

# ENVIRONMENTAL MANAGEMENT AND DISASTER PREPAREDNESS

*Lessons Learnt from the Tokage Typhoon (Typhoon 23 of  
2004) in Japan*



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UNITED NATIONS ENVIRONMENT PROGRAMME

## FOREWORD



In order to assess global environmental conditions and to identify potential environmental problems and new ways to address the complex effects of environmental change on sustainable development, we must pay particular attention to the broad causes and effects of disasters.

The increasing frequency and severity of man-made and natural disasters may well be changing the global environment. All of these threats to the environment have been apparent in recent disasters. Disasters affect the environment when they have direct or indirect effects on ecology and human settlements that last far beyond the scope of immediate humanitarian response. Changing ecological conditions can provoke emergencies by placing concurrent stresses on the environment. Mitigating the effects of disasters are primary components in global efforts to ensure environmental security.

It is clear that further coordination and cooperation on environmental matters depends on UNEP's ability to set an environmental agenda for disaster management. In particular, UNEP's strategy on disasters can help the United Nations to pay attention to the environmental conditions that lead to disasters, and to natural resource management for disaster prevention and reduction.

There is a clear need to reinforce the importance of environmental concerns in the entire disaster management cycle of prevention, preparedness, assessment, mitigation and response and to integrate environmental concerns into planning for relief, rehabilitation, reconstruction and development. This will also require the enhancement of capacities to undertake short and medium-term activities in disaster management based on long-term environmental considerations.

Japan has been in the forefront of sound practices in minimizing the destructive impacts of disasters, with a comprehensive system of preparedness and response in place at the national, prefectural and local levels, and with responsibilities mapped to respond to disaster situations.

This UNEP study on the recent Tokage Typhoon (No. 23 of 2004) is the first in a series of publications that will help demonstrate the preparedness measures in place in Japan, and provide valuable lessons for mitigation and management in other countries facing similar disasters.

**Klaus Toepfer**  
Executive Director, UNEP

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Many of the photographs used in this report were provided by the Toyo-oka city government. We highly appreciate their kind cooperation.

*United Nations Environment Programme extends its deepest condolences and sympathy for the great suffering that recent natural disasters in 2004, have caused in Japan. UNEP joins the international community in calling for disaster preparedness strategies to be integrated in regional and national development in all countries that are affected by disasters and learn from the lessons of Japan in preparing and coping with disasters.*

## EXECUTIVE SUMMARY

The impacts of disasters, whether natural or man-made, not only have human dimensions, but environmental ones as well. Environmental conditions may exacerbate the impact of a disaster, and vice versa, disasters tend to have an impact on the environment. Deforestation, forest management practices, or agriculture systems can exacerbate the negative environmental impacts of a storm or typhoon, leading to landslides, flooding, silting and ground/surface water contamination – as illustrated by the 2004 hurricane and storm tragedies in the Haiti, and in the Philippines.

We have only now come to understand these cyclical causes and impacts and realize that taking care of our natural resources and managing them wisely not only assures that future generations will be able to live in sustainable ways, but also reduces the risks that natural and man-made hazards pose to people living today. Emphasizing and reinforcing the centrality of environmental concerns in disaster management has become a critical priority, as advocated by UNEP, requiring the sound management of natural resources as a tool to prevent disasters and lessen their impacts on people, their homes and livelihoods. Thus, understanding of current practices of disaster preparedness has to intrinsically incorporate environmental management issues.

Meteorological and hydrological events, such as typhoons, are hazards that cause heavy rain, high wind and sea surges. But the real damage also happens due to the vulnerability of the people who lie in its path. Post-disaster assessment of hurricanes and typhoons have clearly illustrated that, along with disaster preparedness, proper management of the environment – its air, land, water, forests, and wastes, go a long way in reducing the risks and vulnerabilities associated with typhoons.

The recent spate of typhoons to hit Japan in 2004 – a record of ten typhoons, out of a total of 29 made landfall – has put the country in the spotlight for disaster preparedness. The Tokage typhoon (Typhoon No. 23 of 2004) hit the Japanese islands from 19 to 21 October 2004, leaving a trail of damage and destruction. It was the worst typhoon for 2004. While the impacts was heavy – 93 dead with more than 490 injured as of 29 November 2004 – extensive damage was avoided due to the various levels of preparedness and mitigation measures that were in place at the national, prefectural and local levels.

Compared to typhoons that usually strike Japan, Tokage had a number of characteristics that increased its impact, including strong wind speed and gradually increasing energy, deflection from usual typhoon paths, and the fact that the hardest hit areas were affected during the night. The combination of these factors worsened the impact of the typhoon on people, infrastructure, leaving small cities particularly vulnerable.

As a part of the preparation of this report, UNEP carried out a field survey in Toyo-oka city in Hyogo Prefecture, one of the worst affected cities. There were a number of factors that resulted in extensive damage in Toyo-oka city, including, extreme rainfall and rapid rise of river water within short period; failure of the pump system; collapse of the dyke system; critical

timing of peak rainfall; low evacuation rate; management of relief materials etc.

With respect to the local environment and ecology, Toyo-oka city also faced a number of challenges, particularly related to landslides and its effect on the topography, extremely high volume of waste debris, high percentage of electrical waste, silting of river and water systems, high volume of waste plant debris and logs, effects on the local ecology and effects to the local economy.

A number of lessons were learnt from the Tokage typhoon in Toyo-oka with respect to infrastructure management (related to management of dykes, forests, river basins etc.) policy, strategy, and planning (related to policy integration, development of plans and programmes, knowledge dissemination, and training), and community activities (related to community awareness and action, and local preparedness).

The degree of preparedness that Japan has put in place for disasters in general provide some important lessons for policy development and action in other countries facing similar disasters. These include:

- Need to raise awareness for integration of environment and disaster issues
- Need to document and disseminate examples
- Need to bridge gaps between knowledge and practice
- Need to implement practical examples
- Need to develop guidelines and tools on environment and disaster management
- Need for continuous monitoring

This UNEP report is a collaborative effort of the UNEP Disaster Management Branch in Nairobi, Kenya and the UNEP International Environmental Technology Center in Osaka, Japan. It was developed in cooperation with the UNEP-OCHA Joint Unit in Geneva, Switzerland.

It forms part of a series that will be developed on the interlinkages between environmental management and disaster preparedness. Lessons learnt and the environmental know-how that reduce the vulnerability and risks will be covered in future reports, including measures relevant both at the national and local levels.

The overall lesson emerging from this study is clear – a number of good environmental management measures are in place in Japan, as in many countries, but these have to be studied in greater detail, in light of the needs of disaster management. It is imperative that environmental knowledge is integrated into the prediction, prevention, risk reduction, assessment and response policies.

## TABLE OF CONTENTS

Foreword .....	iii
Acknowledgements .....	iv
Executive Summary .....	v
1. Introduction .....	1
<i>Disasters and environmental management</i>	
<i>Japan and Disasters</i>	
<i>Typhoons in Japan</i>	
<i>Aims of the report</i>	
2. Characteristics of the Tokage Typhoon (No. 23 of 2004) .....	4
3. Findings and Observations.....	5
<i>Focus on Toyo-oka City</i>	
<i>Experiences of the Hyogo Prefecture</i>	
<i>Experiences of the Cabinet Office</i>	
4. Lessons Learned from the Tokage Typhoon.....	11
<i>Lessons in infrastructure management</i>	
<i>Lessons in policy, strategy and planning</i>	
<i>Lessons in community activities</i>	
5. Policy Implications for Disaster Preparedness .....	14
6. References and further information .....	16
<i>References</i>	
<i>Japan-based websites</i>	
<i>International websites</i>	
7. UNEP and Disaster Management .....	17





# 1

## Introduction

The world is facing an increasing frequency and intensity of disasters – natural and man-made – that has had devastating impacts. As reported by the secretariat of the International Strategy for Disaster Reduction (ISDR), the last ten years have seen 478,100 people killed, more than 2.5 billion people affected and about US\$ 690 billion in economic losses. Disasters triggered by hydro-meteorological hazards amounted for 97 percent of the total people affected by disasters, and 60 percent of the total economic losses<sup>1</sup>.

The impacts of disasters, whether natural or man-made, not only have human dimensions, but environmental ones as well. Environmental conditions may exacerbate the impact of a disaster, and *vice versa*, disasters have an impact on the environment. Deforestation, forest management practices, agriculture systems etc. can exacerbate the negative environmental impacts of a storm or typhoon, leading to landslides, flooding, silting and ground/surface water contamination – as illustrated by the 2004 hurricane and storm tragedies in Haiti, and in the Philippines. The high volume of wastes from disasters, from households and debris from forests and rivers, also constitute a major concern for proper disposal. A study conducted by Japan's Ministry of Environment also showed that air pollution from urban and industrial sources has led to increased acid rain by hurricanes and typhoons<sup>2</sup>.

### ■ *Disasters and environmental management*

We have only now come to realize that taking care of our natural resources and managing them wisely not only assures that future generations will be able to live sustainably, but also reduces the risks that natural and man-made hazards pose to people living today. Emphasizing and reinforcing the centrality of environmental concerns in disaster management has become a critical priority, requiring the sound management of natural resources as a tool to prevent disasters or lessen their impacts on people, their homes and livelihoods.

Meteorological and hydrological events, such as typhoons, are hazards that cause heavy rain, high wind and sea surges. But the real damage also happens due to the vulnerability of the people who lie in its path. Post-disaster assessment of hurricanes and typhoons have clearly illustrated that, along with disaster preparedness, proper management of the environment – its air, land, water, forests, and wastes, go a long way in reducing the risks and vulnerabilities associated with typhoons.

Need for better environmental management also finds its precedence in the risks and hazards posed by industrial sites, as a result of earthquakes, landslides, flooding etc.

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<sup>1</sup> UNISDR "Living with Risk: A global review of disaster reduction initiatives" 2004 version, Geneva, 2004

<sup>2</sup> Ministry of Environment presentation at the Meteorological Society of Japan, 7 October 2004, Fukuoka, Japan

## ■ Japan and disasters

Japan is located in the circum-Pacific mobile zone where seismic and volcanic activities occur constantly. Although the country covers only 0.25 percent of the land area on the planet, the number of earthquakes and distribution of active volcanoes is quite high. Due to geographical, topographical and meteorological conditions, the country is also subject to frequent and different types of disasters. These include, in order of intensity and severity, earthquakes and resultant tsunamis, typhoons, torrential rains, volcanic eruption, and heavy snowstorms.

As a nation, Japan is unusually well prepared for natural disasters. Since the 1950s, successive governments have invested in stronger buildings, inland and off-shore forecasting technology for earthquakes and storms, response command structures, and regular training of its citizens at the national, prefectural and local levels.

In Japan, the overall policy development and coordination of disasters lies with the Cabinet Office, with each ministry having specific responsibilities. At the national level, the Prime Minister heads the Central Disaster Management Council. Along with designated administrative bodies and public corporations (such as TV, electricity, gas and telephone companies), the Council is responsible for (1) formulation and execution of disaster management plan, comprehensive coordination; (2) formulation and promoting execution of the Basic Disaster Management Plan; and (3) formulation and execution of the disaster management operation plans.



Location of Toyo-oka City

At the prefectural level, the Governor heads the Prefectural Disaster Management Council, which is responsible for prefectural policy development and coordination for disaster. This structure is further intrapolated at the local level, with the respective mayors heading disaster management councils that formulate and implement local plans.

At the time of a disaster, it is affected municipalities' primary responsibility to handle the situation. However, if the disaster occurs in a wider area, prefectural governments intervene to coordinate administrative matters including making a request to nearby Self Defense Forces to dispatch personnel for assistance. Access to fire brigades and police forces is primarily with the local government, and a local government can request other nearby cities to assist at the time of a disaster, including dispatch of garbage trucks for hauling waste<sup>3</sup>.

<sup>3</sup> This however is not mandated in Disaster Management Plans, and is usually done on a voluntary manner, depending on the need and severity of a disaster's impact.

## ■ *Typhoons in Japan*

The typhoon season in Japan lasts from August until December. Most typhoons die out in the sea, with about two to four making landfall. Typically, a typhoon has wind speeds of more than 17 meters per second, and cause extensive damage when they pass over the land mass, in the form of heavy rain and precipitation, flooding, damage to houses and infrastructure, and destruction of forests and agricultural lands.

The recent spate of typhoons to hit Japan in 2004 – a total record of ten typhoons that made landfall – has put the country in the spotlight for disaster preparedness. The Tokage typhoon (Typhoon No. 23 of 2004) hit the Japanese islands from 19 to 21 October 2004, leaving a trail of damage and destruction. It was the worst typhoon for 2004. While the impacts were heavy – 93 dead with more than 490 injured as of 29 November 2004 – extensive damage was avoided due to the various levels of preparedness and mitigation measures that were in place at the national, prefectural and local levels.

## ■ *Aims of the report*

The Tokage Typhoon<sup>4</sup>, and Japan's response to its impacts, provides an excellent opportunity for the world community to draw lessons in disaster preparedness. The package of measures related to governance, education and awareness, information and data management, and related procedures collectively helped in mitigating the negative impacts of the disaster.

This report aims to study the environmental concerns related to the Tokage typhoon. It looks at the various environmental dimensions of the typhoon, at the local, prefectural and national levels, and draw lessons for effective implementation of disaster preparedness programmes. Its intended audience are decision-makers and practitioners facing similar situations in other countries, particularly in the Asia Pacific region. It is hoped that the contents of this report will also be used for policy development and implementing projects in other countries in the region. This report is not, however, a comprehensive assessment of the typhoon's environmental impacts.

The report was prepared using data collected from local government offices, official government reports, interviews, with government officials, and local residents, and field visits. It forms part of a series that will be developed on the interlinkages between environmental management and disaster preparedness. Lessons learnt and the environmental know-how that reduced the vulnerability and risks will be covered in future reports, including measures relevant both on the national and local levels.

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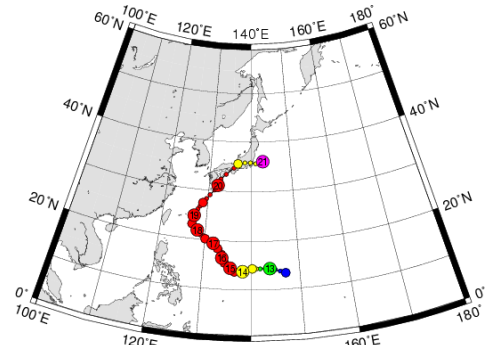
<sup>4</sup> The name 'Tokage' means a lizard in Japanese, and is the accepted international name for the typhoon that hit Japan in October 2004. The typhoon is also known locally as 'Typhoon no.23' of 2004. For consistency, the name 'Tokage' is used throughout the report.

# 2

## Characteristics of the Tokage Typhoon (No. 23 of 2004)

On Wednesday 20 October, 2004, the Tokage typhoon, Japan's severest storm in many years, swept through most of the southern half of Japan. People were overcome by the massive waves and flash floods triggered by the typhoon's heavy rains and strong winds, which left at least 93 people dead, and some 490 injured, 97 of them severely.

The number of casualties from Tokage was the highest from a typhoon since October 1979 when 115 people were killed or presumed dead. Many of the deaths occurred when homes were buried in landslides caused by two days of torrential rain. Television images showed rescue workers digging through the remains of wooden homes for survivors.



*Best Track of the Tokage Typhoon*

More than two-thirds of the dead were aged 60 years or older and many of them could not flee as Tokage rampaged through packing winds of up to 144km/h. At its height, Tokage had an 800km radius of strong winds, enough to set off more than 700 landslides and flip over trains parked before the storm. The typhoon first started battering the southernmost islands of Okinawa on 18 October, moving steadily north until it came ashore on Shikoku on the afternoon of 20 October. It then moved through Honshu overnight and went offshore near Choshi, Chiba Prefecture, at around 6 a.m. 21 October, and was downgraded to an extra-tropical depression.

Compared to typhoons that usually strike Japan, Tokage had a number of characteristics that increased its impact, including strong wind speed and gradually increasing energy, deflection from usual typhoon paths, and the fact that the hardest hit areas were affected during the night. The combination of these factors enhanced the impact of the typhoon on people, infrastructure, leaving small cities particularly vulnerable.

The number of typhoon related casualties is the highest in over a quarter of a century, and it further destroyed homes, damaged and flooded many residences. Storms and floods killed over 100 people in Japan in 2004, and the damage from this typhoon season already exceeds the bill for weather-related damage in 2003, which amounted to 940 billion yen (about US\$ 9 billion).

# 3 Findings and Observations

## ■ Tokage Typhoon: Focus on Toyo-oka City

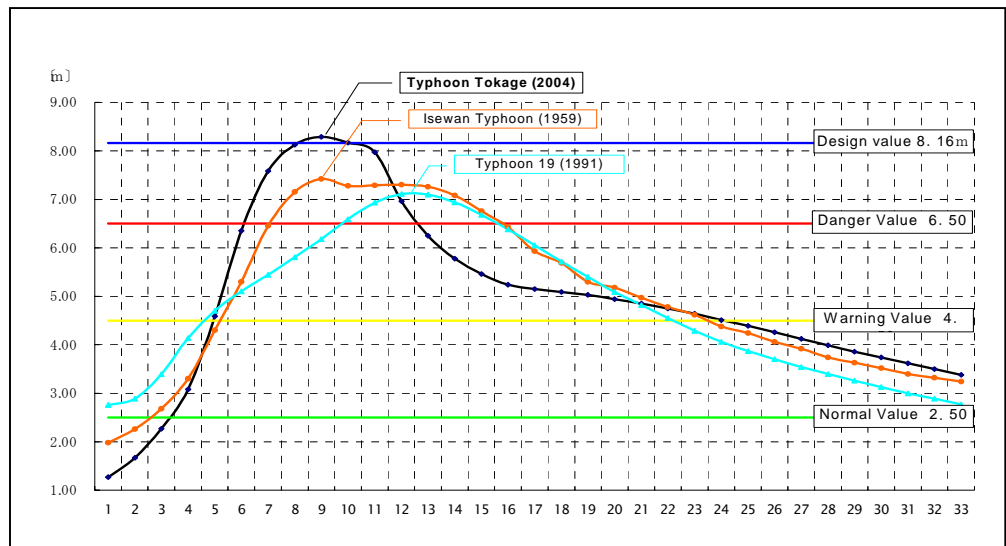
Toyo-oka is a small city, with a population of 48,000. It has a river running from south to north, a wide-open rice field in the middle, surrounded by mountains on all sides, and a narrow passage to the sea to the north. It was traditionally a farming community, with recent development making it a commercially important city in the region. It is famous as a nesting place for migrating White Oriental Storks – one of the last remaining sites in Japan. As a result, tourism is also an important element of the city's economy.



City officials explain Toyo-oka's topography

Hyogo prefecture of west-central Japan was the hardest hit prefecture, and Toyo-oka city, located in the northern part of the prefecture, experienced the highest damage – residences, infrastructure, forests and agricultural lands were severely damaged.

The field survey of Toyo-oka city was conducted on 16 December 2004, with visits coordinated by the Toyo-oka City Government. It consisted of field inspection of different sites affected by the disaster, including a temporary disaster waste storage area; discussion with the disaster and environment practitioners in the city government; interview with local residents, and discussion with the City Mayor.



Rise of water level in Maruyama River (Height against time in hour)



■ **Toyoka City: Observations related to disaster management**

There were a number of factors that resulted in extensive damage in Toyoka city due to the typhoon.

- *Extreme rainfall and rapid rise of river water within a short period:* The main reason of the damage was extreme rainfall within a short period of 7-8 hours. The rainfall varied from 16 to 40 mm/hour, and had a total downpour of 350-400 mm. This caused a sharp increase in water levels of the Maruyama river within a very short period. The highest water level observed in the river was 7.3 meters during the devastating Isewan typhoon of 1959. However, water levels rose to 8.25 meters during the current typhoon, which was even higher than the designed value of the embankment. The rise in the water level was also very sharp, with an increase of four meters within a period of four hours.
- *Failure of the pump system:* The Maruyama river and its branches are separated by a water-gate for effective flood management. During high rainfall, the gate is closed, and the water is pumped out of the branch to the main river, and thereby maintaining a state of equilibrium. Since the rainfall rate was high, the pumping system did not work properly, and consequently, the water level increased dramatically in the main river.
- *Collapse of the dyke system:* Most sections of the river's dykes were made of concrete, with some parts were made of soil. Continuous rain had softened the soil, and caused the failure of its foundation. As a result, part of the dyke system in the western bank of the river collapsed, and water rushed into the residential areas, causing significant damages to the houses and infrastructure.
- *Critical timing of peak rainfall:* The rainfall started in the afternoon, and reached its peak in the evening, causing the dyke to collapse in the night, which hampered immediate search and rescue operations. While people were waiting on rooftops during the night, the Civil Defense and Fire-Rescue Teams could not reach the affected sites before morning.
- *Low evacuation rate:* While the City Mayor gave an evacuation order to 42,000 people (more than 90 percent of the city population), only 3,800 people actually evacuated. This was due to the community's perception of the typhoon's impact on their lives, and the need to protect their homes from rising floodwaters.
- *Management of relief materials:* After any disaster, one of key issues is to effectively distribute relief materials to the needy people. Significant amount of relief materials arrived from different parts of Japan, and was



*Maruyama River's sluice pump system*



*Dyke break: Maruyama river flooded beyond its bank*

effectively managed with the help of volunteers and local residents, in cooperation with the local government.

- *Effective volunteer coordination and management:* In the aftermath of the typhoon, volunteers from different parts of Japan arrived in Toyo-oka city, and helped in the immediate response, especially for cleaning up typhoon waste. The local government noted that a typhoon's aftermath is different from that of an earthquake, since the first priority after a typhoon is to clean the residences, and remove destroyed and damaged household materials. For this, management of volunteers (for example, ensuring that volunteers were distributed to all needy areas of the city) was critical, and this was effectively carried out by non-profit organizations (NGOs)<sup>5</sup>.



*Effective volunteer management in Toyo-oka City*

- *Effective psychological/mental care:* After any disaster, psychological/mental care of the affected people is of utmost importance. In the aftermath of a typhoon, a number of programmes were carried out by volunteer groups, local governments and other organizations, to cheer up residents, children and aged people. These included, entertainment programs, shows, and sending flowers, toys, and pets to the children.

#### ■ **Toyo-oka City: Observations related to the environment**

With respect to the local environment and ecology, Toyo-oka city also faced a number of challenges.



*Landslide sites covered by plastic sheeting*

- *Landslide and its effect on the topography:* The typhoon caused a number of landslides and local mudflows in several locations in the affected area, thereby significantly affecting the mountain and river environments. Landslides were caused by lack of appropriate vegetation cover that was accentuated by strong downpour and steep slope of the mountains. In several places, the typhoon had uprooted the trees on the mountain slopes, which accelerated mudflows.



*A temporary waste-handling site set up after Tokage*

- *Extremely high volume of waste debris:* Immediately after the event, a major issue was dealing with the very high amount of waste debris, caused by the typhoon. The typhoon produced 45,000 tons of waste, which was equal to the total waste normally produced in 1.5

<sup>5</sup> Most of these NGOs were located throughout the Hyogo prefecture who dispatched staff members to Toyo-oka. They used their experiences during the Great Hanshin-Awaji Earthquake of 1995 to effectively respond to the needs of the city. The city government itself was not involved in the management of volunteers, and coordinated the need for volunteers in the city through these NGOs.



years by the city. The waste was composed of domestic materials (including electrical appliances), woods and logs, significant amount of weeds, and silt. The city found itself unable to handle the waste, and had to seek help and cooperation from surrounding cities and prefectures. This waste also caused several other problems in terms of clearing the waste in a timely manner to avoid health hazards, treatment and incineration of wastes (location, man-power, cost), and recycling of waste materials, where possible.

- *High percentage of electrical waste:* A related problem of wastes and debris was the handling of a high percentage of household electrical appliances, which were discarded due to water logging and flooding of houses. Few residents realized that most of these appliances could be recycled and used again, highlighting the need for sharing appropriate information and awareness on techniques to carry out such restoration.
- *Silting of river and water systems:* The typhoon and rains caused erosion from mountains and flooding of rivers, resulting in a significant amount of silt. The collapse of the river's dykes and overflow caused this silt to spread to residential and agricultural areas. This had a significant impact on the natural environment, in terms of affecting the land's fertility, contaminating surface and ground water aquifers. City officials anticipate a long-term impact on the environment in this regard, especially on the water system. Silt that entered houses as a result of flooding also caused significant damage, which had to be cleaned by the residents.
- *High volume of waste plant debris and logs:* Significant part of the waste was composed of plant debris and logs, which was transported by rivers and flood waters from mountains and forests to Toyo-oka city. These debris and logs created a barrier in the rivers, resulting in overflows and flooding. This was caused by improper management of planted forests, culling of trees, and clearing of ground cover – an example of an upstream issue having significant downstream impacts. Significant amounts of these debris eventually found their way to the Japan Sea, causing environmental degradation of the coastal areas and fishing zones.
- *Effect on the local ecology:* Toyo-oka is famous for its natural environment, and as one of the last reserves for the nesting of White Oriental Storks, an endangered migratory bird species. Several programs and initiatives have been implemented by the city to protect these birds. The typhoon caused considerable damage to the natural habitat of these birds.
- *Effect to the local economy:* Due to its rich ecology and environment, Toyo-oka is the destination of many tourists, and significant part of the city's income is based on local tourism (for example, from nearby hot springs, local seafood, and bird watching). The effect of the typhoon on



*Extensive forest debris along river banks*



*Residents remove silt from their homes*



the ecology and environment will have deep-rooted impact on the local economy, and the revival will require significant time and efforts.

### ■ ***Tokage Typhoon: Experiences of the Hyogo Prefecture***

In order to understand the continuum of action and coordination from local to national levels, discussion and interviews were also conducted with the Hyogo Prefecture Government's Disaster Management Division. Following are the major observations and lessons learnt:

- *Need to enhance communication system:* Due to failure of telecommunication system, direct information on damages and intensity of the typhoon could not be properly transmitted to other prefectures. Therefore, there is a strong need to improve the communication system, particularly to share the information before and during the time of disasters.
- *Need to incorporate environment issues in disaster management:* Current disaster management plans of the prefecture do not concretely incorporate environmental issues. In contrast, environmental issues are handled by a separate department, which has few links to disaster issues.
- *Relief versus long-term rehabilitation and reconstruction:* In most cases, the emergency committee after the disaster focuses on the emergency response, and inter-agency coordination only. Reconstruction efforts are handled by individual departments as part of their everyday duties. Thus, there is the lack of integration of different issues and disciplines, and environment aspects are no exception. Long-term impacts of environment are often overlooked as a result.
- *Need for a proactive link between research and practice:* It is often found that the practitioners at prefecture and city governments are not aware of research results conducted in universities and research institutions. Thus, opportunities for information exchange in the form of study groups and/or participatory training programmes should be created, where practitioners can interact with experts and resources persons on a continual basis.
- *Training of community leaders:* Similar to the above interaction, opportunities for training of community leaders should also be created, and interactions among the practitioners and the community members promoted.
- *Dissemination of experiences to other prefectures:* It is important and relevant to share experiences of good practices with other prefectures and regions. Incentives to the prefecture to undertake certain innovative approaches are also important – for example, in the form of awards or prizes. The prefecture should take pride of the incentive, and should promote its dissemination to other prefectures, and thereby motivating its neighbors.

It has to be noted, however, that waste management (collection, treatment, processing, disposal and incineration) is well organized in Japan, via strong laws and regulations, and good implementation of programmes by local governments. It particularly, also includes hazardous wastes. This may have contributed to a significantly lower impact of the typhoon.

## ■ **Tokage Typhoon: Experiences of the Cabinet Office**

Interviews were also conducted with the Cabinet Office of Japan to discuss the issues and problems related to disaster and environment management, with specific focus on the Tokage Typhoon. Following are the main excerpts:

- *Basic Disaster Management Structure at the National Level:*  
There are two schemes regarding natural disasters in Japan at national level, as prescribed in the Basic Disaster Countermeasures Act.
  - a) Central Disaster Management Council (headed by Prime Minister) for disaster management planning (pre-disaster). All the concerned ministries are the members of the Council. The Cabinet Office plays the coordination role.
  - b) Emergency center (headed by Prime Minister) to be set up at the time of a disaster (post-disaster). Here too, the Cabinet Office plays a coordination role; however, relief measures and reconstruction are responsibilities of local governments. Concerned ministries play specific roles, under their own mandate.
  
- *Typhoon Tokage and Waste Management Issues:*  
Two ministries are primarily responsible for the waste management. Ministry of Environment deals with waste produced by the disaster event, and the Ministry of Health, Labour and Welfare handles debris and rubble, resulting from collapsed buildings and infrastructure. Since Tokage produced an unusual amount of waste, it was the primary responsibility of the Ministry of Environment to work with local governments, and provide resources (both technical and financial).
  
- *Volunteer Management:*  
Coordination efforts by volunteers were very effective for Tokage. This was a unique exercise of cooperation and coordination among the local government and non-government organizations. Special relief experts were sent in the volunteer teams for coordination.
  
- *Need for interlinkages between environmental management and disaster preparedness:*  
Although not much was done, the experiences from the Tokage Typhoon point out a strong need to interlink environment management and disaster preparedness. Environment issue is not merely a “waste management” issue – it incorporates land use management, forest management, river basin management and so on. For each of these items, different ministries are responsible, e.g., Ministry of Land, Infrastructure and Transport (MLIT) for land use, Ministry of Agriculture and Forestry for the Forest Management, and there is a need for close coordination among these ministries, in formulation of policies for disaster management. Upstream-downstream linkages in river basin management also need similar close coordination.

# 4

## Lessons Learned from the Tokage Typhoon

Typhoons are a special type of disaster, which not only affect the lives and livelihoods of people and communities, but also poses a significant threat to the ecology and natural environment, affecting air, water, land, forests and mountains. Therefore, the typhoon study demonstrates the clear link between environment management and disaster preparedness.



*Poor forest cover and landslides*

Immediately after the event, the major issue tackled was debris and waste management at the household and local levels. In most cases, the houses were not destroyed, but were affected by water logging for 2-3 days and damaged the house itself and its belongings. Since the houses were not actually destroyed, no temporary housing was provided, and people lived in emergency shelters for the first few days. Thus, immediately after the event, the priority was removal of wastes, so that people could return to their homes.

The other aspect of the typhoon's impacts was the effect on the natural environment. Not only was the surrounding environment affected, but the impacts were also long-term, particularly on the surface and ground water systems – including water pollution, siltation, and floating debris.

Lessons learned from the Tokage typhoon in Toyo-oka can be classified into three parts: 1) infrastructure management, 2) policy, strategy, and planning, and 3) community activities. These are described below:

### ■ *Lessons in infrastructure management*

- *Dyke Management:* This emerged as a critical aspect of disaster prevention and flood management, and is especially relevant to cities and areas located along rivers. Two issues came to the fore: a) need for regular inspection of dyke systems, and b) reconciliation of design values with unexpected rainfall values.



*Flooding and silting of agriculture lands*

- *Urban and land-use management:* Many of the river banks are an integral part of the city's leisure areas, and are zoned as 'urbanization control areas' and as nature preserves - where building construction cannot take place in close proximity.
- *Forest Management:* One of the important aspects of disaster preparedness is proper forest management in mountain areas. Many of these areas are characterized by planted monoculture forests and shallow anchorage of trees. To enhance growth of stronger trees, some

of the slow-growing trees are culled, but not cleared since these do not have any market value. During a typhoon, these wood debris are washed downstream, clogging the rivers. Proper forest management is a key to reducing the impacts of flooding during disasters.

- *River Basin Management:* Typhoon and flood management should be undertaken in an integrated way, looking at the river basin as a whole. Proper upstream management of forests also enhances disaster management efforts downstream, and similarly, downstream river management enhances upstream environmental management.



*Effects on the planted forests*

### ■ **Lessons in policy, strategy and planning**

- *Inter-linkages between disaster preparedness and environmental management:* The first and the most important lesson that emerged from the Toyo-oka visit was the inter-linkages between disaster preparedness and environmental management in policies and plans at the local and national levels. Disaster management plans should incorporate environmental dimensions, and should anticipate the impact of disasters on the environment, as well as the impact of environmental practices (for example, forest and river management) on the impacts of disasters.
- *Plans and Programmes:* While disaster and environmental management should be linked to development planning, broader river basin management should also be considered in disaster programmes, and should be linked to the overall city management strategy.
- *Dissemination, adaptation and implementation:* Many of the lessons from the past disasters in the same country are relevant to other cities/ areas, but are often not disseminated properly. Cooperation of cities and prefectures in this regard is essential for adaptation and implementation of the lessons learnt.
- *Training and human resource development:* Proper training and human resource development programmes should be undertaken not only for disaster managers, but also for high level decision makers such as city mayors. Training in decision-making systems is essential in this regard to integrate disaster preparedness and response into the larger development and management of cities in general.



*Toyo-oka residents are rescued from rooftops after extensive flooding*

### ■ **Lessons in community activities**

- *Perception versus action:* While an evacuation order was issued by the Toyo-oka Mayor to 42,000 people, only 3,800 people actually evacuated during the disaster. This indicates the differences in perception, and the action taken. While people are quite aware of the risks involved, and of risk mitigation measures, it is not reflected in the action that they take.
- *Preparedness for evacuation:* The experiences of Toyo-oka also demonstrates the need for the local government and community to work



together in organizing evacuation simulation exercises, and designating 'disaster evacuation areas' for residents to assemble during a disaster.

- *Self-reliability versus dependence:* Toyo-oka has a traditional and strong community, with high community bonds and social capital. The community had a sense of self-responsibility, and was actively involved during past disasters. However, a new system of emergency radios that the city had introduced made people more reliant on the system. A balanced approach that introduces new ideas without destroying local existing systems is necessary.
- *Public awareness:* It is important to raise awareness of people and communities on the link between environmental management and disaster preparedness. The link between upstream and downstream issues should not only be reflected in river basin management, but should also be incorporated in community awareness raising and implementing projects at the local level.

### Major Concern: Post-disaster waste management

Typhoon Tokage produced a significant amount of waste, composed of both forest debris and household goods. A comparison with other affected cities in the prefecture shows that the waste produced in Toyo-oka was 44,780 tons, as against 12,591 tons in Sumoto-shi in Awaji island (the next largest production of waste in the prefecture, as a result of the typhoon). Only four percent of the waste was treated as of the second week of December, and city officials report that it would take another four months to complete the waste treatment. The estimated cost for waste treatment is US\$ 15-20 million, which poses a significant financial burden on the city's budget, especially for smaller cities such as Toyo-oka.



# 5

## Policy Implications for Disaster Preparedness

Based on the above observations, following is a set of needs and future recommended actions at the local, sub-national, national and regional levels:

- Need to raise awareness on the integration of environment and disaster issues: This is the first step, and should be done at different levels, targeting (1) policy makers, to initiate policy dialogue at central, prefecture and city levels; (2) professionals, to raise awareness among managers; and (3) individuals, to raise awareness at community levels.  
*Proposed Actions: Arrange meetings, seminars, and forums at different levels.*
- Need to document and disseminate examples: Documentation and its dissemination is one of the best ways to raise awareness of different stakeholders on the need for good cooperation for disaster preparedness.  
*Proposed Actions: Undertake field surveys after different disaster events to document concrete examples and disseminate it through the Internet, and in training and study programmes.*
- Need to bridge gaps between knowledge and practice: To enhance understanding the need to integrate environment and disaster management, gaps between knowledge and practice should be reduced. Experts, resource persons and practitioners should have opportunities to interact and learn from each other's experiences, for example, in preparing disaster contingency plans.  
*Proposed Actions: Undertake and facilitate training programmes involving experts, resource persons, practitioners and community leaders through forums.*
- Need to implement practical examples: While it is important to raise awareness, provide training, and initiate policy dialogue, it is also important to implement environment and disaster management practices at the local level.  
*Proposed Actions: Undertake small projects at different locations having different socio-economic contexts. These will be learning experiences, which can also be disseminated to other areas.*
- Need to develop guidelines and tools on environment and disaster management: To provide a standard of environment and disaster management practices, guidelines and tools will have to be developed.  
*Proposed Actions: Guidelines and tools should be developed based on the field experiences, and incorporating the comments and expertise of practitioners and professionals from different parts of the world.*

- Need for continuous monitoring: It is required to continuously monitor the progress in the practices of environment management and disaster preparedness, and to distribute the lessons to develop policies and strategies.

*Proposed Actions: A network or partnership should be developed which will continuously monitor different activities, identify best practices, and disseminate through training and capacity building programmes.*

### **Major Concern: Siltation and Effect on Agriculture Land**

Typhoon Tokage had two major impacts on the agricultural land – one, the overflow of river water with waste and silt, and second, the surge of saline water from the sea. It had two cumulative effects, one on the silt and waste deposit, and the other salinity of the soil. These two elements combined together had a significant impact on the quality and productivity of agricultural land, leaving many parts fallow. Effluence and siltation were observed in 418 places in Toyo-oka, and inundation affected more than 1,144 hectares. Similar observations were made in India and Philippines, in the aftermath of typhoons, especially in coastal inland areas.









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### ■ *Japan based websites*

- Cabinet Office: <http://www.cao.go.jp/index-e.html>
- Fire and Disaster Management Agency: <http://www.fdma.go.jp/en/>
- Hyogo Prefecture: <http://web.pref.hyogo.jp/english/index.html>
- Toyo-oka City: <http://www.city.toyooka.hyogo.jp/> (only in Japanese)
- Digital Typhoon: <http://agora.ex.nii.ac.jp/digital-typhoon/>
- Asian Disaster Preparedness Center: <http://www.adrc.or.jp/>
- UNEP-IETC: <http://www.unep.or.jp/>

### ■ *International websites*

- United Nations International Strategy for Disaster Reduction: <http://www.unisdr.org/>
- World Conference on Disaster Reduction: <http://www.unisdr.org/wcdr/>
- UN Office for the Coordination of Humanitarian Affairs: <http://ochaonline.un.org/>
- Relief Web: <http://www.reliefweb.int/>
- United Nations Environment Programme : <http://www.unep.org/>



## UNEP and Disaster Management

Environmental emergencies are sudden-onset disasters or accidents resulting from natural or man-made factors or a combination of the both factors that cause or threaten to cause severe environmental damages as well as loss of human lives and property.

Human populations are suffering from such environmental emergencies. Natural disasters -- floods, droughts, cyclones, earthquakes are occurring all over the world with increasing frequency and severity. Technological accidents -- chemical releases, oil spills and nuclear leakage, etc. continue to happen despite the efforts made. Furthermore, the number and complexity of emergencies involving a combination of natural and man-made elements are also growing.

This situation requires UNEP to develop a strategy for dealing with emergency prevention, preparedness, assessment, mitigation and response.

Further, the document serves as a generic and rolling framework which will be subjected to regular revisions consonant with new and emerging international and global agenda on disaster prevention, preparedness, assessment, mitigation and response.

At its fifth special session held in May 1998, the Governing Council, in its decision SS.V/2, identified environmental information, assessment and research, including environmental emergency response capacity and the strengthening of early warning and assessment functions, as areas of concentration for the activities of UNEP. Subsequently at its 20th session held in February 1999 in its decision 20/8, the Council requested the Executive Director to focus and strengthen the contribution of UNEP's environmental expertise to the coordination of United Nations system-wide responses to disasters.

At the sixth special session of the Governing Council/ the First Global Ministerial Environment Forum, held in May 2000 in Malmö, Sweden, the Governing Council identified increasing environmental emergencies as one of the environmental threats that needed to be addressed and expressed support for UNEP's activities in response to environmental emergencies.

UNEP's overall programmes on the environment are actually long-term measures that intuitively address the issue of environmental emergency prevention. Decisions by the Governing Council of UNEP in respect of emergency prevention, preparedness, assessment, mitigation and response therefore solidly enhance and refine UNEP's mandate. As the impact of environmental emergencies has become more pronounced and as global responses to emergencies have received more attention from within the United Nations, the function of UNEP has grown increasingly important. UNEP's special mandates, to assess global environmental conditions in order to identify potential environmental problems and new ways to address the complex effects of environmental change on

sustainable development and to underscore the transnational character of the global environment agenda, require UNEP to pay particular attention to the broad causes and effects of environmental emergencies.

In defining the future role for UNEP within United Nations emergency-related activities, the following goals are paramount: to reinforce the importance of environmental concerns in emergency prevention, preparedness, assessment, mitigation and response; to integrate environmental concerns into planning for relief, rehabilitation, reconstruction and development; bring to the attention of the United Nations and its partners and national governments the transnational and global environmental aspects of emergencies; and to enhance UNEP's capacity to undertake short and medium-term activities in environmental emergencies based on long-term environmental considerations.

Each of these goals is intended to strengthen not only the capacity of UNEP, but also the capacity of peoples and countries to prepare for emergencies, survive catastrophes, manage resources to sustain development and deploy resources to ensure the security of the environment.

Building on its current resources and strengths, UNEP's primary role in emergencies is to marshal intellectual resources to ensure that the environmental aspects of emergencies are clearly understood and that the imperatives for prevention and preparedness, including assessment and early warning, are fully recognized as critical to human and environmental security. To develop and maintain an environmental agenda for emergency prevention and preparedness, UNEP must translate its sectoral responsibilities into a broader capacity to act as a think tank for the United Nations on environmental matters. This effort requires four concurrent investments by UNEP: developing methodologies for early warning, undertaking environmental assessments of past and current emergencies, in collaboration with OCHA, other UN agencies and partners, building and maintaining analytical capacity through training, and reinforcing institutional structures that can help to prevent emergencies and alleviate their effects.

All of these concurrent investments should underscore UNEP's role in the development of an agenda for environmental emergency prevention, preparedness, assessment, mitigation and response.

UNEP's mandate for action with respect to environmental emergencies and environmental aspects of complex emergencies stems from decisions of the Governing Council, requests of governments and availability of resources. As part of UNEP's overall reform and revitalization process, increased importance has been given to environmental emergencies and the strengthening of UNEP's capacity in the area of emergency prevention, preparedness, assessment, mitigation and response.

UNEP's agenda for action, which will strengthen its environmental emergency capacity, focuses on in prevention and preparedness, assessment and early warning, mitigation and Response, communications, and publicity and resource mobilization.



*A photograph of Toyo-oka city from the 1960s, illustrating the critical need for a symbiotic existence with the environment. The photo shows farmers working in a field with wild Oriental Storks, cows, and other animals.*

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