The GEOSS User Requirement Registry: A Common Infrastructure Component Facilitating the Linkage of Science and GEOSS

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GEOSS: A SYSTEM OF SYSTEM FOR USERS AND DRIVEN BY USERS

The Group on Earth Observations (GEO) has the mandate to build the Global Earth Observation System of Systems (GEOSS) as a system that is user-driven and responds to the needs of users in a wide range of societal benefit areas (SBAs) of Earth observations (EOs). The 10-Year Implementation Plan for GEOSS (GEO, 2005) emphasizes the importance of a user-driven GEOSS. Utilizing the societal benefits of EOs in the nine interdependent SBAs of EOs addressed by GEO, GEOSS requires an interdisciplinary scientific approach; a scientific interpretation of the collected observations; and the extraction of actionable information. Science and technology (S&T) communities need to be involved in both the development and the use of GEOSS. Since 2006, the GEOSS User Requirements Registry (URR) is being developed as a facility that enables S&T and other users to express their needs in terms of EOs and to understand the benefits of GEOSS for their fields. A prototype URR became available in 2010 (Plag et al,, 2010) and was improved in 2011 (Plag et al., 2011, see Fig. 1). In response to user demands, on-line tutorials are explaining the concepts of the URR and guiding users through publishing, viewing, and analyzing the URR contents. The Concept of Operation (CoO) for the URR was developed in 2011 (GEO, 2011), and finalization of the operational URR is expected by the end of 2012.

THE URR: A COMPONENT OF THE GEOSS COMMON INFRASTRUCTURE (GCI)

The GCI includes registries enabling users to discover, access, and use EOs and derived products and services available through GEOSS. These registries primarily collect provider-related information on the available services and products, as well as information needed to ensure interoperability between the services contributing to GEOSS.

Complementing these system-related registries, the URR is a user-related registry enabling an efficient dialog between users and providers. It is a community-based facility to publish, view, and analyze information on societal activities depending on EOs and derived products, on the user types associated with these applications, and on a range of needs and requirements.

THE URR DATA MODEL

The core of the data model of the URR consists of seven relations that describe the users, applications, requirements, and various needs related to decision making and support through EOs (Fig. 2). A link relation is used to capture the interconnectivity between entries in each of these relations. This concept is a novel and rather powerful way of capturing interconnectivity. Information on the societal relevance and the implementation status of a link enable the analysis of value chains from EOs to end applications. Table 1 provides an overview of the URR data model.

Table 1: Relations in the URR. Upper part: The seven basic relations. Middle: The Links relation and auxiliary relations. Lower Part: controlled vocabularies defined in the Lexicon.

Relation	Description
Applications	Activities that use EOs or derived information to produce new information or arrive at decisions.
User Types	Generic users involved in applications, benefit from these, or contribute to them.
Requirements	Specifications of observations or derived products.
Research Needs	Research tasks to be performed in order to enable applications that are currently not possible due to a lack of knowledge.
Technology Needs	Description of technology needed to meet preferably observational requirements that cannot be met currently.
Infrastructure Needs	Description of infrastructure needed to meet requirements or execute application that cannot be met currently.
Capacity Building Needs	Description of capacity building required to address problems that cannot be addressed today because of a lack of capacity in terms of organizational or human resources.
Links	Connectivity of a source entry and a target entry in two different relations or in the same relation.
References	References to documents (publications, reports, web pages, etc.) used to link entries to more detailed background information.
Lexicon	Terms used in the URR, including definitions of acronyms & abbreviations.
Keywords	Entries in User Types and Applications can be linked explicitly to keywords.
EO parameter	Requirements can only be specified for EO observation parameters, which first need to be entered in the Lexicon.
Attributes	Special terms indicating a derived quantity of an EO parameter. E.g., *Concentration* is an attribute that could be used in connection with the EO parameter *Carbon dioxide* to indicate that concentration of CO_2 is required.
Medium	Special terms identifying a specific medium in the Earth system. Some observations are only needed in a specific medium (e.g., soil moisture in soil).
Units	Units of measurements, for which it is assumed that the acronym given indicates the short notation for that unit. EO parameter can be associated with a unit.
Acronyms	For each term published in the Lexicon, an acronym can be given.

Figure 1. Upper part of the home Page of the URR. The URR is available at http://www.scgcorp.com/urr. The URR has menus for searching, viewing and exporting entries in the URR (View); publishing data (Publish); and analyzing networks and gaps (Analyze). A graphical interface will allow users to explore the interdependencies between entries. All menus will be fully implemented by the end of 2012.
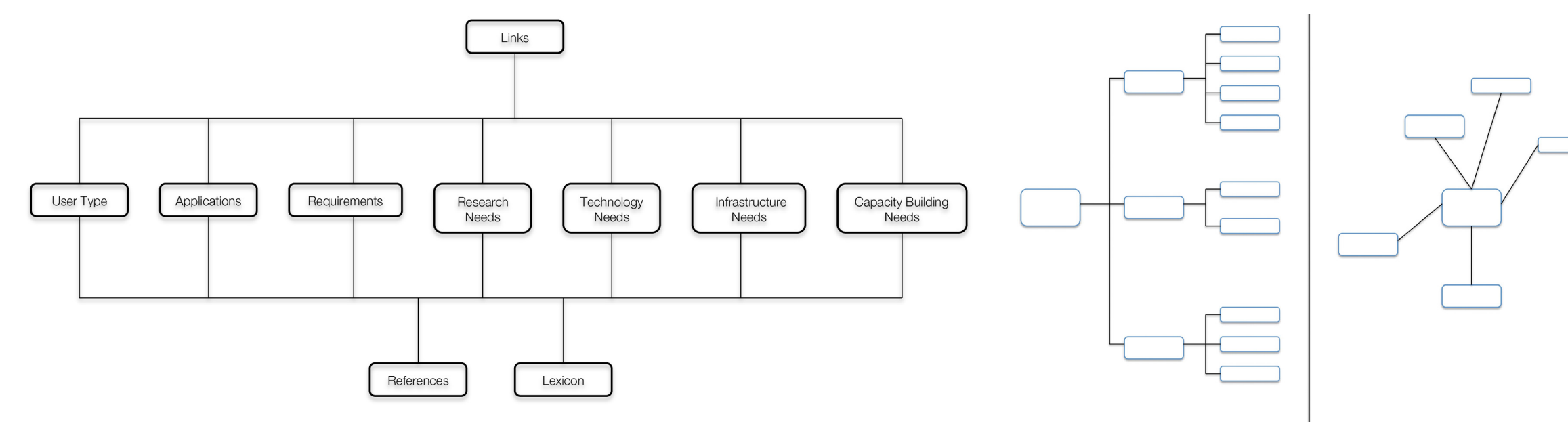

Figure 2. Data model of the URR. The data model can be separated into three parts: (1) seven forms to capture information on user needs and applications (middle); (2) the Links form to capture connectivity (top); (3) a number of auxiliary forms to capture relevant information used in the other parts (bottom).

Figure 3: Two principle approaches to the analysis of needs in a societal area. Left: the global, top-down approach resulting in a comprehensive structure for the area; right: the local, bottom-up approach starting from a local environment. The local approach can be used by any expert in a narrowly defined area of decision making. A global approach requires a broad expert knowledge of a comprehensive field.
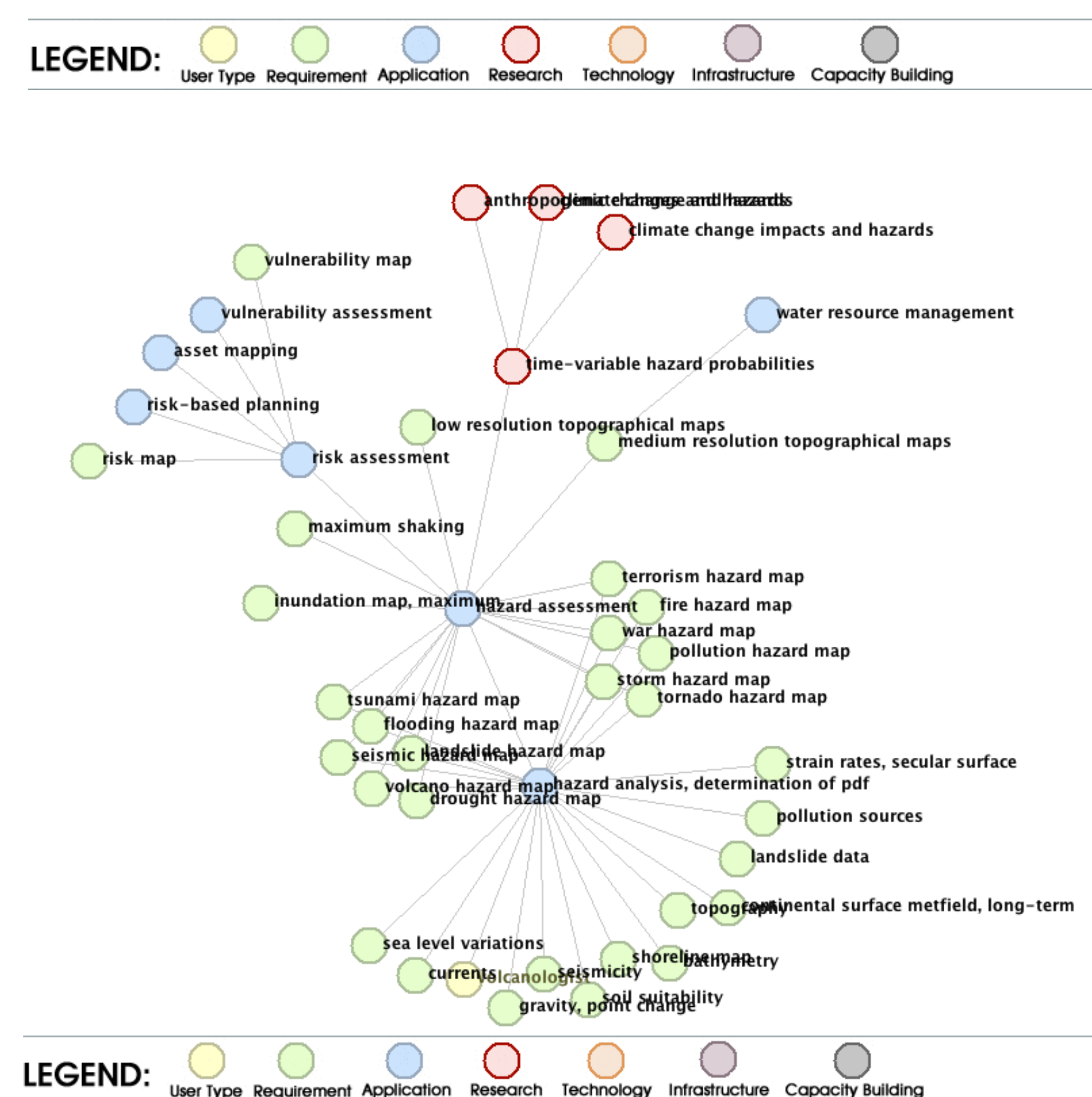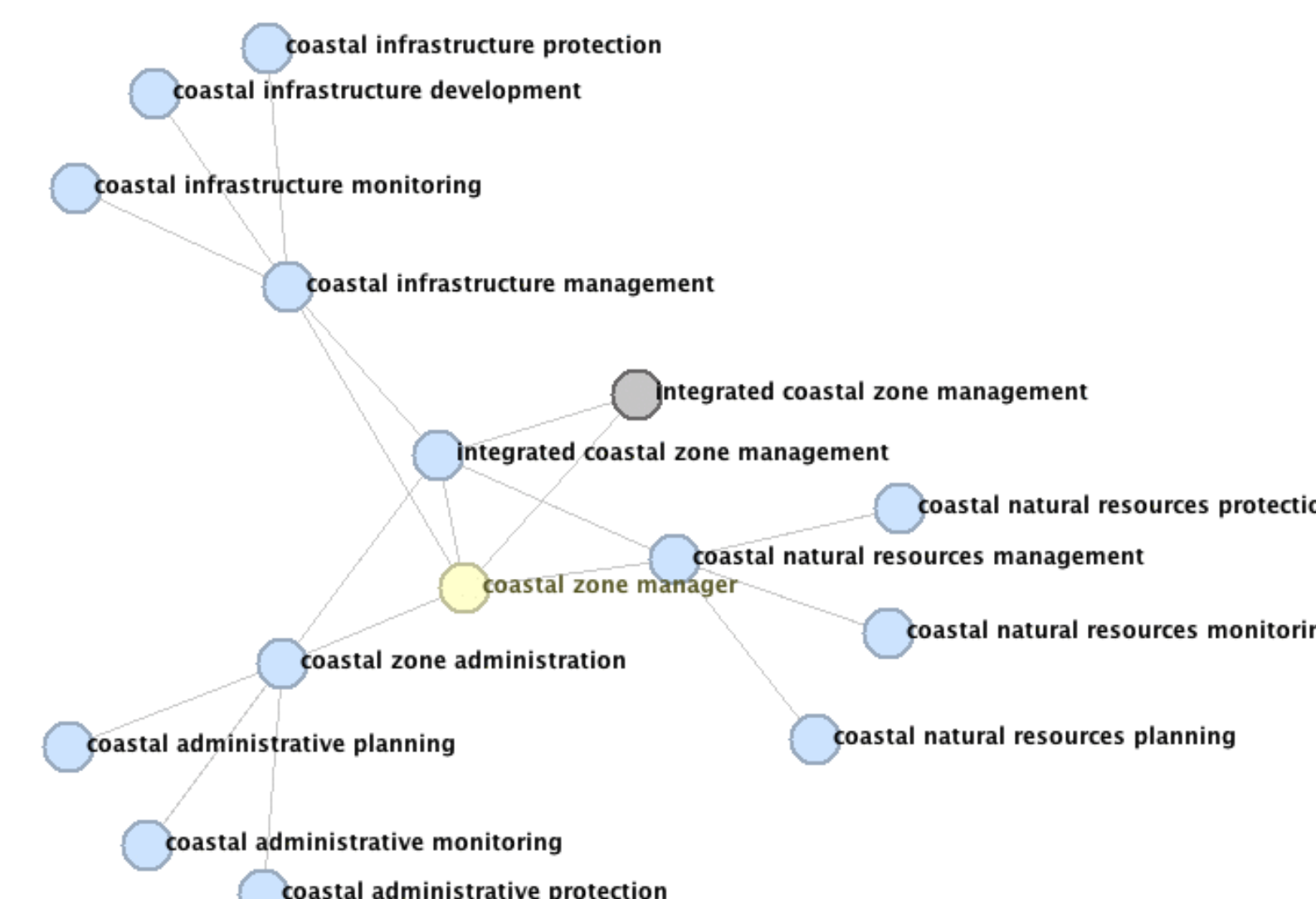

Figure 4. Examples of graphical representation of the interconnectivity captured in the URR. Top: center of graphics is on the application ICZM; Bottom: center is on the application hazard assessment, which feeds into risk assessment and risk-based planning;

METHOD FOR POPULATING THE URR

Experience with the population of the URR was gained in 2010 and 2011. The results of a review of user requirements in the nine SBAs carried out by the UIC (see http://sbageotask.larc.nasa.gov/) were used to translate the requirements in the Health and Disasters SBAs into the URR data model. Risk-based management and Integrated Coastal Zone Management (ICZM) provided two use cases in cross-cutting areas. Populating the URR has two separate aspects, one being the analysis of user needs and applications in a societal area, and the other being the collection of information to be published in the URR.

Methods for the analysis of the various needs and requirements separate into the two main classes (Fig. 3):
– global (more top-down) approach (left sketch): uses a high-level, rather general starting point (e.g., an application), from which all contributing entries can be determined and progress can be made to the next level. Requires analysis prior to start of publishing (for examples, see Fig. 4).
– local (more bottom-up) approach (right sketch): any possible entry can be the starting point to analyze the local environment of this entry. Lends itself to an ad hoc start of publishing.

For the collection of information, we have identified four different methods (Table 2). To date, primarily methods (1) and (2) have been employed in populating the URR. Method (3) will be pursued in 2012 and method (4) is being investigated separately, through the application of the URR infrastructure to a domestic (United States) environmental issue.

Table 1: Attributes to be included in Data Citation

No.	Name	Description
1	Expert-based	Experts in a societal area analyze the area using the global approach and publish the results.
2	Crowd-sourcing	People publish information from their environment using the local approach.
3	Harvesting	Harvest information published in other registries and integrated into the URR.
4	Interviews	Collects information in interviews with users based on agreed-upon questions.

DISCUSSION, CONCLUSIONS AND PERSPECTIVE

The currently available URR provides a viable tool for the publishing and viewing of user-related information, and the analyzing of the links between EOs, applications, and users. The data model of the URR appears to be comprehensive and flexible enough to capture all user-related aspects such that they can be compared to the system-related information in the GCI.

The entries in the URR display a wide range of quality, and in many cases, editing is required. The use of experts is not always a guarantee for the published information being consistent with the URR data model and of high quality. The value of the URR depends on the information published in the URR. An ensemble of methods is needed for the collection of information; perhaps beyond the four described above. The inclusion of research, infrastructure, technology and capacity building needs in the data model opens the URR for emerging uses such as the assessment of the societal relevance of a research need. By publishing and viewing problem-specific data in the URR and graphically displaying options, users have the opportunity to exhibit and differentiate among problem-solving approaches that may not be possible without this dynamic analytical tool.

References

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