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Major Effects of Water Stress Related Issues in Disaster Management

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Abstract: Summary Major disasters cause massive disruption to societies and overburden national economic systems. Thousands of people are killed and tens of thousands more are displaced from their homes every year by natural disasters triggered by storms, floods, volcanic eruptions and earthquakes. Many thousands more lose their livelihoods and huge damage is caused to property. By windstorms, floods, earthquakes, tsunamis, debris flows and lahars, vital resources are destroyed, infrastructure is damaged and transport and communication are jeopardized. Enduring periods of drought decrease crop yields, increase wildfire risks and affect human health. However, these effects could be minimized and considerable losses of life and property could be avoided through improved risk assessment, early warning and disaster detection and monitoring. Risk assessment provides information about the combined effect of hazard and vulnerability, allowing improved risk reduction and mitigation. The outcome of early warning is information on the onset of potential disasters, which can improve preparedness in the affected area. This paper aims to identify the role of Water Stress related issues as floods and droughts as a major global disaster.

Key words: Water stress・Disaster management・Earth observation・Water management・Climate change

INTRODUCTION

Stakeholder Assessment: Assessment by expert stakeholders is an indispensable approach when it comes to valuating the benefits of scientific approaches and related techniques, taking into account the full range of products and services applicable to all the different types of hazard and all phases of disaster management, including prevention and risk reduction. Given this widespread application potential and the likely workload of any experts in this field, an approach to in collecting expert knowledge from the global community has to be designed in a pragmatic way in order to keep the participants' effort within reasonable limits. As a result of an expert stakeholder assessment we can mention the UNOOSA-JBGIS and ICSU-GeoUnions Project VALID. (2).

In this assessment we can see in terms of hazard types addressed, the evaluators' professional role had no major effect on the outcome (Fig. 1 and 2). In total, on the level of hazard types, Flood scored highest (17%), followed by Tsunami (13%), Drought (12%), Fire (11%) and Earthquake (11.5%), with the other disaster types polling below 10% (Fig. 3.3). This clearly indicates that the major concern of the stakeholder community is about hydro-meteorological hazards (including Fire) and Earthquake (including Tsunami).

Water Stress as Disaster: Article 1 of the United Nations Convention to Combat Desertification (UNCCD) 1 defines drought as "the naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems".

Beyond this general definition, there are more specific ways of understanding drought. For example, a classification of droughts from a discipline perspective also exists. Thus, in terms of typologies, droughts are commonly classified as meteorological, agricultural, hydrological and socio-economic inter-related events (Fig. 2).

In general, the potential disaster losses in terms of lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period, are defined as *disaster risk* (UNISDR, 2009b). The risk associated with a disaster for any region or group is a product of the

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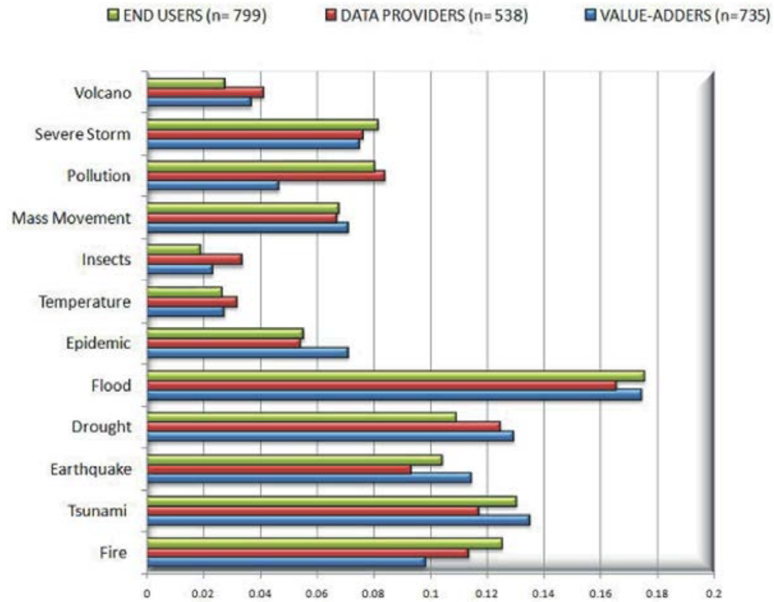

Fig. 1: Relative distribution of poll results by participants' occupation and hazard type addressed

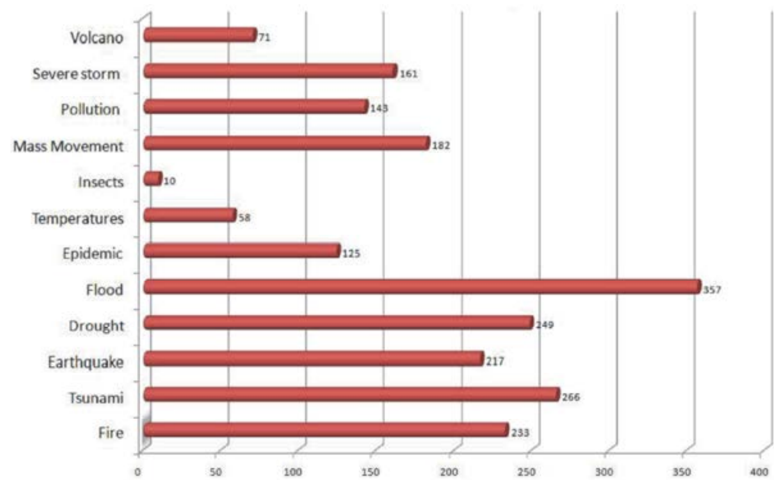

Fig. 2: Total poll results in counts per type of hazard

exposure to the natural hazard and the *vulnerability* of the society to the event. Therefore, *drought risk* is based on a combination of the frequency, severity and spatial extent of drought events (the physical nature of the considered hazard) and the degree to which a population or activity is vulnerable to the effects of drought (UNISDR, 2009b). The degree of vulnerability of a region depends on the environmental and social characteristics of the region and is measured by the inhabitants' ability to anticipate, cope with, resist and recover from drought.

In the following, some considerations regarding indicators and indices developed to identify, assess and map drought hazards and vulnerability are presented.

Floods are among the most frequent disasters and are ranked as number three world-wide in frequency. Europe, America, Asia and Australia have recently witnessed a severe growth in the scale and frequency of flood events. Fig. 3 clearly shows that storms and floods are the most extreme and frequent disasters. If we count the effects of the Meteorological hazards (Heat-Wave, Cold-Wave…) to the cause of droughts these natural disasters related especially to the water stress it will be the most dominant hazard type. For example, the Elbe floods in 2002 caused a total of-8 billion of economic damage in Germany, Austria and the Czech Republic. The economic losses contributed to reductions in these countries' 2002 GDP of 0.54%, 1.4% and 3.75%

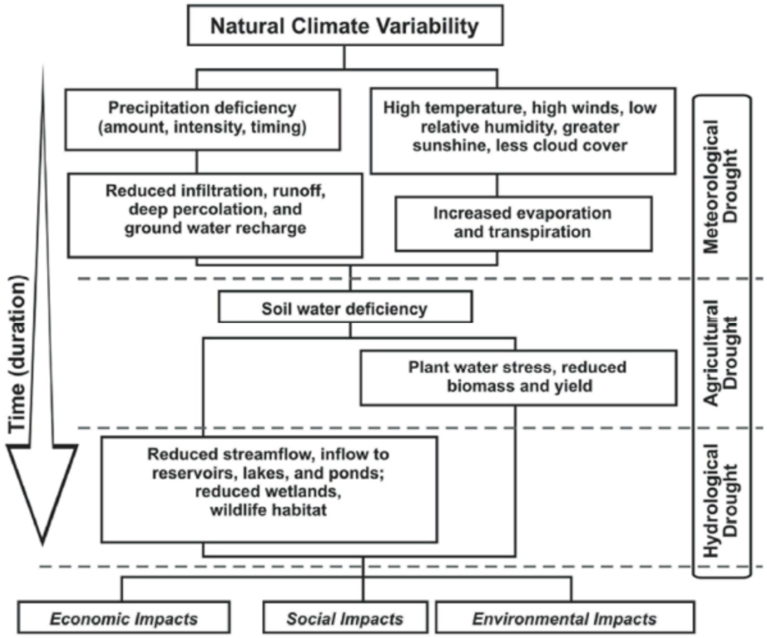

Fig. 3: Relationship between meteorological, agricultural, hydrological and socio-economic drought (National Drought Mitigation Center, University of Nebraska-Lincoln, USA)

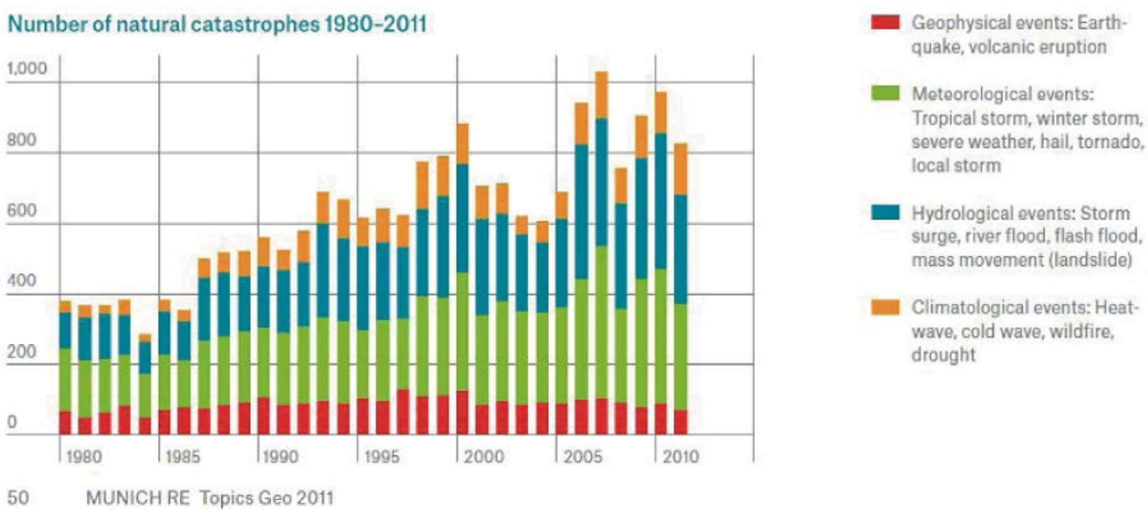

Fig. 4: Catastrophes statistics published by Munich Re, 2012

respectively (CEA, 2007). About 91% of the most severe catastrophes in the world have been weather related: 300 storms, 310 floods, storm surges and mass movements caused by heavy rain (Munich Re, 2012).

Water Stress as a Management Problem: The outlook for the coming decades is that agriculture will require more water to meet the demands of growing populations. Ensuring equitable access to water and its benefits now and for future generations is a major challenge as scarcity and competition increase.

With growing concern for the environment, some difficult choices will have to be made. Further tradeoffs cannot be avoided and will be politically contested. Choices about water use and management in agriculture will determine to a large extent whether societies reach the interlinked multiple goals of economic and social development and environmental sustainability as articulated in the Millennium Development Goals (Table 1). How should water be managed for agriculture in the future? World Water Vision, culminating in The Hague in 2000, produced the *Vision for Water and Nature*

Table 1: Relationship of water management in agriculture to the Millennium Development Goals

Millennium Development Goal	Role of water management in agriculture
Goal 1 Eradicate extreme poverty and hunger	Increase agricultural production and productivity to keep up with rising demand and maintain affordable food prices for the poor; improve access to factors of production and markets for the rural poor.
Goal 3 Promote gender equality and empower women	Enhance equitable access to water and thus the ability to produce food.
Goal 4 Reduce child mortality	Contribute to better hygiene and diets, particularly through the appropriate use of marginal-quality water and the integration of multiple water-use approaches into new and existing agricultural water management systems, including domestic and productive functions.
Goal 5 Improve maternal health	
Goal 6 Combat HIV/AIDS, malaria, and other diseases.	
Goal 7 Ensure environmental sustainability	Integrate the principles of sustainable development into agricultural water development to reverse the loss of environmental resources.
Goal 8 Develop a global partnership for development	Involve the diverse range of practitioners, researchers, and decisionmakers in the preparation of water management actions.

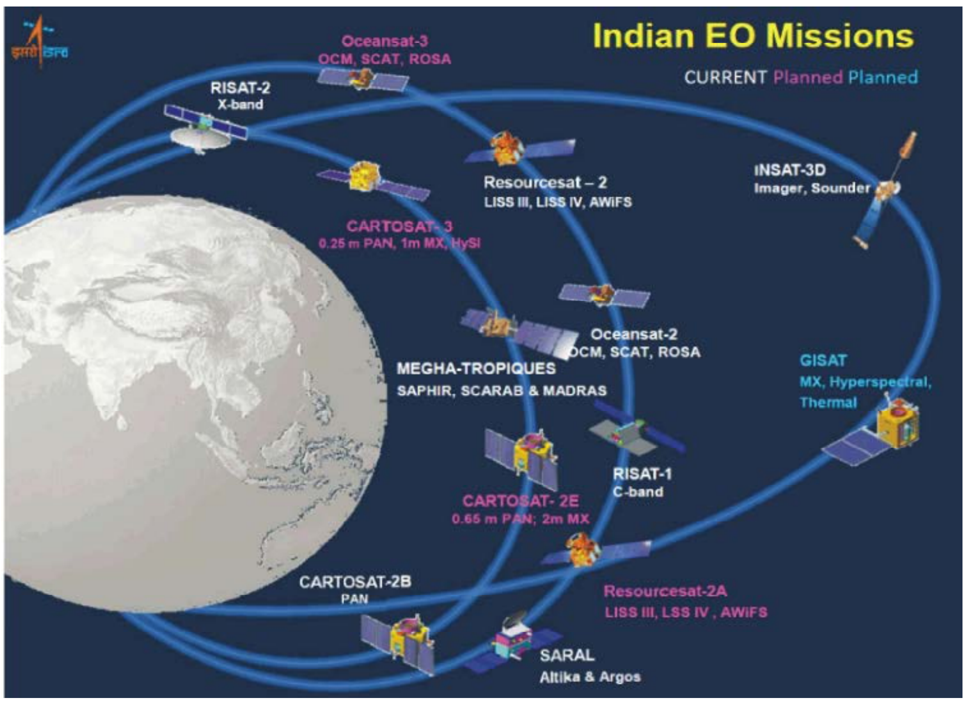

Fig. 5: Earth Observation program of India in Water Resource Management. (6)

(IUCN 2000) and "A Vision for Water for Food and Rural Development" (van Hofwegen and Svendsen 2000). These two "visions" contain widely diverging views on the need to develop additional water resources for agriculture, on how society should use water and on the benefits and costs of such developments. A major reason for the divergence? The difference in understanding of some basic premises, such as how effectively water is used for poverty reduction, the extent of ecological impact, the contribution of groundwater and the current use and future potential of rain fed agriculture. Both technical and institutional solutions are proposed, but uptake is difficult.

Lacking is adequate knowledge of past impacts and a clear sense of the present situation of water use. A major step toward creating more equitable and effective use of water in agriculture in developing countries is to take stock of how water is currently managed for agriculture and of the impacts of its use on food and environmental sustainability. To move forward we need to combine knowledge of what has worked and what has failed and who has benefited and who has not, with information on promising and less conventional approaches that may hold the key to future water management. And we need to identify the range of sources of potential increases in agricultural water productivity and the ways to realize them.

Earth Observation and Water Management: From the data obtained by the Earth Observation trough satellites we can focus on the following areas:

- Atmospheric Chemistry and Composition
- Carbon Cycle and Ecosystems
- Climate Variability and Change
- Earth Surface and Interior
- Water and Energy Cycle
- Weather

In order to achieve these data current missions of Earth Observation focus on

- Flood mapping/damage assessment
- Groundwater changes (GRACE mission)
- Precipitation
- Evapotranspiration
- Irrigation
- Lake and reservoir monitoring; stream flow forecasting
- Wetland mapping
- Soil moisture,

As an example of these capabilities we can see the Earth Observation program of India in Water Resource Management in Fig. 5.

CONCLUSIONS

Water scarcity is key vulnerability parameter is a crucial element of droughts, which is the susceptibility to the damaging effects of drought hazard. Drought hazard assessment is based on several indicators most of which may be derived from low resolution satellite data, so the application of geoinformation for drought hazard assessment should be low cost. People's vulnerability to drought, however, is complex and has to be derived from historical and prevailing cultural, social, environmental, political and economic contexts. Hence, drought vulnerability indicators are based on global socio-economic databases available mostly on a national aggregation level, or geospatial datasets with a very coarse resolution, some of which are derived from satellite acquisitions. This is a limiting factor for the spatial resolution of drought vulnerability maps.

A sophisticated to the needs tailored geoinformation based management system surly will help to overcome this very important problem. It has been proven in all regions applied.

For this and other similar purposes the UNGGIM Entity (Global Geospatial Information Management) endorsed at its last meeting at the UN Headquarters in New York in August this year following suggestions:

That all member countries:

- Contribute to United Nations activities on global geospatial information management;
- Solve legal and policy issues;
- Do administrative arrangements;
- And build necessary capacity
- Organize publicity and outreach;
- Build partnerships;
- Enrich regional and international collaboration and
- Solve technical, priority issues and challenges;

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