

Implementing River Projects Adapted to Climate Change

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1. National land susceptible to flooding

In Japan, about 1/2 of the total population and 3/4 of total assets are concentrated on alluvial plains covering only 10% of the national land. The land surrounding three large bays (Tokyo Bay, Ise Bay, Osaka Bay) which adjoin the three large metropolitan regions, includes zero-meter belts of land below sea level, occupied by 4.04 million people. And Japan is located at the eastern end of the Asian monsoon zone, one of the world's heaviest rainfall zones, where it is exposed to the risk of the approach and landfall of typhoons. Japan can, for these reasons, be described as land susceptible to direct attack by flooding, sediment disasters and storm surge disasters.

To overcome such national land conditions, the Japanese have worked unremittingly to implement flood control measures such as building series of levees and constructing dams and other flood regulation structures, achieving great improvements in safety from floods. But the state of provision of flood control facilities remains at a low level of only about 60% of the present targets.

On the other hand, a poetic term for the beauty of Japan's mountains means "purple hills and crystal streams", giving the strong impression of a beautiful country endowed with abundant water, and the annual average rainfall in Japan is about 1,700mm, which is about double the worldwide average. But nevertheless, rainfall per unit of population in Japan is low at 1/3 of the world average, so Japan does not possess abundant usable water. Japan has, therefore, responded by providing water resource development systems, but in recent years, annual rainfall has fluctuated widely and years of extremely low rainfall have tended to occur, arousing renewed fears of a decline of the safety of the water supply and of droughts.

Social factors include the declining population, a falling birthrate and aging of society, the concentration of the population and assets in large metropolitan regions, and deteriorating regional economies. Among

farming and fishing villages, so-called villages at the viability limit are increasing, mainly in mountainous regions. Such villages are gradually losing their ability to maintain functions they need to protect their residents from natural disasters, and it is assumed that when a severe disaster does occur, they will suffer unprecedented damage. In Japan, a country susceptible to flooding, droughts, storm surges, and other natural disasters, finding ways to respond to intensifying risk caused by climate change is an important challenge facing future management of the national land.

2. Increase of risk caused by climate change

Severe natural disasters which can be associated with the impact of global warming are occurring around the world. Examples include flooding triggered in various parts of Japan by concentrated rainfall in Yamaguchi Prefecture in 2008 and by the recently increasing landfall of typhoons, and the terrible disaster in the southern U.S. caused by storm surges produced by Hurricane Katrina in 2005. In 2007, the Fourth Report of the IPCC predicted prolonged climate change and severe damage caused by this trend.

Japan has prepared concrete estimates of the impact of increasing rainfall during torrential rainstorms, the decline of the flow rate of melting snow etc., in regional and drainage basin units. For example, the degree of flood control safety (annual probability of exceedance) which is a goal under present plans, has declined by between 40% and 70% according to many estimates, and it is reported that in Hokkaido and in Tohoku in particular, there are river systems where it has fallen to about 30%.

And if it is assumed that in the zero meter zones around the three large bays, the average sea level will rise 59cm which is a predicted upper limit shown in the IPCC report, the population living in zero-meter zones will increase about 50%.

In order to survey the impact of and adaptation to

climate change, it is essential to appropriately assess the social and economic impacts of changes of external forces. In Japan, systematic studies have not been conducted, so we must quickly carry out such studies.

3. Basic concept of adaptation

The fact that both adaptation and mitigation are vital in order to respond to global warming is not only written in the Fourth Assessment Report by the IPCC, it is also an awareness shared worldwide. But awareness of this point is low in Japanese society where, discussions are liable to be biased toward mitigation. In Japan, a country particularly susceptible to flood disasters, it is vital to increase awareness of the need for adaptation.

And floods, sediment disasters, storm surge disasters etc. which are intensified by climate change, are assumed to vary widely in scale, so it is difficult to provide total protection from all such disasters. It is therefore important to adapt to climate change by clarifying to what extent structures will provide protection from flooding, then based on the results, study measures to restrict runoff in river basins, measures to mitigate damage by submersion of inundation of the land, and measures to restore damaged structures and help damaged regions recover, and in these ways, achieve the goal of “zero victims” of flooding of all scales likely to occur.

And in the Tokyo region and others where core functions are concentrated, it is essential to take priority action to avoid paralysis of the nation’s functions and to minimize damage. And according to region, flood disasters may occur in many river basins simultaneously, so it is necessary to plan for a wide area response encompassing more than a single river basin.

4. Responding to growing risk

So at the National Institute for Land and Infrastructure Management, an organization including the River Department, Water Quality Control Department, and the Research Center for Disaster Risk Management has jointly established the “Climate Change Adaptation Research Headquarters”, which undertakes research on rivers and coastline management to respond to climate change as its priority challenge. Specifically, it is now undertaking the following research projects.

(1) Assessment of risk caused by climate change

To study research on climate change, flood disasters caused by the change of the weather which is the premise for the study, and the impact on society and the economy must be assessed as disaster risks, and the results represented in a form easily understood by the public and by concerned organizations. When dealing with flood disasters, it is possible to include flooding of every scale which could occur by analyzing the forms of inundations in the river basin to evaluate the flood risk posed by each form of inundation. It is vital to show the results visually as a risk map. Assessing flood risk is important in the sense that it not only reveals an existing state of susceptibility, but also permits a comparison of the present susceptibility with a case where adaptation has been introduced and the clarification of the results.

(2) Minimization of inundation damage

In order to prepare a flood control plan by evaluating the results of calculation of the risks of inundation by flooding caused by climate change, comprehensive measures combining measures in river basins (for example, setting flood control safety according to land use, and controlling inundation by building backup levees etc.) are studied to compensate for inadequate flood control measures on rivers. When proposing such measures, a classification is made based on conditions on each river (not only natural conditions such as the scale, gradient, etc. of the river, but social conditions which include population, land use, state of concentration of assets etc. in the river basin) in order to propose patterns of adaptation suited to each set of conditions.

To also minimize the harm to residents of the river basin, basic studies of the best way to improve evacuation guidance systems, to guide land use, and to provide flood insurance which economically provides for the risk (risk financing).

5. To implement adaptations to climate change

It is essential for Japan, as a nation susceptible to flooding, to clarify assessments of risk under the impact of climate change and to propose appropriate and effective responses. And at the same time it is Japan’s duty to share information of advanced technologies in this field with countries around the world. In either case, there are time restrictions on the process of proposing adaptations to the impact of climate change, so we wish to quickly undertake research.