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**Invited papers on recent developments in geospatial information
management in addressing national, regional and global issues**

**Emerging issues to use geospatial initiatives in the
societal context of disaster managing ****

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Emerging issues to use geospatial initiatives in the societal context of disaster managing ¹

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1. Foreword and rationale.

Two recent documents issued by the UN: the World Risk Report 2012³ (WRR2012) and the “Future trends in geospatial management: the five to ten year vision”⁴ (UNGGIM) drive to some considerations about the geospatial initiatives which may be taken by the States to contribute to disaster managing.

The geospatial information and particularly the geoservices are considered as contemporary drivers of economy, society and as qualified components and tools of public administrations all over the world. Just to mention the OXERA report⁵ recently commissioned by GOOGLE, which says “*The report also quantified the economic value of the sector, based on reported commercial revenues, as being in the range of \$150 billion to \$270 billion.*”

Due to some already well known policies such as e-government and public administration digitization and interoperability, it is worldwide possible to record that States are becoming interested in taking actions and/or in starting process to use geospatial information for their mandatory activities in all phases of disaster management and not only in the emergency and immediate recovery one.

While the usage of geospatial information, due to technology-driven trends, it is expected to create an unimaginable amounts of location-referenced data to

¹ The paper has been prepared as contribution to the 10th UN-RCCA Conference (<http://unstats.un.org/unsd/geoinfo/rcc/unrcca10.html>), it is a position and discussion paper and has the purpose of reflecting on how geospatial initiatives and societal measures may jointly contribute to disaster management. It has been jointly supported by EUROGI (www.eurogi.org) and AMFM GIS Italia (www.amfm.it)

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³ <http://www.worldriskreport.com/Bericht.435.0.html?&L=3> The report is presented by the United Nations University Institute for Environment and Human Security (UNU-EHS), the Alliance Development Works/Bündnis Entwicklung Hilft and The Nature Conservancy (TNC).

⁴ <http://ggim.un.org/docs/meetings/3rd%20UNCE/UN-GGIM-Future-trends.pdf>

⁵ <http://www.oxera.com/Publications/Reports/2013/What-is-the-economic-impact-of-Geo-services-.aspx>

be used in disaster management the paper focuses on questioning the relationship among societal aspects and geo-information.

The WRR2012 based on the statement “ *The risk a country runs of becoming a victim depends crucially on social economic and institutional factors*” calculates the *worldriskindex* via four components : exposure to natural hazards ; susceptibility depending on infrastructure; coping capacities to reduce negative consequences; adaptation as capacities for long term strategies for societal changes.

This paper starts discussing the geospatial components of the four *worldriskindex* components in order to contribute to geospatial initiatives which States are willing to take for disaster management and it aims to demonstrate that geospatial information are relevant resources of the social capital as part of the entire disaster management process. Because of this an innovative approach to consider States geoinitiatives is needed.

The figure depicts where geoinitiatives concretize as the overlap zone of the State and the society in the disaster managing.

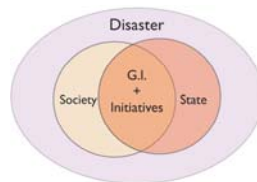


Figure 01

2. Vulnerability and geospatial information.

The Vulnerability (V) indicates the level of exposure of an object to natural hazards. It is function of the variables that characterize the object , the state and the context of object location. The three vulnerability components considered by WRR2012 may be taken into account: susceptibility, coping capacities, adaptive capacities.

The exposure to natural hazards, as component of the risk, has to be taken by itself and it has to be considered as territorial Dangerousness (P) to indicate the level of potential impact of harmful events (earthquakes, storms, floods, droughts, etc.). The most obvious data of exposure to be considered is the settled population but other data should be considered as productive plants and natural resources and species.

The exposure component mainly refers to physical entities such as settlements, built-up areas, infrastructures and natural areas, which are defined for location and consistency through geospatial data. To this regard the scale factor is absolutely crucial since the occurring hazard has impact at micro-scale level of entities, such as e.g. dwellings. The micro level data are the most expensive and complex to survey and manage. If geodata of

physical entities are available at smaller scale (more generalized) only overall initiatives may be taken for disaster managing but the detailed scale will not be present. Who is in charge of disaster managing clearly should bare in mind the process of generalizing geospatial data and take careful decisions about the original scale to use of geographical data base to be used.

Since the susceptibility mainly refers to damages provoked by disasters, the attribute data of physical entities exposed to be damaged are absolutely relevant. Housing conditions, features of settlements, status of infrastructures are attribute data which should be surveyed in advance and stored in disaster management data bases to be used in case of catastrophic events. To this regard the data specification issues are relevant since they affect the attribute descriptive geospatial information already considered in the exposure component.

The coping capacities component since refers to disaster preparedness and early warning is mainly related to location based services and geoservices early and preventive usage. For this component the communities networking and the geoservices provision together with e-government services at the society level are relevant.

As adaptive capacities are based on long term process of societal skills in terms of geo components are very much related to the capacity to monitor and to affect the environmental status and modifications of soil and environment as a whole. Land use, land cover, soil sealing are some of the issues to be managed by a society showing adaptive capability.

Table 01 is summarizing the geo information issues related to each of the vulnerability components.

Vulnerability component (*)	Geo information components
exposure	base maps and images, geo-entities, scale factor, population statistics ,census tract granularity
susceptibility	attribute data, data quality
coping capacity	geoservices, e-gov services
adaptive capacity	land cover, land use, soil sealing , environment modifications

Table 01

(*) As defined by WRR2012 report

Previous table and considerations demonstrate that vulnerability components seek specific geo-information components that granularity is relevant and attributes and their quality is essential.

3. Disaster management and geospatial information

The disaster management has been largely scientifically, technically and politically discussed so that an agreed stack of phases is worldwide accepted. The table below aim to focus on geospatial information properties related to disaster managing phases.

GI PROPERTIES	DISASTER MANAGEMENT PHASES
DATA SPECIFICATIONS, DATA COLLECTION & STORING, DATA MODELLING,	RECOVERY
STANDARD COMPLIANCE, DATA AVAILABILITY, DATA DISTRIBUTION TYPES, DATA OPENNESS, SYSTEM AVAILABILITY AND ACCESSIBILITY ,	RESPONSE
METADATA, DATABASE CATALOGUING, NETWORK ACCESS, DATA OPENNESS, GI AWARENESS, SYSTEM AVAILABILITY , HUMAN RESOURCES CAPABILITY, DATA MONITORING & MAINTENANCE	PREPARATION
DATA & SYSTEM AWARENESS RAISING, LOCATIONAL MODELS, DATA ACQUISITION STRATEGIES, DATA SHARING & USING POLICY, DATA OPENNESS	MITIGATION

Table 02

Present achievements in collecting and sharing geo information and images offer consistent opportunities for disaster managing. The endemic characteristics and the functioning of contemporary society push local residents and remote volunteers in the process of voluntarily producing new geographic data and of augmenting the attributes of already available geographic information and moreover sharing them within spatial data infrastructures and “cloud” geoservices.

While the availability of adequate geographic information is still representing a divide for less favored States and sub-national areas, the States are presently called to manage the volunteered geographical data and to set up validation

procedures for managing the geographic information and attributes not produced by national map agencies.

On the other hand there is likely to remain a set of reference datasets for which it is both economically and socially sensible for the government to produce and maintain, in order to ensure the common base and reference and allow that they may be used many times.

It has been already widely recognized that the risk and disaster management is strictly depending on available geographic information and spatial data infrastructures, recent catastrophic events demonstrate that their management and mitigation are also directly influenced by volunteered geographic information and data produced by local communities . In this context the *ad hoc* mechanisms and resources for properly managing the geo-information are needed at national and regional level.

It is demonstrated that the risk and disaster management and the recovery process are strictly related to the societal resilience and that this specific societal ability is benefiting from geospatial initiatives. In terms of managing the societal impact it has to be noted that there is a substantial need of awareness raising and capacity building of how geospatial information can be used and the economic and social benefits of such use may be brought in the world.

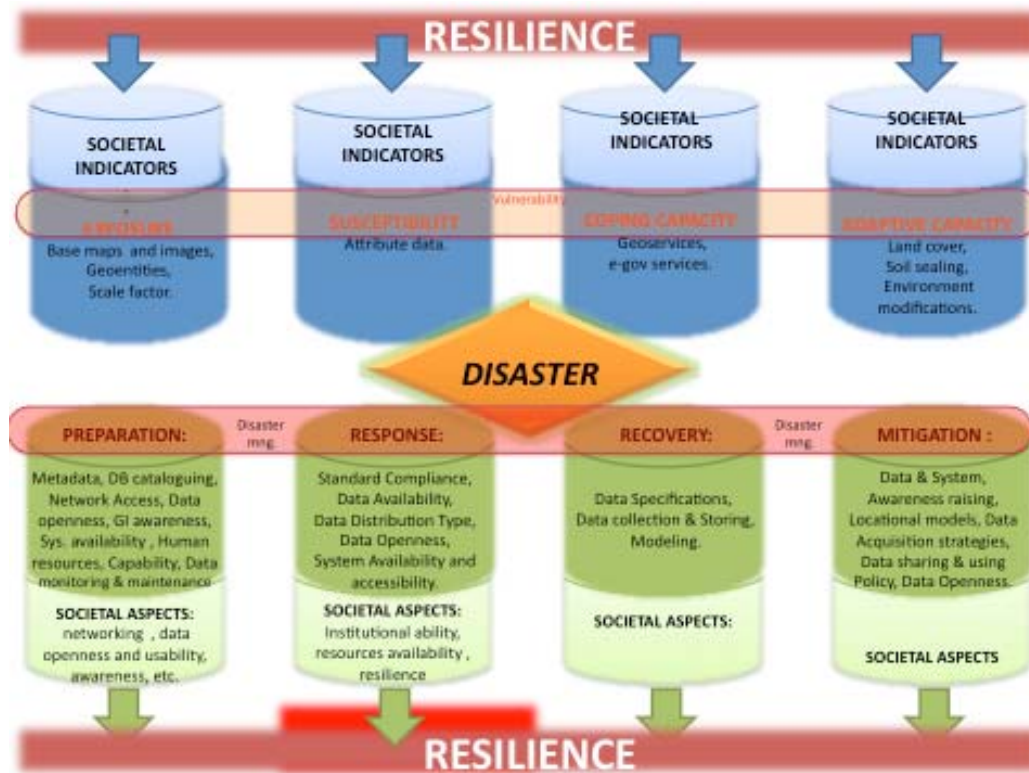
4. **Geospatial initiatives and societal dimension**

While sociologists discussed since several decades the social capital let us consider the Putman sentence : "*The central idea of social capital, in my view, is that networks and the associated norms of reciprocity have value.* " The geospatial initiatives of governments taken for disaster management influence the value of networks and of their normative system and by this way the social capital.

The geodata interoperability and SDI development may give a good example. If a State is fostering interoperability among organizations and networks (also voluntary networks), the capacity of that organizations and networks to collaborate is augmenting even if they are not strictly linked by any formal agreement so that in disaster occurring they are likely able to perform the bridging and bonding of users and user activities. The geospatial information adequately fostered by the State geospatial initiatives increase the social capital to be used in emergency and disaster managing. The geospatial information is playing the role of bond and bridge between the society components for the citizens' benefit.

The increasing of social capital is diminishing the vulnerability and augmenting the resilience of the whole society which, according with the vulnerability indicators becomes more resilient to hazard. The increasing of resilience is also depending on three of the phases of disaster managing (namely preparedness, mitigation, and recovery) as these phases are strictly connected with the use of geo spatial information as shown in table 02.

The figure below is showing how the resilience is influenced by the geo components of disaster management and consequently how the societal aspects (indicators of vulnerability parameters) are influencing the vulnerability index.



5. Problems, caveats and conclusions

While it has been noted by several authors that disasters reveal the divides in society it has to be pointed out that a consistent part of occurring digital divide is geospatial information related. A well developed infrastructure allows reliable computer networks , Internet connections and data accessibility. SDIs allow data cataloging and sharing and the application of modeling and services to standard data sets , as they are fundamental functions in disaster managing phases.

The common and trivial viewer functions (zoom and pan) are far away to give a substantial help during disaster occurring instead the access to robust and complete databases previously organized and harvested is needed. The completeness of data originated by the territory in the preparation phases should not ignore the already existent social components and maps produced as during the recovery phase should not ignore the territorial physical and societal data for geospatial analysis application.

Satellite platforms greatly help in providing on time images but they have to be integrated with human terrain maps in order to allow real disaster managing. Some terrain constituents, specially ones rapidly changing for population movement, are difficult to monitor as also the real disaster area which not necessarily is defined by the satellite detected borders of the physical disaster.

It is worth to note that in the preparation phase geospatial information are collected about the specific critical area (natural and/or manufactured) but often the surrounding area is forgotten in terms of data to be collected and treated. The surrounding areas are often the places where volunteered data are collected and shared. The two types of data sets need to be adequately merged and analyzed.

Considering the humans as sensors is strictly related with the above mentioned issues and introduces relevant considerations about the voluntary common data and geospatial information.

Within the complexity of disaster management the geospatial information have a relevant role. This role is not only directly related to the phase of response but it highly influences all the management phases, as the geospatial information management is one of the components of the social capital. The States should pay specific attention to properly manage the geospatial information through adequate initiatives such as SDIs (Spatial Data Infrastructures), standardization policies, authoritative data and voluntary data, reference data and land cover data aiming to allow to largest population number to use data and services and by this way contributing to increase the social cohesion and the resilience to hazards.

As the UN already recognizes “ *Geospatial information can play a critical role in spurring economic growth and productivity, enhancing governance and improving a citizen’s quality of life.*” This consideration, if shared by the State and the government, should be applied to all disaster-managing phases with specific regard to recovery, mitigation and preparation in order to be effectively ready to the response phase.

In the global vision of disaster management comprehensive tools such as global mapping, already largely and often recalled by UN, should be taken in high consideration as they are giving an uniform distribution of the ground truth knowledge to all world States enabling to manage cross board problems and lack of locally surveyed data. To this regard two major issues need to be addressed the resolution of the mapping and the access to data also before the disaster occurring. As already discussed and stated in the resolutions of 9th UN RCCA the INSPIRE regional experience in Europe is expected to provide useful guidance in this endeavor. In terms of global mapping it should be paid attention to focus on already established results and the latest technologies and achievements such as (30m resolution Global Land Cover data developed by China). The political issues related to give to all States, specially the less favored ones, an equal opportunity to access data at a

sustainable cost or for free and the adequate national capacity for data processing it is major key point of global disaster management.

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