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Anticipating cascading change in land use: Exploring the implications of a major trend in US Northern forests

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ABSTRACT

Land managers, planners, and policy makers need to proactively consider the potential effects of change in order to prepare for it. But the direct consequences of social and ecological change are often not thoroughly identified and explored in policy analysis, and possible higher-order implications are rarely considered. This study used a structured group process called the Futures Wheel to uncover and analyze possible higher-order implications of an important trend in US Northern forests: lack of age-class diversity and uniform aging. Multidisciplinary teams of participants generated 384 possible second- and third-order implications of this trend and scored them for desirability and likelihood. The large set of implications identified by our participants suggests some daunting challenges. But positive consequences also emerged from the group process, indicating opportunities. Foresight tools such as the Futures Wheel can help environmental decision makers anticipate the future to avoid problems and make the most of opportunities.

1. Introduction

Forests are continually changing due to many natural and anthropogenic factors. Current major drivers of change affecting forests include policy and management actions (or inaction), climate change, nonnative invasive species, urban expansion, wildfires, forest fragmentation, and parcelization (e.g. Butler, 2008; Smith et al., 2009; USDA Forest Service, 2009, 2012; Shifley et al., 2012). Changes such as these produce direct impacts as well as cascading higher-order consequences. Land managers, planners, and policy makers need to proactively consider the potential positive and negative effects of cascading change in order to prepare for it. Early awareness of positive but unlikely consequences could prompt the timely design of policies to promote desirable effects. Advanced warning of possible negative consequences of change can enable decision makers to design strategies and management actions to avoid or mitigate future disasters. Foresight about the cascading implications of change is needed to strengthen the resilience of social-ecological systems.

Unfortunately, policy analysis tends to focus on the more obvious direct or first-order impacts of change and rarely considers possible higher-order consequences (Hummel, 1984; Garb et al., 2006). Second- and third-order impacts are more difficult to discern, often involve surprising social and economic consequences, and may be most important due to their far-reaching effects. In addition to focusing on first-order impacts, decision makers often focus on the ecological implications of change. Analyses that give greater prominence to social and economic implications are particularly important in implementing sustainable land management, which by definition includes ecological, social and economic considerations.

This paper describes an application of the Futures Wheel, a structured brainstorming technique developed to uncover and evaluate possible higher-order consequences of change (Bengston, 2016; Glenn, 2009). The Futures Wheel is easy for participants to learn and can be carried out with minimal training and equipment. The method has been widely used in corporate, military, and intelligence settings to explore potential unanticipated consequences of all types of change, including emerging trends and issues, new policies, policy changes, and technological innovations. The group process facilitates “cascade thinking,” that is, “how one event or implication leads to multiple possibilities, each of which in turn leads to additional possibilities” (Barker and Kenny 2010, 2). Cascade thinking enables planners and decision makers to proactively consider potential long-term, higher-order effects of change in order to prepare for it. The Futures Wheel process also stimulates non-linear thinking and shifts the mind away from simplistic, linear patterns. This facilitates the detection of unforeseen implications of change that are difficult to perceive.

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The change explored in this paper is the lack of age-class diversity and uniform aging in Northern US forests, a trend that will have profound implications for forestland policy and management in the coming decades (Shifley et al., 2014). The following section summarizes this trend, followed by a description of the specific approach to the Futures Wheel used in this study. Next, the results of a series of Futures Wheel workshops conducted with a diverse group of forestry professionals are described, identifying possible implications of the uniform aging of Northern US forests. The results include discussion of future themes and scenarios that emerged from the exercise, as well as unique implications, trends and countertrends, highly significant implications, and "wild cards." A concluding section assesses the usefulness of this tool for forestland policy and planning.

2. Trend: aging northern forests

A lack of age-class diversity and uniform aging of northern US forests was one of five anthropogenic trends identified by Shifley et al. (2014) as profoundly affecting forest conditions and management needs in the northern United States over the next 50 years. This age class pattern has low diversity and is generally considered less resilient than a forest landscape with a more even distribution of forest area among age classes. Northern forests are defined here as forests in the 20-state region bounded by Maine, Maryland, Missouri, and Minnesota (Fig. 1). Forests are a dominant land use in this region, which is the mostly densely forested (42% of land area) and populated (74 people/km^2) area of the United States, with 70 million ha of forestland and about 124 million people. Salient details about this trend include:

- Almost 60% of northern forestland is clustered in age classes spanning 40–80 years (Fig. 2).
- Young forests (age 20 years or less) comprise 8% of all forests in the region; forests older than 100 years comprise 5%.
- Within the Northern forests, this unimodal pattern of clustered age classes is repeated at smaller spatial scales for individual states and for individual forest-type groups (Shifley and Thompson 2011; Shifley et al., 2012; Miles 2015).
- The unimodal age-class distributions common through the North are markedly different from those observed for other regions of the United States (Pan et al., 2011).
- Because of the vast forest area and the relatively low rates of forest disturbance, without significant intervention the uniform aging of the northern forests will continue for decades to come.
- The unimodal pattern of clustered age classes in Northern forests is an artifact of anthropogenic influences over the past century that include patterns of timber harvest, land clearing, land abandonment, livestock grazing, wildfires, and fires suppression (MacCleery, 2011).

3. Method: the futures wheel

The Futures Wheel was originally proposed by futurist Jerome Glenn (1972) as a way to help students understand the implications of change. The method has since been developed and extensively applied in many fields. Corporate, military, public sector, and nongovernmental organization (NGO) planners and decision makers have used it to identify and analyze unforeseen consequences of emerging trends, new policies, technological innovations, and other types of change. Published applications of the Futures Wheel are wide-ranging and include:

- analyzing the possible future influences of forces of change in the commercial real estate market (Toivonen and Viitanen, 2016)
- helping students understand the potential consequences of science-related developments (BouJaoude, 2000),
- exploring the impacts of trends affecting tourism (Benckendorff, 2008; Benckendorff et al., 2009),
- examining the implications of European integration (Potůček, 2005),
- identifying challenges for the future of the mining industry in Australia (Prior et al., 2013),
- evaluating of the sustainability of policies (Sajeva et al., 2015),
- probing the implications of proposed church policies (Gebhard and Meyer, 2006), and
- exploring the consequences of technological innovations that augment human abilities (Farrington et al., 2013).[1]

In this study, a refined and more structured version of the Futures Wheel called the Implications Wheel® was used (Barker and Kenny, 2011). The name for each method derives from the wheel-like structure that emerges as the group process proceeds, with the change of interest placed in the center like the hub of a wheel and first-, second-, and third-order implications of the change emanating outward in concentric rings. The Futures Wheel is the generic term for the basic method, which encompasses many variations in how it is applied in practice. The Implications Wheel is a specific approach to the Futures Wheel, which is distinguished by the use of trained facilitators, a set of rules for generating implications (e.g., include both positive and negative implications, implications must be specific and concrete, etc.), a process for scoring implications for desirability and likelihood (described below), and online software to facilitate conducting and/or analyzing the results of an Implications Wheel exercise.

Three Implications Wheel workshops exploring the trend described in the preceding section were carried out in Minnesota, Ohio and Pennsylvania. A total of 70 forestry professionals and support personnel participated, with five groups of 5–6 participants in both Minnesota and Pennsylvania, and three groups of 5–6 in Ohio. Many participants were US Forest Service scientists representing a wide range of scientific disciplines: forest ecology, soil science, biometrics, plant physiology, plant pathology, wildlife biology, fisheries biology, landscape ecology, genetics, invasive species ecology, various social sciences, and others. Participants also included natural resource professionals with state agencies, forestry professionals from environmental non-governmental organizations, federal land managers, research administrators, technicians and other support personnel. Thus, the 70 participants represented a diverse cross-section of forestry professionals.

Identification of a reasonably complete set of first-order implications is an important step in setting up an Implications Wheel exercise, because a partial set could limit the generation of higher-order implications. An initial set of first-order implications were identified in advance by the research team in consultation with several forestry experts with diverse disciplinary backgrounds. We then contacted three additional forestry experts and asked if there were any direct implications of the center trend that were missing from our initial set. The consensus was that our implications were appropriate and thorough. Identification of first-order implications in advance allows more time for participants to focus on generating second- and third-order implications. The following five first-order implications of the aging of northern forests were identified for exploration:

1. Continued significant decrease in early-successional forest
2. Continued significant increase in late-successional forest
3. Decreased resilience to many types of future forest disturbances (e.g., extreme weather events, changing climate, insects, diseases)
4. Decrease in carbon sequestration rates (older forests sequester carbon at a slower rate)
5. Increase in the popular perception that this is the way all forests are and should be (i.e., older forests are what people are used to seeing and therefore what they perceive as normal and prefer)

[1] Contact the authors for a comprehensive Futures Wheel bibliography.