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New EU-scale environmental scenarios until 2050 – Scenario process and initial scenario applications

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ABSTRACT

Understanding uncertainties and risks can be considered to be the main motivation behind environmental scenario studies to assess potential economic, environmental, social or technical developments and their expected consequences for society and environment. The scenario study presented in this paper was designed to contribute to the question of how natural capital and ecosystem services may evolve in Europe under different socio-environmental conditions. The study was conducted as part of OpenNESS, an on-going EU FP7 research project. We present the iterative participatory scenario process, the storylines and drivers, examples for regional applications, as well as initial feedback from stakeholders.

In a participatory iterative approach four scenarios were developed for the period to 2050, involving regional and EU-level users and stakeholders. Subsequently, scenarios were successfully contextualised and applied in regional place-based studies under widely differing socio-environmental conditions. Regional teams used different approaches to adapt storylines and drivers to the regional contexts. In an internal evaluation process among regional stakeholders some participants expressed concerns about the scenario method. Suggestions are made how to overcome these limitations. However, most participants approved the scenario method, especially in terms of provoking discussions, and confirmed the usefulness and applicability of the approach.

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1. Introduction

Understanding uncertainties and risks can be considered to be the main motivation behind 'Futures Thinking' or 'Futures Studies' to assess potential economic, environmental, social or technical developments and their expected consequences on society and environment (Lempert et al., 2004; Liu et al., 2007; O'Neill et al., 2015; Raskin et al., 2002; Tversky and Kahnemann, 1974). A broad range of approaches such as forecasting, predictions, scenarios, trend and uncertainty analysis is used to assess future developments and their consequences on economy, society or the biophysical environment (Bernarie, 1988; Bishop et al., 2007; Hulme and Dessai, 2008; Lempert et al., 2004; Webster et al., 2003). In the

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context of environmental and climate change studies, scenarios seem to be the dominant approach for assessing uncertain futures, such as the IPCC RCP/SSP scenarios, the scenarios of the Millennium Ecosystem Assessment, UNEP's Global Environmental Outlook and others (MEA, 2005; O'Neill et al., 2015; Raskin et al., 2002; UNEP, 2007; van Vuuren et al., 2012, 2014). Many approaches and methods can be combined, which is frequently done in practice. In many studies participatory approaches and mathematical models have been applied in a combined way, which some authors see as an integral step of scenario analysis (Alcamo, 2001; Biggs et al., 2007), while others highlight qualitative or semi-quantitative aspects, depending on the purpose of the study or the preferences of the intended users (Bohunovsky et al., 2010; Henrichs et al., 2010; Kok, 2009).

The scenario study presented in this paper was conducted as part of OpenNESS, an on-going EU FP7 research project (http://www.openness-project.eu/) and builds on existing broad-scale and global scenario approaches. However, a recent scenario review (Hauck et al., 2015) revealed significant shortcomings of existing broad-scale environmental scenarios, in terms of not addressing the future of ecosystem services (ES) explicitly, except the Millennium Ecosystem Assessment (MEA) scenarios (MEA, 2005). However, two aspects were considered as limiting. (i) The MEA scenarios all assume the sustained provision of ES, with a strong focus on demand and supply of provisioning services, and (ii) they make very explicit assumptions about policies, e.g. the pro- or reactive policies involved to achieve the final states of the scenarios.

The new scenarios intend to fill some of the thematic gaps in existing broad-scale environmental scenarios (Ferrier et al., 2016), e.g. to assess conditions leading to increasing or decreasing ES levels. They have been developed as an integrated environmental scenario study contributing to assess futures of natural capital (NC) and ES under different socio-environmental conditions at different scales. Furthermore, they intend to support approaches which try to answer the question of how the ES concept can be operationalized, and providing a framework to evaluate different governance/policy options, e.g. concerning their robustness under different future conditions. In this paper, we present the scenario development process, the storylines and drivers, as well as examples for regional applications. Finally, we present initial stakeholder feedback evaluating scenario process and products and discuss strategies to overcome some of the limitations identified by stakeholders.

2. Methods

2.1. Scenario process

The thematic framework of the scenarios was defined by the focus of the OpenNESS project on the concepts of natural capital (NC) and ecosystem services (ES). In the scenario context the objective implies an exploration of future changes of NC and ES and the biophysical and socio-economic conditions or driving forces leading to different futures.

The conceptual framework and methods for integrative scenario development mainly followed the work by Priess and Hauck (2014). They based their participatory scenarios on three components of a scenario framework: (i) user and stakeholder participation, (ii) knowledge integration, and (iii) quality control, all of which are considered prerequisites to developing integrative scenarios that serve as common boundaries for place-based studies as well as for decision-making needs at different levels. Scenarios are typically developed in a series of steps, e.g. the procedures suggested by Alcamo (2001) or Kok (2009). Similarly, a six-step participatory and iterative approach has been used in OpenNESS: (1) establishing a scenario team – (2) review of drivers – (3) selection of drivers (and indicators) – (4) development and review of storylines – (5) application of scenarios at EU/case study levels – (6) synthesis and feedback to case studies and EU level. In this paper we present steps 1 – 5 and provide initial feedback from stakeholders based on an evaluation of the scenario and other key methods applied in the project.

First, the scenario team was established, covering a broad range of thematic and methodological expertise and ensuring the participation of modellers and leaders of regional place-based studies as key end-users (see section Participation for more details). After establishing the scenario team, an ex-ante survey among the 27 OpenNESS regional studies was conducted to assess their perceptions of key drivers of ecosystem and ecosystem service change at the (i) European and (ii) case study level (an overview of results is presented in Appendix A). Second, an additional component was included at the beginning of the scenario process in the form of an extensive review, which was conducted to assess the range of quantified assumptions of existing global and European environmental scenarios with the objective of providing guidance on the drivers for the new scenarios (Hauck et al., 2015).

The scenario team considered a generic set of EU level scenarios in the form of storylines followed by a process of driver quantification as the most useful approach. Previous studies and scenario manuals repeatedly pointed out that a low number of scenarios (3–6) is advantageous in participatory processes to avoid overburdening participants, scientists, and also the scenario team (Henrichs et al., 2010). In OpenNESS, four scenarios were developed along two axes of uncertainty. Based on the preferences and recommendations of intended users from science, the broader public and policy-making, it was decided that the OpenNESS scenarios should explicitly address mid-term (to 2030) and long-term changes (to 2050); scientists tended to focus on the long term while preferences from the public and policy making arenas tended towards the short- to mid-term period.

Different methods or combinations of methods can be used to develop scenarios, e.g. explorative vs. normative scenarios involving *backcasting, visioning, storytelling, fuzzy cognitive maps*, or other methods (Alcamo et al., 2008; Keune et al., 2014; Kok, 2009; Kok et al., 2011). Based on the inputs from the survey, the scenario review and the expertise of the team, a normative approach which included backcasting methods was used. In scenario processes, backcasting is often used to assess the pathways to desired futures or undesirable ones to be avoided. In this scenario process, it was applied in a general way to identify trajectories and characteristics, which (parts of) society may want to avoid, such as overexploitation of natural resources and declining levels of ES supply.

2.2. Participation

Different potential users and stakeholders were identified by the scenario team. One of the core objectives of this scenario process was to provide a common set of assumptions and constraints (common boundary conditions) for those of the 27 regional case studies which planned to use scenarios (n = 14). Many examples are available of studies deriving boundary conditions for regional and local environmental change assessments, interpreting regional storylines from global or European levels (Rounsevell et al., 2006; Rounsevell and Metzger, 2010; Kaljonen et al., 2012) and downscaling and contextualising broad-scale scenarios for regional or local levels (Zurek and Henrichs, 2007; Alcamo and Henrichs, 2008; Metzger et al., 2010; Kaljonen et al., 2012). While the 27 place-based studies participating in this project were organised in different ways, all of them had OpenNESS representatives and advisory boards or additional forms of public participation,

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