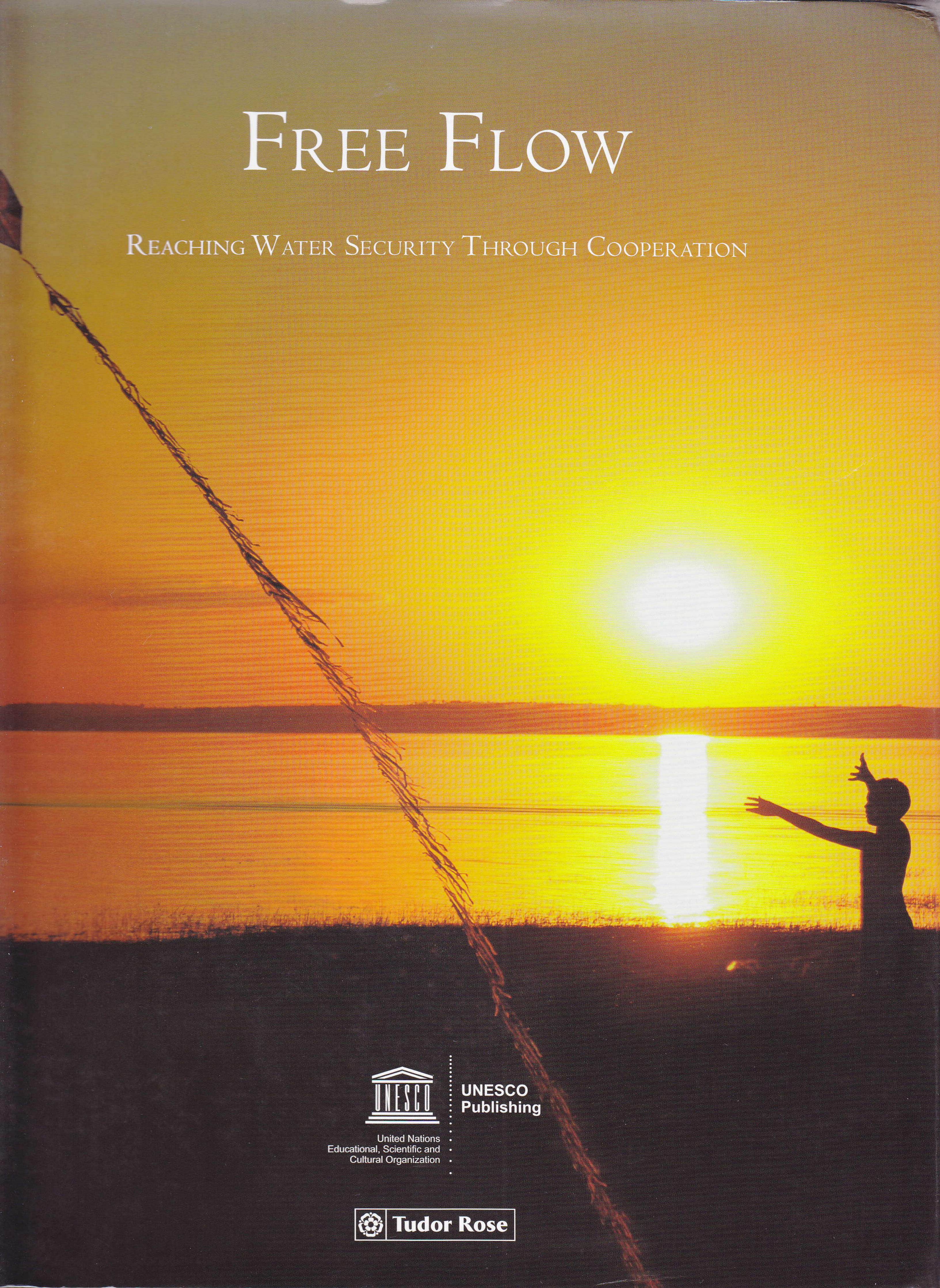
FREE FLOW

REACHING WATER SECURITY THROUGH COOPERATION



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Coping with extreme weather and water-related disasters

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Extreme weather events frequently take place in many parts of the world, causing various kinds of water-related disasters such as wind storms, floods, high tides, debris flows, droughts, and water-quality problems. This is a key issue for the sustainability and survival of our society. Interdisciplinary educational systems are necessary at all levels from elementary to higher education, as well as social education including the general public, industries and policymakers.

Extreme weather and water-related disasters

The Asia-Pacific region is one of the most disaster-prone areas in the world. It is adversely affected by natural hazards such as cyclones (typhoons), rainstorms, floods, landslides, and tsunamis caused by earthquakes and volcanic eruptions under the sea. These natural hazards bring severe disasters to all countries in the region where social change, in terms of population and economic growth, is the most dynamic in the world.[1]

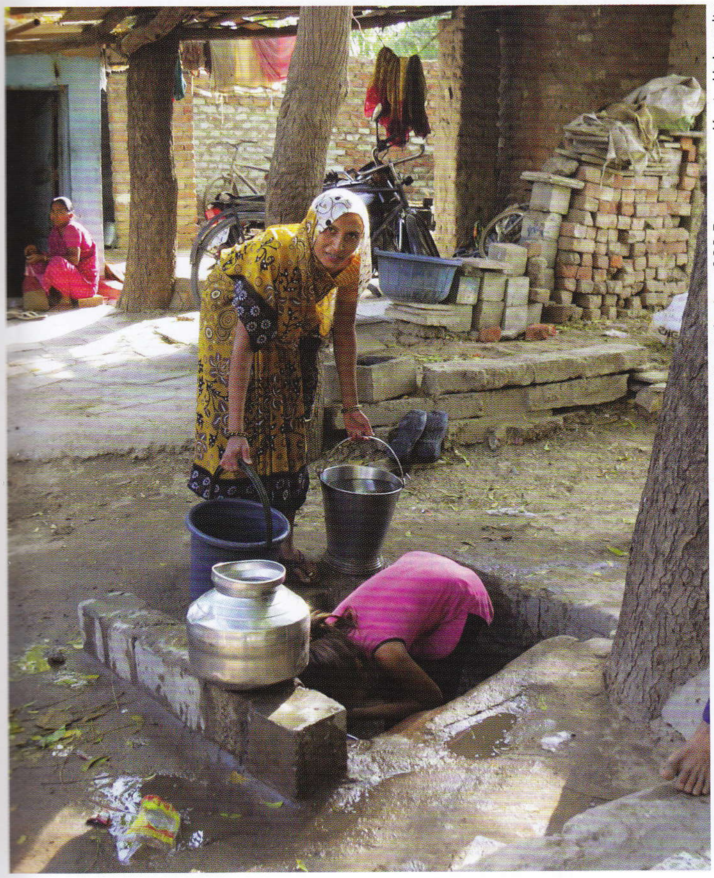

Image: Dr Akhilesh Surjan, GSS Programme, Kyoto University

A community water post in a slum community in Ahmedabad, India; the community set the tap below ground level to improve water pressure

Growth in this region has not, however, led to advances in disaster risk management. The situation is getting worse because infrastructure development cannot keep up with growth. Policies for poverty reduction and alleviation are insufficient and the difference between the rich and the poor is increasing.

Vulnerable populations are often those hit worst by hazards and disasters. As the world's cities expand to occupy greater portions of the world's flood plains, riversides and shorelines, the risk of flooding will continue to outpace both structural and non-structural mitigation efforts.

"A natural hazard strikes when people lose their memory of the previous one." This quotation is from Dr Torahiko Terada (1878–1935), a former Professor of the University of Tokyo who influenced many Japanese people as an educator, physicist and philosopher. People tend to forget bad memories if they do not experience a similar event for a long time. This ignorance and lack of experience increases the vulnerability of society to disasters.

Typical examples

In 2012, Hurricane Sandy hit areas of the Caribbean and the east coast of the United States. Economic loss from this hurricane in the US was estimated at more than US$50 billion and more than 170 people were killed. Another famous example is Hurricane Katrina in 2005, which killed at least 1,833 people and for which total property damage is said to have been US$81 billion.

Hurricanes, cyclones and typhoons often cause serious damage due to strong wind, heavy rainfall and flooding in riverine and coastal areas. It is often said that their power will be increased by climate change, which means that more serious damage will take place in the future in many parts of the world.

African countries and other arid and semi-arid regions suffer from water shortages, droughts, and desertification. These are also brought about by extreme weather conditions that continue for longer periods in wider areas.

Major natural hazards and disasters in the twenty-first century

Year	Location	Hazard type	Economic Loss (Million US$)	Death toll (people)
2002	Central Europe	Flood	20,000+	69
2003	Central Europe	Heat wave	13,000+	70,000+
2004	Haiti, Dominique, etc.	Flood, Hurricane Jeanne	9,000	3,025+
2004	India, Bangladesh, Nepal, etc.	Flood	N/A	3,076
2004	Indonesia + 13 countries	Indian Ocean earthquake and tsunami	14,000	230,000
2005	USA	Hurricane Katrina	14,400	1,322
2007	Bangladesh	Cyclone Sidr	1,700	3,447
2008	Myanmar	Cyclone Nargis	10,000	138,366
2008	USA + Caribbean countries	Hurricanes Gustav and Ike	4,000	170
2009	Taiwan	Typhoon Morakot, landslide	3,300	678
2010	Chile	Earthquake, tsunami	3,100	525+
2010	Russia	Heat wave	15,000	55,000+
2010	Pakistan	Flood	43,000	1,781+
2011	Japan	Earthquake, tsunami	235,000	15,840
2011	Thailand	Flood	4,000	813

Source: Munich Re, *The Economist* (14 January 2012), Wikipedia, etc.

Higher fluctuation examples in Europe

Extreme meteorological variation is taking place. Europeans may clearly remember the floods of 2002, severe snowfall events during the winters of 2002 and 2003 and the heat waves in 2003.

During the 2002 floods, Europe received approximately 500 mm of rainfall produced by a low pressure that moved from the United Kingdom to central Europe during 9-12 August. The Elbe and Danube rivers caused much damage. Major urban areas of Dresden and Prague, located respectively along the Elbe River and the Vltava River upstream, were inundated by flooding, which was said to be caused by an outdated irrigation system upstream. After this event the Czech and German governments discussed how to avoid a repeat of this kind of flood disaster. The Elbe River has long been contaminated by industrial wastewater including heavy metals such as mercury, cadmium and lead, as well as chlorides. The management of water in this river is of great importance to the countries situated along it. Rainstorm events from the end of May to the beginning of June in 2013 damaged these rivers by resultant floods, which were smaller (3,200 m^3/s) than the devastating flood event of 2002 with more than 5,000 m^3/s.

In south-east France, a heavy rainfall of 687 mm in 24 hours on 8-9 September 2002 caused severe flooding in the Gard River basin (2,070 km^2). There were 24 deaths, half of which occurred in privately owned cars, and economic loss of about €1.12 billion. These flood events were followed by heavy snowfall in the winter of 2002-2003, which was the second heaviest snow since 1967. The snow accumulated in the Alps melted and caused flood disasters.

A very severe heat wave then came to Europe. It killed a total of 35,118 people in France (14,802), Germany (7,000), Spain (4,230), Italy (4,175), Portugal (1,316), Wales, UK (2,045), the Netherlands (1,400) and Belgium (150), according to the Earth Policy Institute. A maximum air temperature of more than 35 °C continued from 4-13 August 2003, increasing the death toll day by day with a peak of 2,197 on 12 August. Even in developed European countries, such a tragedy happened because many aged people lived in houses where there was no air conditioning. In 2010, the northern hemisphere again faced significant damage from heat waves.

Examples in Japan – tragedy in an 'aged' society

Likewise, the Asia-Pacific region is also affected by extreme weather. Ten typhoons directly hit Japan in 2004, for example, while the overall annual average number of typhoons to hit the country is usually fewer than three. The Japanese Meteorological Agency reported that 326 people were killed in 2004 by these typhoons, other rainstorms and resultant flood events.

Japan is now an 'aged' society (severer than an 'ageing' society). In Niigata, in July 2004, flooding killed 15 elderly people. There were three main reasons for these deaths in different parts of the region. First, floodwaters 3 m deep damaged houses directly and killed three elderly people (75-78 years old) who had insisted on not leaving in their homes. Second, with a 1.5 m depth inundation, two people (a 37-year-old man and a 42-year-old woman) were killed while moving from their houses to the evacuation point. Third, many houses were inundated but not destroyed by the power of the flood; therefore people remained on upper floors of their homes and did not lose their lives. Four elderly people living alone, however, drowned in floodwaters that rose just 1 m above floor level. Being 76-88 years-old, sick or handicapped and without family members or caretakers to assist them, they were unable to move to the second floor of their buildings. It is therefore important that we consider these people the most vulnerable during such disasters. Welfare work should be included in disaster management in such aged societies.

Examples in Asian countries

Severe flooding events were caused by cyclones in Bangladesh in 2007 and in Myanmar in 2008. Similar events occurred in Bangladesh in 1991, killing 138,866 people and causing economic loss of US$7.6 billion. However, Cyclone Sidr in 2007 killed 3,363 people and caused economic loss of US$3.1 billion. The reasons for the lower number of deaths and economic loss were:

- the 1991 cyclone passed through a more densely populated area than Sidr in 2007
- the 1991 cyclone occurred during the rainy season, while Sidr occurred during the dry season
- disaster prevention education and information dissemination systems have improved, raising awareness of and the need for preparedness for cyclone disasters
- investment in cyclone shelters has increased
- meteorological forecasting and early warning systems have been improved
- overall educational levels have increased, for example the literacy rate in Bangladesh has increased from 20 per cent to 50 per cent.

The first two reasons listed above are natural conditions, whereas the rest are related to social or human efforts to reduce or manage risk. Note, however, that in Myanmar, where education and awareness of disaster risk reduction and management needs have been minimal, 100,000 people were killed and 220,000 recorded as missing due to Cyclone Nargis in May 2008.

These examples in Bangladesh and Myanmar suggest that basic risk management measures are important, especially in developing countries. People in the developed world can learn from those in developing countries. Advanced flood risk management not only includes so-called 'high-tech' measures but also 'low-tech', economical and achievable measures. Social capital and social technology are also essential for the implementation of any kind of flood risk management measures.

In 2011, the flooding in the Chao Phraya River basin (157,925 km^2) continued for several months from July to December due to four typhoons. It adversely affected nearly 13.5 million people, more than 4 million houses, and agricultural land of 1.8 million ha in 65 prefectures. The death toll was 749 in 44 prefectures. This long-lasting flood also adversely affected eight industrial parks in and around Bangkok. According to the Japan External Trade Organization, 804 factories (449 Japanese enterprises) in seven industrial parks were damaged. The influence was so serious that many companies stopped their activities. Economic loss was estimated at US$2.2 billion in total. The importance of the business continuity plan was highlighted in this event, because many kinds of supply chain were stopped in many industries, with serious impacts on the international economy.


Images: MLIT

Pumping cars drain water at (l) Watari Town, Miyagi, Japan after the earthquake and tsunami in March 2011 and (r) Bangkadi Industrial Park, Bangkok, Thailand during the Chao Phraya flood in November 2011

Water cooperation and disaster risk reduction

Many kinds of cooperation activities have been implemented in terms of water. Japanese official development assistance has been contributing to developing countries by constructing water resources systems, flood control facilities and other infrastructures, such as dams, channels, water supply and irrigation systems in cooperation with the Japan International Cooperation Agency (JICA). These structural measures have prevented or mitigated water-related disasters and their risk.

In addition to these, another type of contribution includes emergency management. After the Great Earthquake and Tsunami disasters in east Japan, including Iwate, Miyagi and Fukushima prefectures, there was land subsidence in a number of low-lying areas where water inundation in residential districts, as well as in agricultural lands, was a serious problem. The pumping cars, which were prepared by the Ministry of Land, Infrastructure, Transport and Tourism of Japan (MLIT), played a significant role in the drainage of inundated water. The pumping cars were also dispatched to the Chao Phraya River in order to drain floodwater in Bangkok and surrounding areas. This was a notable water cooperation activity made by MLIT and JICA. Other water cooperation examples can be seen in activities by the Japan Water Forum (JWF), which carries out water supply and sanitation activities at the grass-roots level through assistance to non-governmental organizations and collaboration with local partners in developing countries. The JWF Fund awards grants of up to US$1,000 to approximately 15 grass-roots organizations in developing countries every year, to support their activities and projects to improve access to water and sanitation.[2]

It is also important to bear in mind that risk communication measures are useful in raising public awareness and preparedness for coping with floods and droughts as well as waterborne disasters including epidemiological infectious diseases such as malaria, which are triggered by environmental or climatic drivers. Literacy, communication skills and gender issues must be seriously considered. Many cooperation activities for water-related disaster risk reduction are implemented through international programmes such as UN Water and the United Nations Educational, Scientific and Cultural Organization International Hydrological Programme, of which the eighth phase (2014-2021) will deal with water security issues.[3]

Image: Dr Rajib Shaw, GSS Programme, Kyoto University

Women collect water from surface sources in the coastal Satkhira district of Bangladesh, where water bodies are mostly saline

Academic contributions

Interdisciplinary approaches at university (graduate school) level include the Global COE Program for 'Sustainability/Survivability Science for a Resilient Society Adaptable to Extreme Weather Conditions' (GCOE-ARS), implemented by the Disaster Prevention Research Institute (DPRI) at Kyoto University, Japan.[4] This programme focuses on how human beings and human society could adapt to global-scale changes including climate change that incur extreme weather and changes in the Earth's water cycle, population increase, urbanization, land use change, rural development, desertification and so on. It especially emphasizes scientific explanation and the prediction of weather and hydrological disasters as well as social adaptation to these events.

In Asia, as stated above, located in a humid climate and tectonic zone, overpopulation and land development are escalating. Africa has arid and semi-arid regions as well as tropical rainforests. The environmental conditions in these areas are more severe than elsewhere in the world in terms of social and natural aspects, and thus especially sensitive and vulnerable to extreme weather. The people's living and economy in these areas provide implications for the survivability of humans on Earth, while at the same time requiring adaptation strategies to cope with more difficult conditions expected in the future. GCOE-ARS pursues sustainability science for survivability of humankind and fosters world-leading experts by developing practical research in these areas in the world.

Another similar programme is 'Inter-Graduate School Program for Sustainable Development and Survival Societies' (Global Survivability Studies (GSS) Programme), which was launched in 2011 to form a strong interdisciplinary graduate school educational system. This programme deals with four major areas:

- catastrophic natural hazards and disasters
- man-made accidents and disasters
- regional environment change and degradation
- food security.

These challenges of academic research and education, led by DPRI, are intended to involve cooperation on water-related disaster risk reduction with many overseas or international institutions and organizations, as well as with local communities around the world. We believe that this transdisciplinary approach can be strongly connected to policy or real-world issues and contribute to disaster risk reduction for sustainable development of our Earth system.