national and international), and technological and socio-economic changes?

B. Questionnaire to prefectures and municipalities

B. 1. Risk and vulnerability assessment

- Please describe your role and responsibilities in assessing risks and vulnerabilities regarding flood disasters, and in communicating this information to your local and regional stakeholders, including the population.
- Of these activities, which are implementation of decisions from the central administration and the prefecture and which draw from the municipality's sole responsibility in this area?
- What is the organisational structure in place to fulfil these responsibilities?
- Please provide available data on the municipality's specific resources corresponding to these functions (grants from the central government, taxes, etc.)
- Please describe the methods and tools you use to carry out risk and vulnerability analyses. Do you receive training in conducting such analyses?
- How do you evaluate the quality of the data used in the risk and vulnerability analyses? Who collects the data?
- How often are risk and vulnerability analyses updated?

B.2. Policy decision-making

B.2.a. Resource allocation

- Please indicate, as percentage of total budgetary spending, the resources devoted to flood preparedness.
- Please indicate the funding sources of your spending on flood prevention. Is it mainly from your own local government budget, or via central government grants? Are the latter grants (if any) earmarked (attached to predetermined measures)?
- What is the balance between prevention and emergency response policies in your budget?

B.2.b. Strategic coordination and supervision

- Please describe your role and responsibilities when it comes to designing and implementing prevention and preparedness policies in the area of floods.
- Of these activities, which are implementation of decisions from the central administration and the prefecture and which draw from the municipality's sole responsibility in this area?
- What is the organisational structure in place to fulfil these responsibilities?
- How do the relevant services inside your municipality (rescue, buildings and infrastructures, education, social and health services, other) cooperate on flood disaster risk prevention and preparedness?

- Please describe the coordination and communication channels with other government actors when it comes to designing and implementing policy (other actors in local government, central government).

B.3. Framework conditions

B.3.a. Land use policies

- Please indicate the main principles and criteria (and existing legislation) for designing and implementing land use policies, in relation to flood preparedness.
- How do you assess your room for manoeuvre vis-à-vis central authorities when it comes to designing land use policies?
- If there are national principles and criteria of land use, how does the central government monitor their implementation at the local level (in your prefecture/municipality)?

B.3.b. Building codes

- Please indicate the main principles and criteria (and existing legislation) for designing and implementing building codes, in relation to flood preparedness?
- How does the central government encourage and monitor the implementation of building codes at the local level (in your prefecture/municipality)?

B.4. Protection

- Please describe the main policies of structural protection against floods in your prefecture/municipality. Please indicate whether these policies have been designed at the municipality, regional or state level.
- What is the organisational structure in place to fulfil these responsibilities?
- Please provide available data on the municipality's specific resources corresponding to these functions (grants from the central government, taxes, etc.)
- Who has the responsibility for the maintenance of flood defence structures?

B.5. Information and early warning

- How do you get your information concerning flood risks, methods of organising preparedness activities, necessary prevention measures, and so on?
- Do you exchange information with other government and/or private actors on these issues, and if yes, how?

B.6. Evacuation and rescue

- Please describe your role and responsibilities with regard to evacuation and rescue of populations and structures in flood disasters?
- What is the organisational structure in place to fulfil these responsibilities?
- Please describe the main coordination and communication channels with prefectural and governmental organisations participating in evacuation and rescue.

B.7. Self-assessment

B.7.a. The general situation

- What are the major challenges faced by your municipality in preventing and preparing for flood disasters? What are their causes?
- How has the physical and social vulnerability to floods evolved in the past 10 years?
- How do you expect these vulnerabilities to evolve in the next 10 years in your municipality?

B.7.b. Own capacity

- How do you evaluate your municipality's capacity to fulfil its responsibilities regarding flood disaster preparedness?

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OECD Studies in Risk Management

Japan

FLOODS

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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