A visualization and data-sharing tool for ecosystem service maps: Lessons learnt, challenges and the way forward

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ABSTRACT

A plurality in methods, models, terminologies is used to assess, quantify, map and communicate ecosystem services (ES). The Thematic Working Groups on Mapping (TWG4) and Modeling ES (TWG5) of the Ecosystem Service Partnership (ESP), recent literature and expert workshops, have highlighted the need for developing a platform that systematically organizes, visualizes and shares ES maps and related information. This led to the development of the Ecosystem Services Partnership Visualization Tool (ESP-VT), an open-access interactive platform that hosts a catalogue of ES maps with information on indicators, models and used data. Users can upload or download ES maps and associated information. ESP-VT aims at increasing transparency in ES mapping approaches to facilitate the flow of information within the ES community from academics to policy-makers and practitioners. Populating the ESP-VT with ES maps from different geographic locations, across different spatial scales, using different models and with various purposes, leads to a diverse and heterogeneous ES map library. The scientific community has not yet agreed on standards for ES terminology, methodologies and maps. However we do believe that populating and using the ESP-VT can set a basis for developing such standards and serve towards achieving interoperability among the varying ES related tools.

1. Introduction

Maps are powerful means to visualize spatial information and communicate complex phenomena (McInerny et al., 2014). Maps can be used to support decision-making in policy, spatial planning and management and they facilitate dialogue among science, policy and practice. Hence, a wide variety of spatial information and map sharing systems on land and natural resources have been developed (Bagstad et al., 2013; Pagella and Sinclair, 2014). The data presented in maps are derived in many different ways, including traditional field survey methods, remote sensing data interpretation, modeling and interpolation, and online or participatory mapping (e.g. Toillier et al., 2011; Palomo et al., 2013), resulting in a broad range of map types with varying complexity used to address different user needs.

Ecosystem services (ES) have a strong geospatial component. A wealth of studies has quantified and mapped the supply and demand of different ES at different spatial and temporal scales (Naidoo et al., 2008; Chen et al., 2009; Deng et al., 2011; Burkhard et al., 2012; Schulp et al., 2014), resulting in a diverse array of ES maps. The growth in popularity of the ES approach has seen the emergence of a number of spatial tools addressing different target audiences' needs. All these tools have the common aim of supporting end users in the decision-making process. Such tools range from standalone mapping applications (e.g. Norman et al., 2010; Pert et al., 2013) to online tools or tools tightly coupled to GIS or other software types (Roberts et al., 2010). Yet the exponential increase of the number of these tools allows users to create maps "easily" with all the risks such an approach entails, like not considering errors or uncertainties, when using this information for decision making (Jacobs et al., 2014).

Box 1–Timeline of the ESP-VT development

The development of the '*blueprint for modeling and mapping ecosystem services*' (Crossman et al., 2013) during the 5th ESP Conference by the members of the Thematic Working Groups (TWG) on Mapping and Modelling ES (TWGs 4 and 5) of the Ecosystem Services Partnership (ESP) followed by its publication, initiated an effort to make ES maps and relevant information freely accessible to interested users. ESP Visualisation Tool (ESP-VT) was developed based on this effort. The Joint Research Centre of the European Commission (JRC-EC) led the technical development of the tool. The *alpha* version of the tool was published under the http://esp-mapping.net/Home/ web address and was released in August 2013 during the 6th ESP Conference, where it was tested by ES scientists and practitioners. The participants worked in six groups of four and tested the ESP-VT functions and gave feedback to the provided forms for each of the tool functionalities. The feedback received was then used to improve the functions and structure of the tool and will lead to its *beta* version (see Box Figure). The ESP-VT is a work in progress and in this development phase users can upload maps, consult example entries and send their feed-back through the webpage.
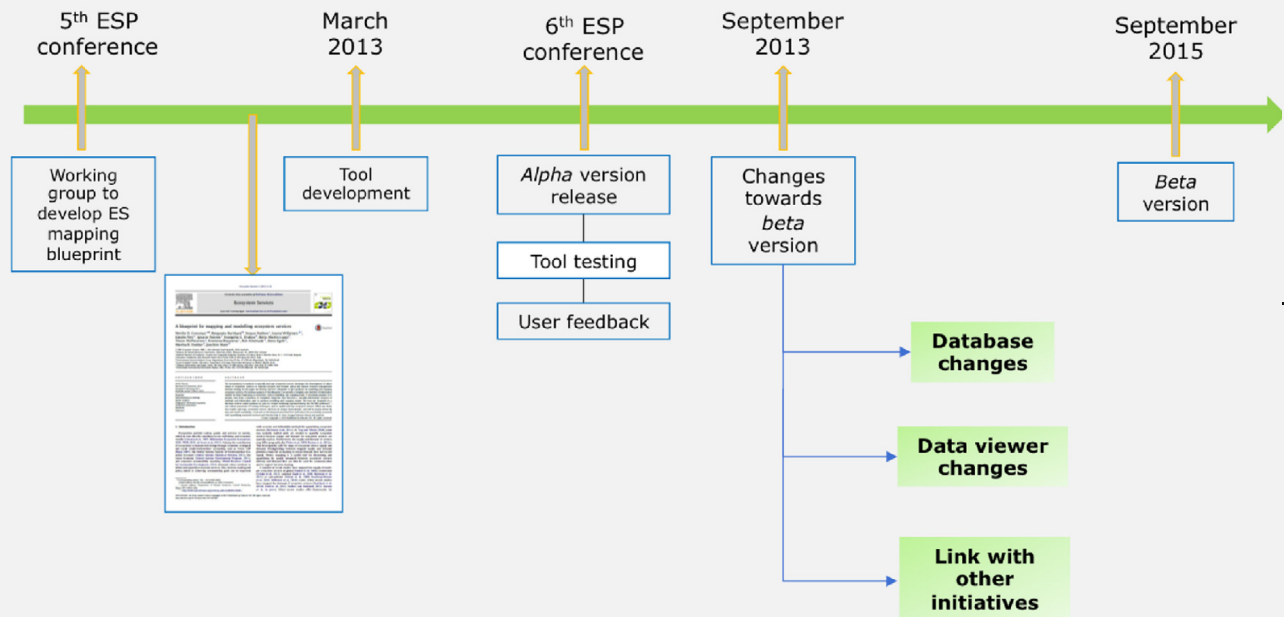
On the other hand when dealing with decision-making one should consider that not all types of ES information can be or need to be presented in the form of maps and this should be made explicit, especially if such tools are used by non-experts. A detailed review of ES quantification and valuation tools was conducted by Bagstad et al. (2013).

The growing popularity of ES within the scientific, policy and practitioner communities (Egoh et al., 2012) creates a demand for standard and consistent presentation of information to ensure common understanding and application within and across these communities (Boyd and Banzhaf, 2007; Seppelt et al., 2012). To this end the ES Mapping[1] and Modelling[2] Working Groups of the Ecosystem Service Partnership (ESP) developed a blueprint for mapping and modeling ES (Crossman et al., 2013), that proposes such a documentation scheme for ES maps. The aim of the blueprint is to serve as a basic framework to structure and share ES spatial information within the science-policy-practice community, as the ES concept becomes mainstream. Providing a method for documenting ES spatial data produced by the many existing online, standalone and GIS-coupled ES modeling tools can set a basis to facilitate the communication between ES "mappers" and "map users". This communication and sharing of ecosystem service maps has been acknowledged as a need for moving forward the field of ecosystem services (De Groot et al., 2010; Hauck et al., 2012; Maes et al., 2012).

In this paper we present the Ecosystem Services Partnership Visualization Tool (ESP-VT), an online platform to collect, publish and share ES maps. The tool is currently available as an *alpha* version (i.e. work in progress), meaning that the content is subject to modifications according to user requirements and suggestions that keep emerging through the ESP community and beyond.

In this paper we give a brief overview of the existing tools and databases for quantifying and mapping ES. We then present the basic structure and functions of the Ecosystem Services Partnership Visualization Tool (ESP-VT). Finally we discuss the challenges encountered in developing the ESP-VT and provide suggestions for a way forward in ES mapping and data sharing to facilitate the development of best mapping practices for ES.

2. Overview of ES tools

Building on Bagstad et al. (2013), we discuss ES related tools into three major categories: (i) those serving as data catalogues; (ii) those serving as toolkits, allowing the users to enter their own input data to map or model ES; and (iii) those combining both, but tailored to the needs of a specific region or a specific ES category. *Data catalogue tools* are mainly listings of available ES assessments (e.g. IPBES catalogue of assessments) or ES valuations (e.g. Marine Ecosystem Service Partnership-MESP database). Such tools serve as data repositories and are useful sources of information especially when dealing with large-scale assessments or gap analyses (e.g. at global, regional levels). Among the identified data catalogue tools, there is indeed no

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[1] http://www.es-partnership.org/esp/79222/5/0/50.
[2] http://www.es-partnership.org/esp/79026/5/0/50.