ANTICIPATING CASCADING CHANGE IN FORESTS: SEEKING A DEEPER UNDERSTANDING OF THE FUTURE CONSEQUENCES OF FOREST MANAGEMENT ACTION OR INACTION

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Abstract.—This study used a participatory group brainstorming process called the Futures Wheel to identify and evaluate the direct and higher-order implications of this trend: Central Hardwood forests lack age-class diversity and will uniformly grow old. Five 1st-order consequences of this trend were identified: continued significant decrease in early-successional forest, continued significant increase in late-successional forest, decreased resilience to many types of forest disturbances, decrease in carbon sequestration rates, and increase in the popular perception that this is the way all forests are and should be. Twenty-five forestry professionals participated in a Futures Wheel exercise to identify 2nd- and 3rd-order implications of the five 1st orders. Participants identified 25 2nd-order and 121 3rd-order implications and scored them for likelihood and desirability. Analysis of the 2nd and 3rd orders revealed many types of implications that are relevant for policy and management interventions, including high-likelihood but strongly negative implications, and low-likelihood but strongly positive implications.

INTRODUCTION

As an artifact of past disturbance (MacCleery 2011), nearly 60 percent of Central Hardwood forestland is clustered in age classes that span 40–80 years. This is one of the five anthropogenic trends identified by Shifley et al. (2014) as having profound consequences for forest conditions and management needs in the future. Young forests (age 20 years or newer) comprise 7 percent of all forests in the region; forests older than 100 years comprise 5 percent (Fig. 1). Within the region, this unimodal (bell-shaped) pattern of clustered age classes is repeated at smaller spatial scales for individual states and for individual forest-type groups (Miles 2015, Shifley et al. 2012). The unimodal age-class distributions common throughout the Central Hardwood region differ from those observed for other regions of the United States (Pan et al. 2011). Because of built-in inertia and low rates of natural or anthropogenic forest-regenerating disturbance, the uniform aging of these forests will continue for decades.

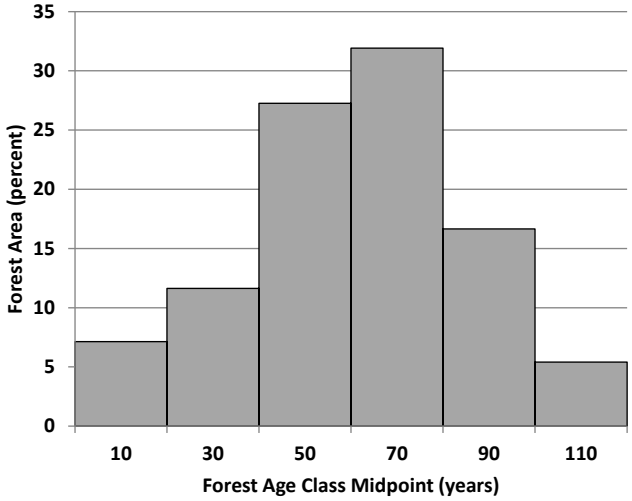

Figure 1.—Central Hardwood forest area summarized by 20-year age classes. Based on the 126 million acres of forest land in the Eastern Broadleaf Forest Province (221), Midwest Broadleaf Forest Province (222), Central Interior Broadleaf Forest Province (223), Prairie Parkland (Temperate) Province (251), and Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow Province (M221) (based on Miles [2015] and McNab et al. [2007]).

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Major but slow-moving trends such as uniform aging of forests are often ignored by planners and policy makers. As business futurist Peter Schwartz (2003) observed, "The dominant intellectual strategy that people bring to bear on the future is denial." It is much easier to focus on the countless immediate problems of today and ignore the far-reaching, slowly unfolding challenges of tomorrow. But major changes—even slow-moving ones—often produce a cascade of unanticipated consequences. These consequences may be direct or indirect, obvious or hidden, immediate or long-range, positive or negative, and insignificant or game changing.

Forestry professionals need to recognize, explore, and prepare for the possible consequences of cascading change. Forest policies and management actions can be designed to avoid negative consequences and to promote positive changes. The direct 1st-order impacts of cascading change may be relatively easy to identify: 1st-order consequences are overwhelmingly what groups identify in unstructured brainstorming about the impacts of change (Schreier 2011). The higher-order consequences, however, are rarely detected without deeper analyses. The higher-order (2nd- and 3rd-order) implications contain the most surprises, both positive and negative, and may have the most relevance for forward-looking policy and management. The Futures Wheel was designed to facilitate uncovering and analyzing the higher-order implications of change.

THE FUTURES WHEEL

The Futures Wheel, also called the Implications Wheel® (Barker 2011), is a participatory research method that uses a structured brainstorming process to discover multiple levels of consequences that result from all types of change: an emerging trend, a new or revised policy, a technological innovation, a major event, new strategic objectives, new laws or regulations, and other types of change. It is a group process that, if conducted properly, incorporates the four conditions required to form a "wise crowd" (Surowiecki 2004): (1) diversity (participants represent diverse perspectives), (2) independence (a participant's opinions are not determined by the opinions of others in the group), (3) decentralization (participants are able to specialize and draw on local knowledge), and (4) aggregation (a mechanism exists for aggregating individual perspectives). The diversity of participants is a key to the effectiveness of the Futures Wheel method. Page (2007) and others have shown that complex problems may be solved more effectively with a diverse team than by the best individual experts.

Originally proposed by futurist Jerome Glenn (1972), the Futures Wheel has been widely used to identify and analyze unanticipated consequences of change in many organizational settings, including corporations, the military, public sector agencies, and nongovernmental organizations. Most applications of the Futures Wheel are not published because they are proprietary or confidential, but examples of published studies include examining the implications of trends that affect tourism (Benckendorff 2008, Benckendorff et al. 2009), European integration (Potůček 2005), research and technology management (Farrington et al. 2013), operational changes in religious organizations (Gebhard and Meyer 2006), and student understanding of the potential consequences of science-related developments (BouJaoude 2000).

The Futures Wheel takes a broad look at the future landscape to quickly gather information on potential opportunities, dangers, and consequences of a particular change. The method provides a means to quickly develop qualitative information that is useful to find the best pathway forward, avoid obstacles, and enhance decision-making information.

Central to the Implications Wheel approach to the Futures Wheel is the "cascade thinking" that emerges through the process and traces how one change leads to multiple possibilities,

and each of these possibilities in turn leads to further possibilities (Barker and Kenny 2011). Cascading consequences, and how a seemingly insignificant event can have catastrophic results, are illustrated in the classic proverb "For want of a nail":

> For want of a nail the shoe was lost.
>
> For want of a shoe the horse was lost.
>
> For want of a horse the rider was lost.
>
> For want of a rider the message was lost.
>
> For want of a message the battle was lost.
>
> For want of a battle the kingdom was lost.
>
> And all for the want of a horseshoe nail.

Conversely, insignificant or undesirable changes can also have strongly positive consequences and opportunities. The Futures Wheel uncovers positive and negative cascading changes.

OVERVIEW OF THE FUTURES WHEEL METHOD

The first step in a Futures Wheel exercise is to define and describe the change of interest. In our case, this was the lack of age-class diversity and uniform aging of Central Hardwood forests. Five major direct or 1st-order implications of this trend were identified by the research team before the group process:

1. Continued significant decrease in early-successional forest.
2. Continued significant increase in late-successional forest.
3. Decreased resilience to many types of forest disturbances such as extreme weather events and climate change.
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 accustomed to and therefore what they prefer).

These outcomes seemed likely given the current state of Central Hardwood forests.

A diverse group of participants—including participants with specialized knowledge about hardwood forests and nonspecialists—was recruited to explore the 1st-order implications in depth. In general, the group sizes range from as few as a single small group of about five for an informal exploration to hundreds of participants divided into small groups. Our study included 25 participants.

Figure 2 illustrates the structure of a Futures Wheel used to guide the group process. The exploration process begins by briefing participants on details of the issue at the center, dividing participants into groups of about five, and assigning a 1st-order implication to each group. The facilitator then asks, "If this occurs, what might happen next?" Participants take turns contributing possible 2nd-order implications, which are added to the diagram, branching out from the 1st orders. The facilitator ensures that contributed implications are clear and specific, and that they follow directly from the preceding implication.

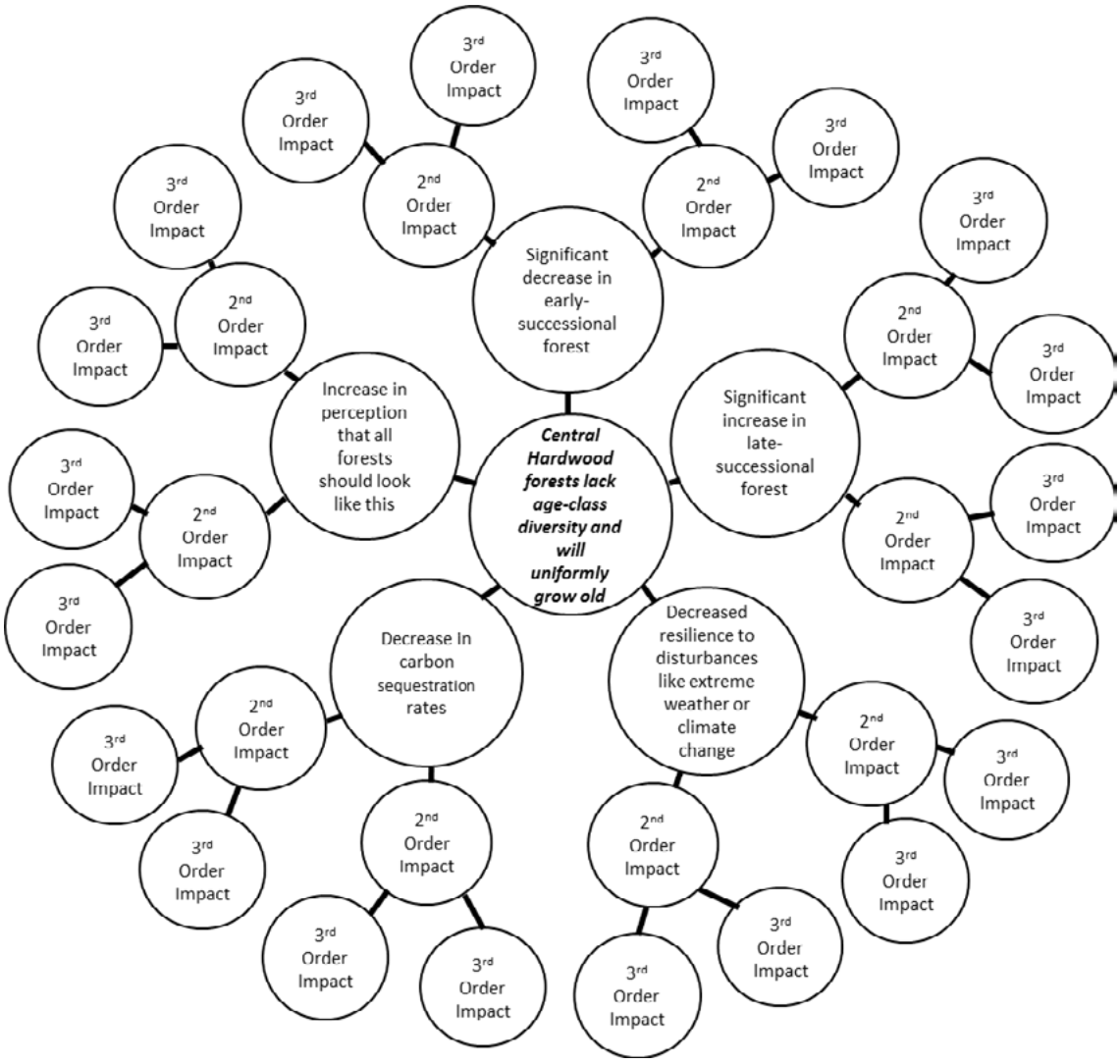

Figure 2.—Futures Wheel diagram with the central trend and 1st-order implications. In our Futures Wheel exercise, participants generated about five 2nd-order impacts for each 1st-order impact, and five 3rd-order impacts for each 2nd-order impact.

Once the brainstorming groups have identified about five 2nd orders for each 1st order, the process is repeated to identify a set of possible 3rd-order implications for each 2nd order.

After the implications are identified, the Implications Wheel version of the Futures Wheel includes a group scoring process. Participants rate each of the 1st-, 2nd-, and 3rd-order implications for desirability and likelihood, arriving at a consensus score in their small groups (Schreier 2005). Scoring provides significant additional information and highlights likely negative and unlikely positive implications that may be most important to decisionmakers. Benckendorff (2008), Bengston (2015), and Glenn (2009) provide additional details on the Futures Wheel method.

SELECTED FINDINGS

This section highlights selected findings from a November 2014 Futures Wheel exercise we conducted to explore the implications of the trend that Central Hardwood forests lack age-class diversity and will uniformly grow old. The 25 participants in our study included diverse forestry and natural resource professionals, administrators, support personnel, and communications specialists.

From the five 1st-order implications that were developed in advance by the research team, our participants generated 25 2nd-order implications and 121 3rd-order implications. The large number of higher-order implications is due to the structure of the brainstorming process, which shifts the focus from the short-term and direct implications to the longer-term and higher-order implications of change.

Similar Implications

Similar implications are ones that emerge repeatedly in different contexts (i.e., from different 1st and 2nd orders) during the Futures Wheel process. The appearance of the same or similar implications suggests that they are robust and more likely to occur. The most common similar implications from our Futures Wheel exercise were the following:

- Increasing conflict over forest management, including legal action
- Decreased biodiversity
- Decreased resilience to disturbance
- Fewer forest management options
- Fewer hunting opportunities
- Worsening climate change

The fact that these most commonly generated similar implications are all undesirable—or strongly negative—is significant. Advanced knowledge that these negative consequences are likely to emerge from the central trend of uniformly aging forests could be quite useful for planners, managers, and policy makers in setting priorities and designing management strategies.

Unique Implications

Unique implications are ones that were mentioned only once throughout the process of generating implications in small groups. They tend to be suggested by participants who are "outside-the-box" thinkers or who have diverse backgrounds and perspectives. Unique implications may represent uncommon but significant issues that most forest planners and managers are not considering. Examples of unique 3rd-order implications from our Futures Wheel exercise include the following (the preceding 1st- and 2nd-order implications are given to provide the context for the unique 3rd orders):

- (1st order) Decreased resilience to many types of future forest disturbances → (2nd order) Increased large-scale land cover conversion caused by low resistance to large-scale natural disturbances → (3rd order) Increased opportunities to create climate-resilient forest.
- (1st order) Continued significant increase in late-successional forest → (2nd order) Decrease in the diversity of understory species (wildlife and vegetation) → (3rd order) Decreased opportunities to gather edible plants.

- (1st order) Continued significant increase in late-successional forest → (2nd order) More big trees → (3rd order) Enhanced tribal connections to the spiritual values of big trees.
- (1st order) Growing popular perception that this is the way all forests are and should be (i.e., older forests are what people are accustomed to and prefer) → (2nd order) Delayed development and application of best forest management practices → (3rd order) Increasing difficulties in changing public perceptions of forests.
- (1st order) Growing popular perception that this is the way all forests are and should be (i.e., older forests are what people are accustomed to and prefer) → (2nd order) Laws change to protect old forests → (3rd order) Limits on motorized recreation.

Many of the unique implications that our participants suggested were of low relevance to forest decisionmakers. But some useful insights emerged—elements of the future that are not immediately evident.

Highly Significant Implications

Two types of highly significant implications have special relevance for forest decisionmakers: likely strong negatives and unlikely strong positives. Likely strong negatives are implications that the participants scored as both highly likely and strongly negative; unlikely strong positive implications were scored as both highly unlikely and strongly positive.

Likely strong negative implications require policies or management actions that are designed to decrease their likelihood or reduce their negative effects. Examples from our Futures Wheel exercise include the following:

- (1st order) Continued significant decrease in early-successional forest → (2nd order) Decrease in abundance of early-successional wildlife → (3rd order) Further declines in bird species already of conservation concern.
- (1st order) Decreased resilience to many types of future forest disturbance → (2nd order) More uncertainty for industry re: timber supply (declining forest-based industry) → (3rd order). Declining quality of local school districts where mills are located because of reduced tax revenues
- (1st order) Increase in popular perception that this is the way all forests are and should be → (2nd order) Laws change to protect old forests → (3rd order) Wildlife and forest diversity declines.

Unlikely strong positive implications represent potential opportunities for forest decisionmakers to provide desirable outcomes through policies or management actions that increase the chances of these events occurring. Our participants generated far more likely strong negatives than unlikely strong positives.

CONCLUDING COMMENT

Forest decisionmakers need to anticipate unforeseen consequences of major trends and other types of change and address them proactively. Most analyses of planning and policy issues do not go beyond identifying the most evident direct consequences of change. But the higher-order consequences may be the most significant. The smart group process and nonlinear thinking that occur when conducting a Futures Wheel make it a powerful tool for identifying and evaluating possible implications of all types of changes that affect forests. This process gives deeper insights into the future consequences of forest change and highlights possibilities for avoiding potential problems and embracing opportunities.

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