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Space for Sustainable Development
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Space-based data and sustainable water management

Water issues continue to rise on the Global Agenda. Between 1900 and 2000 the world population tripled. Yet water demand increased sevenfold. Our current situation is characterized by the fact that 1,1 billion people lack access to safe water supply and 2,4 billion to adequate sanitation. According to the United Nations more than two billion people suffer from water-borne diseases with more than 2,2 million people dying every year. By 2015 3 billion people - nearly 40% of the world population - are expected to live in countries that find it difficult or impossible to mobilize enough water to satisfy the food, industrial and domestic needs of their citizens. Projections indicate that by 2025 two out of every three persons on Earth will live in water-stressed conditions.
The problems are most acute in Africa and in West Asia but lack of water has already become a major constraint to industrial and socio-economic growth in many areas of the world.

The world has taken note of the water related issues within the broader spectrum of global threats, challenges and needed action. The UN Millennium Summit in 2000 aimed to halve the proportion of people without access to safe water by 2015 an objective which the international community is not going to achieve. After celebrating the International Year of Freshwater in 2003 the United Nations General Assembly proclaimed the period 2005 to 2015 as a Decade on Water for Life. Yet have we really progressed?

The challenges humankind faces with regard to the supply of water are multi-dimensional yet there is consensus that in response to the unequal natural distribution of water resources in the world advanced modes of water management would be the answer.

The challenges to water management are to some extent typical for the new type of agendas we face at local, national and global levels:

- water management reaches into the know-how of different academic disciplines.
- It addresses the competitive and often mutually excluding interests of different economic, social and environmental sectors.
- It relates to private and to public interests and spaces.
- And it is covered by the responsibilities of different administrative institutions dealing with forestry, with mountain management, with

agriculture, with environmental protection, with marine and coastal ecosystems, with economic development, industry, with urban development etc.

To this is to be added the trans-national dimension of water reaching beyond the limits of national sovereignty with an inherent trans-boundary nature of surface-, ground-, and atmospheric water resources. 40 % of the world population in almost 50 % of the Earth's land surface live within such basins whose waters are shared by two or more sovereign states. In fact international rivers account for 60 % of global river flows. 145 of the 192 member countries of the United Nations share their water resources with neighbouring countries. This implies that a multitude of different international, national and local institutions assume responsibilities for shared resources which are interrelated in patterns without reciprocity - upstream vs. downstream. These inter-sectoral and inter-jurisdictional water management patterns are still highly fragmented contradicting the needs for an integrated development and use of the surface and groundwater resources within the framework of multiple-objective policies.

Because of the pluri-institutional nature of water resources administration within and between national administrations a fractal management approach has been considered indispensable. Ultimately every water user, including the citizen, is to be part of achieving sustainability in the use and management of these precious resources.

Fractal management providing a response to different user interests and user impacts contains two key elements

- Shared objectives and principles of management and benefit sharing among the different responsible governmental and intergovernmental structures and
- A shared system of information, data and analysis.

Many water management systems are still marked by a lack of shared data and assessment of resources availability. In fact the Africa Water Vision for 2025 underlined the priority response of improving "water wisdom, data and analysis".

Information and data are to be understood as the basic political tool, the first step in moving towards a shared perception of water development and use and cooperation among different national, regional and local responsibilities including, in particular, in the management of international water resources. Shared data are an almost classical element of confidence-building leading towards institution-building. Ground-based data collection is often difficult, raises issues of methodology, reliability, timing etc. In the case of the Niger River only one of 9 local measuring stations provides reliable data.

The answer to this basic challenges of achieving sustainability in pluri-institutional and interjurisdictional water resources development and use is space - space-based data.

Space-based data avoid some of the classical issues of sharing water and natural resources information. There are no issues of methodology, of standardization, of reliability, of accessibility. While space will not yet replace ground-based data collection, the quality and availability of space-based data have the potential of becoming the central element in pluri-institutional and in inter-jurisdictional water resources development and management. Another important dimension of space-based data is that they easily include information on related natural and environmental resources and their use which have major impacts on the availability and the timing of water availability such as deforestation, soil erosion, industrial pollution etc.

The key principles of international water law, summed up in the 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourses can become effective legal reality only on the basis of reliable, objective information. International water law includes, in addition to the principles of equitable and reasonable use of waters and of not causing harm, the principle of cooperation, including the regular exchange of data. Space-based data are also able to address in addition to the dimensions of water quantity and quality, the increasingly important issue of timing of water availability.

Space-based data are easy to share, to exchange and serve as a common basis for analysis and related shared policies, thus becoming the key element for international peace and cooperation.

Space and Ecosystem Management

The challenges faced in the protection and management of marine and coastal ecosystems are in several dimensions similar to those faced by water management. There is the interdependence and interrelatedness of the different often competing uses of the resources of a marine and coastal ecosystem. There is an inter-jurisdictional dimension in ecosystems defined by sovereign rights and competing user interests.

Many of the 64 coastal and marine ecosystems of the world are suffering environmental degradation, including mismanagement of fisheries resources, stock depletion, mariculture extinction, industrial and municipal pollution, contamination by ballast water, coastal erosion and the destruction of upstream spawning areas. The exploration and exploitation of petroleum and gas

resources has led to a situation where these ecosystems suffer an average of more than 1000 oil spills every year.

The tremendous spacial extension of territorial waters and of the exclusive economic zone poses a fundamental challenge to the needed monitoring of the resource systems but also regarding a control of the effective legal regime in the coastal water systems. There are rising incidences of piracy and the illegal intrusion of foreign fishing boats which tend to destroy the livelihood of local fishermen and of the basic nutrition of coastal populations.

Marine and coastal ecosystems need a recovery and sustenance of depleted fisheries, the restoring of degraded habitats, the reduction of land- and ship-based pollution and a reversal of coastal area degradation and living resources depletion. All of this is to be achieved in a regional, international setting of cooperation among often competing interests and institutions.

Similar to the lack of direct reciprocity in the use of water resources the international negotiating and norm-setting process for coastal and marine ecosystems is marked by the challenges of an imbalance of direct reciprocity. Up-stream vs. down-stream is still a key issue in water management. Up-current vs. down-current is to be addressed in ecosystem management. And there some of the issues are even more complex. How to respond?

For ecosystem protection and management fractal management patterns will be a key element in addressing these challenges. What is needed are shared objectives, a certain coordination of the plurality of different governmental, inter-governmental and non-governmental responsibilities and the working with shared information and data.

As we know from international water resources management space technology can today provide most of the data required for effective marine and coastal ecosystem protection and a sustainable use of the important resources. They are easily transferable, can be stored and serve as basis for shared analysis and assessments, for policies and for local, national and international programmes of action.

Knowledge and information sharing embraces the principle of working together at institutional levels and across political and geographical boundaries to achieve common objectives. Such collaborations will forestall the wastage of meagre resources including the avoidance of un-necessary duplication of efforts and programmes. Information, including space acquired ones, is not only power, but it produces shared vision and understanding which in turn produces joint actions.

The quality of space-based data and related information has in fact become a central element for sustainability management, of water resources and of coastal and marine ecosystems.

The resources-management communities, however, still seem to need an enhanced understanding of the potential contribution of space for attaining the key objective of sustainability in the development and use of our natural and environmental resources endowment. In the first draft of the Rio+20 document the word “space” was not mentioned once. The fundamental role space assumes in the management of sustainability still requires recognition at all levels of governance.

There are numerous observing systems available which offer fundamentally important opportunities for the management quantum leap based on new quality and reliability of information:

The Global Sea Level Observing System (GLOSS) is a programme coordinated by the Intergovernmental Oceanographic Commission (IOC) for the establishment of global and regional sea level networks. The main component of GLOSS is the 'Global Core Network' of 287 stations around the world for long term climate change and oceanographic sea level monitoring.

Other programmes of pertinence in this context includes the ESA – ESRIN (ESA Centre for Earth Observation, Frascati (Rome); EUMETSAT in Darmstadt, GERMANY; NASA’s Goddard Earth Sciences Data and Information Services Center & Others, NOAA’s Satellite and Information Service, Silver Spring, MD; Satellite Imaging Corporation, Houston, Texas, USA

In response to local and regional challenges in ecosystem management new space information programmes have been launched in all regions of the world including by Indian, Malysian, Nigerian and South African space agencies. There is no alternative to space. A fact which however still needs to be recognized by all those institutions bearing the responsibilities for our ecosystems’ common future …