



Guest Editorial

Introduction to the special issue on “Scenario analysis for forest policy and forest management – New insights and experiences”[☆]

“This uncertainty of the future is one of the main marks of the human condition. It taints all manifestations of life and action”.
Von Mises, 1962, p. 65.

1. Introduction

The future has always fascinated and interested mankind. This is especially true in the forest sector. With the long time horizons typical for forestry processes, spanning decades and even generations (Zivnуска, 1949; Price, 1989; Kangas and Kangas, 2005; Hoogstra and Schanz, 2008, 2009), it is not surprising that thinking about the future has a long history in forest policy and forest management. However, the rapid and volatile changes we are currently facing pose a renewed urgency and new challenges to thinking about the future in the forest sector; the last decades have brought structural changes (a.o., climate change, technological advances, increasing importance of forest related services) to the forest sector on a national, European and global level whose full consequences simply cannot be foreseen (Hurmekoski and Hetemäki, 2013). Wagner et al. (2014, p. 32), for example, talk about climate change adding a new and unparalleled dimension to dealing with the far-off future in forestry. Lawrence (2017) writes about such instability and unpredictability that we deal with a “no-analogue” future.

The fact that the future is uncertain is sometimes considered to be fortunate, as a foreseeable and certain future would mean an unliveable life. “Without this uncertainty, human activity would lose its degree of freedom and its meaning – the hope of a desired future” (Godet and Roubelat, 1996, p. 164). The notion of an open future, which can be actively shaped and influenced, is inseparably linked with a not yet determined and, hence, in principle unforeseeable future. At the same time, it is inherent to man to strive for certainty and predictability, not only because it seems to fulfill the human desire for security (Slovic, 1978), but also because knowledge of the future may offer many other possible benefits such as power, wealth, influence and fame (Pillkahn, 2008). Imagine the advantage a forest manager would have in deciding which tree species to plant if he would know what climate to expect, how the timber market would unfold or what policies to await. As long as the environment is stable and the patterns of past and present developments can be reliably projected into the future, future thinking can be rather straightforward. But how can one can think and act strategically, given the unpredictability of all the occurring changes? As stated by Bielawski (2008, p. 102), “Without a time machine any attempt to grasp firmly the future is like a wild goose chase or, at best, like shooting at a moving target”.

Over the last decades, scenarios have become an important tool in the forest sector to support strategic decision-making in the face of future uncertainties. Scenarios are descriptions of possible future developments and acknowledge the uncertainty that is inherent to the future as they capture alternative, albeit equally possible future developments (O'Brien, 2004). This way of thinking can help decision-makers prepare for the uncertain future by stimulating them to think on what could happen, what possible opportunities and threats may occur in the future, and what courses of action could be taken in case a specific event happens (Jarke et al., 1998). The fact that scenario approaches have gained a strong foothold in the sector over the last decade is not that surprising, given that scenario approaches are considered especially suitable in situations where “uncertainty is high, the problem is complex and a long-term view is essential” (Kok et al., 2011, p. 836). Decision-makers in forestry continuously face these kinds of situations.

Due to all the applications and developments of scenario planning over the last decades, not only but also in the forestry sector, the evolution of scenario planning still continuous (Bradfield et al., 2005; Wright et al., 2013b), as well in regard to the theoretical foundations as on the methodological level (Wilkinson, 2009). This special issue contributes to the ongoing development of the scenario planning field by bringing together five papers on the forefront of scenario analysis for forest policy and forest management. The papers were written in the context of the EU FP7 INTEGRAL project (Future oriented integrated management of European forest landscapes), in which 21 partners from 13 European countries focused on collecting and assessing changes in the structural framework of forest development, anticipating future trends and influences, and evaluating their consequences for forest management and the resulting Ecosystem Services. The contributions to this special issue (see table 1) focus on different scenario approaches in diverse organizational and geographic contexts, documenting insights and experiences in order to provide an exploration and evaluation of ongoing trends. Together, the articles illustrate the future potential of scenario analysis for forest policy and management.

This editorial is structured as follows. Section 2 of this paper provides a theoretical frame, offering a perspective to grapple with foresight and

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Table 1

Papers of this special feature.

Hoogstra-Klein, M.A., Hengeveld, G. M., & de Jong, R. Mozgeris, G., Brukas, V., Stanislavaitis, A., Kavaliauskas, M., & Palicinas, M. Hengeveld, G. M., Schüll, E., Trubins, R., & Sallnäs, O.	Analysing scenario approaches for forest management – One decade of experiences in Europe. Owner mapping for forest scenario modelling – A Lithuanian case study.
Sotirov, M., Blum, M., Storch, S., Selter, A., & Schraml, U.	Forest Landscape Development Scenarios (FoLDS) – A framework for integrating forest models, owners' behaviour and socio-economic developments. Do forest policy actors learn through forward-thinking? Conflict and cooperation relating to the past, present and futures of sustainable forest management in Germany.
De Bruin, J.O., Kok, K., & Hoogstra-Klein, M.A.	Exploring the potential of combining participative backcasting and exploratory scenarios for robust strategies: Insights from the Dutch forest sector.

scenario planning in forestry. [Section 3](#) provides a description of scenario planning in forestry and introduces the five articles. The last [Section 4](#) reflects on the insights gained from the five papers of this special feature.

2. Theoretical background

Scenarios are essentially an instrument to deal with the irreducible uncertainty that is inherent to the future due to the complexity of systems. It is therefore not surprising that several scholars have explored the relation between scenario studies and complexity thinking (a.o., [Mannermaa, 1988, 1991; Wilkinson et al., 2013](#)). In this theoretical background, we will also couple scenario thinking with complexity theory to offer a particular perspective on the challenges of creating tenable forecasts – not only, but also in the field of forest policy and management. To do this, we will make use of the work of Weaver, who published a short article on “Science and Complexity” in 1948, in which he distinguished three types of research problems according to the nature of their inherent complexity ([Weaver, 1948](#)): (1) problems of simplicity, (2) problems of disorganized complexity, and (3) problems of organized complexity. These three types provide a frame that describes the basic theoretical features of scenario planning as a science-based activity and explains the different meanings of the term scenario in each context.

2.1. Complexity and scenario approaches

The first type of problems [Weaver \(1948\)](#) called *problems of simplicity*. This type is common in settings that consist of relatively few relevant and variable elements. These elements are known, as are the relations between them, which are more or less stable or even have a law-like character. The system under study can be delimited quite clearly from its environment, so that external influences can either be controlled or ignored, as they do not have relevant effects on the overall system. Typical examples for this kind of problems stem from the field of optics or mechanical systems, where a given intervention always triggers the same effect. [Weaver \(1948\)](#) points out that this type of problem characterized the science of physics between around 1600 and 1900. Science made tremendous progress in solving this type of problems and the practical application of the gained knowledge led to vast technological advancements. The success in solving this type of problem influenced the idea of science itself and subsequently the notion of scientific forecasting ([Willke, 2006](#)). Especially in the natural sciences the common expectation towards a scientific forecast would be that perfect knowledge about the cause-effect relationships that govern a system is to be obtained and, thus, a deterministic model to be created ([Popper, 2002](#)).

The form of these models correspond to the idealized version of deductive-nomological models (DN-models) proposed by [Hempel and Oppenheim \(1948\)](#), which allow – in the model's intended determinism – to deduce explanations by combining the specific circumstances of a given setting with the law-like causal relations in force. According to Hempel and Oppenheim, scientific predictions consist of the same elements and even have the same logical structure as explanations. The difference between an explanation and prediction is caused by the given moment in time: past and present facts have to be explained while future phenomena have to be predicted. Apart from that, the applied procedure to come to an explanation or prediction is considered as structurally identical. For example, the general rule (based on experimental observations) that the application of fertilizer increases the forest growth-rate can *explain* the past or present growth-rate of a fertilized stand. Obviously, it can also be used to *predict* an increase in growth-rate if fertilizer would be applied.

In spite of its limitations to settings that are characterized by problems of simplicity, this methodological approach is quite common in future oriented research and in forestry research. Most models, including forest growth models and model-based decision support systems (DSS), are based on the concept of a finite and known set of elements that are interconnected by cause-effect relationships. In their idealized form these approaches are characterized by deterministic solutions. They yield clear and unambiguous predictions (output) depending on the special conditions or circumstances introduced (input). The already mentioned DSS, for example, are often used for forest scenario planning. They predict the answers to management and policy questions given a “what-if” scenario, for example, the effect on profitability and carbon sequestration if a certain forest management-based mitigation measure is taken in a modelled forest, as determined in the recent study of [Bösch et al. \(2017\)](#).

The second type of problem is called *problems of disorganized complexity*. Problems of this type are common in settings, which are characterized by a high number of involved elements, which, however, are disorganized in the sense that they only interact in ways that are irrelevant for the development of the whole system. Therefore, individual peculiarities level out and the law of large numbers applies. Statistical estimations do not yield specific information about the state or behavior of an individual element of the system, but are able to describe the system as a whole. Thus, it is possible to produce reliable forecasts for generic parameters of the overall system as long as external influences can be excluded.

On a structural level, the predictive approaches to settings that are characterized by problems of disorganized complexity resemble those of problems of simplicity. The basic difference lies in the nature of how the involved elements are related. Whereas causal relations assert that whenever specific conditions occur, a specific event will take place, the so-called statistical laws do not imply effects in a specific case, but assert that “in the long run, an explicitly stated percentage of all cases satisfying a given set of conditions are accompanied by an event of a certain specified kind” ([Hempel and Oppenheim, 1948](#), p. 139). So, while the structure of predictions that are based on statistical laws is in principal similar to the structure of predictions that are based on causal laws, the former refers to the overall effects that a specific intervention or condition will have on a defined set of cases. Forecasts of this kind are common in the field of demography; typical examples are the risk calculations of insurance companies ([Lengwiler, 2010](#)). Examples from the forestry sector would be the methodological approaches applied in outlook studies. The scenarios (projections) provided by these studies build on econometric analysis and firmly rest on the law of large numbers in the sense that individual peculiarities of consumers and

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