



A critical review of the application of environmental scenario exercises



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ABSTRACT

Scenario exercises have become instrumental across multiple fields, from their original usage in business and military planning, to being ubiquitous in environmental planning and policy formation. This article critically reviews whether there are explicit and imminent divisions between how scenario exercises are used and discussed, with particular focus on the literature of qualitative scenarios concerning environmental challenges. The authors interrogate what scenario exercises are in actual practice, in the context of what they are used for and how they are designed, before then considering the criteria for determining 'success' for a scenario exercise. The particular focus of the literature analysed is in the emergence of the discipline of 'environmental scenarios', being scenarios concerned with 21st Century environmental challenges such as the influence of climate change on the notion of natural hazards.

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1. Introduction

Scenario exercises have become instrumental across multiple fields, from their original usage in business and military planning (Lakoff, 2007), to being ubiquitous in environmental planning and policy formation. This article critically reviews whether there are explicit and imminent divisions between how scenario exercises are used and discussed, with particular focus on the literature of qualitative scenarios concerning environmental challenges. The authors question what scenario exercises are in actual practice, in the context of what they are used for and how they are designed, before then considering the criteria for determining 'success' for a scenario exercise. The particular focus of the literature analysed is in the emergence of the discipline of 'environmental scenarios', being scenarios concerned with 21st century environmental challenges such as the influence of climate change on the occurrence and consequences of natural hazard events.

The term 'scenario' has particular properties in the context of 'environmental scenarios', although the core criteria retain the earlier definitions of 'scenario' found in the broader literature (Börjeson, Höjer, Dreborg, Ekvall, & Finnveden, 2006; Bradfield, Wright, Burt, Cairns, & van der Heijden, 2005). The properties particular to 'environmental scenarios' have been most comprehensively determined by major multi-year, multi-governmental international projects about environmental challenges, as these organisations have established the main properties in order to conduct the scenario exercises for their projects. The United Nations Environment Programme's (UNEP) 3rd Global Environmental Outlook (GEO-3), for example, defines scenarios as 'descriptions of journeys to possible futures' which 'reflect different assumptions about how current

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trends will unfold, how critical uncertainties will play out and what new factors will come into play.' Furthermore, GEO-3 argues that 'it is now generally accepted that scenarios do not predict. Rather, they paint pictures of possible futures, and explore the differing outcomes that might result if basic assumptions are changed' (UNEP, 2002: 320). The UN's Millennium Ecosystem Assessment (2001–2005) added the additional criteria that scenarios should be 'plausible and often simplified descriptions of how the future may develop based on a coherent and internally consistent set of assumptions about key driving forces and relationships' (Carpenter, Pingali, Bennett, & Zurek, 2005). Similarly, the Intergovernmental Panel on Climate Change (IPCC) has placed an emphasis on the importance of coherency and plausibility, as it defines a scenario as 'a coherent, internally consistent and plausible description of a possible future state of the world.' The IPCC (2013) also aligns with UNEP's argument that 'scenarios do not predict,' as the former further defines a scenario as 'not a forecast; rather, each scenario is one alternative image of how the future can unfold'. A scenario would seem to be, on this account, a credible possible future; predictive, but not a prediction.

While these definitions clarify central tenets of 'scenarios,' they avoid defining the term once it is joined with its main associated terms: 'exercise', 'development' and 'analysis'. When 'scenario' is used in conjunction with these words the meaning becomes much less clear. Environmental scientist Joseph Alcamo, who has contributed more to disambiguating these terms than any other writer, reasons that this arises since 'scenario development is the discursive procedure by which a scenario or a set of scenarios is conceived, formulated, and elaborated' such that scenario development becomes synonymous with 'scenario building'. In relation to this distinction, he defines 'scenario analysis' as 'a broader concept encompassing both scenario development and the analysis of scenarios' whereby scenario analysis is 'a procedure covering the development of scenarios, comparison of scenario results, and evaluation of their consequences' (2008: 16). However, Alcamo himself nevertheless perpetuates the inconsistent terminology, arguing in one instance that since the terms 'scenario exercise' and 'scenario-based assessment' are often used interchangeably with 'scenario analysis,' the authors in the accompanying volume 'therefore use the three terms interchangeably' (2008: 16). Bishop, Hines, and Collins (2007) also found these persistent 'confusions' around such key terminology and techniques. In line with Alcamo, they argue that the three fundamental 'confusions' in the scenario literature stem from terms being used interchangeably: namely, equating 'scenario development' with 'scenario planning,' equating the term 'scenario' with 'alternative future,' and equating the terms 'methods' and 'techniques' (2007: 6).

The following paper synthesises a wide-ranging review conducted as part of an Australian research project funded by the Bushfire & Natural Hazards Cooperative Research Centre, a government-funded not-for-profit founded to explore the causes, consequences and mitigation of natural disasters (see Wodak, 2014). The project, 'Scientific Diversity, Scientific Uncertainty and Risk Mitigation Policy and Planning', explores the utilisation and management of scientific knowledges and scientific uncertainties in bushfire and flood risk mitigation practice in Australia (see Neale & Weir, 2015). Project researchers identified scenario exercises as an effective possible method to inquire into the knowledges and uncertainties of risk mitigation professionals. To complete this review, approximately 250 sources on scenario exercises, methodology, analysis, and design were reviewed, including from academic journals, white papers, grey literature, industry guidelines, governmental and NGO reports, training manuals and coursebooks. A mixture of highly practical and applied guidelines were incorporated into the analysis in conjunction with more theoretical academic articles. For instance, sources were collected through a review of the journals which extensive history in analysing scenario exercises, including from *Futures*, *Foresight*, *Environmental Modelling & Software*, *Environment & Planning*, and *Environmental Research Letters*. Case studies and projects discussed in these journals were then reviewed, to obtain more primary material on actual scenario exercises. These were then cross-referenced with NGO and governmental reports, drawing on the outreach dimensions of such projects, where formal reports were published as part of the respective projects, including self-reflexive reviews of the 'success' of their scenario exercises.

2. How are scenarios used?

To define the term 'scenarios' when conjoined with its associated terms 'exercise', 'development' and 'analysis' requires applying these terms to their context of actual practice. However, examining scenario practice reveals two broad meanings, defined by two dominant approaches to scenario exercises. In the first, scenario exercises involve the generation of predictive models of possible future events through quantitative analyses. Scenarios in such cases may be produced across levels of probability, as in Monte Carlo simulations, but always within parameters selected to give meaningful insight into the future. In the second, scenario exercises involve participants of various kinds responding to possible future events in order to pay attention to how knowledge of such futures is produced. The authors are here more concerned with this second meaning of 'scenario exercise'.

Exploring these terms in practice, there is broad consensus in the literature that there are two principal types of scenario exercises, comprising five specific subcategories of scenario exercise design. This does not imply that there are not alternate models and typologies, for instance Bishop et al. (2007) argue for the existence of 'eight general categories (types) of scenario techniques with two to three variations for each type, resulting in more than two dozen techniques overall' (2007: 10). While their typology presents a comprehensive overview of these 'more than two dozen techniques,' this article is principally concerned with the aforementioned two principal types of scenario exercises that emerge in the literature pertaining to 'environmental scenarios'.

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