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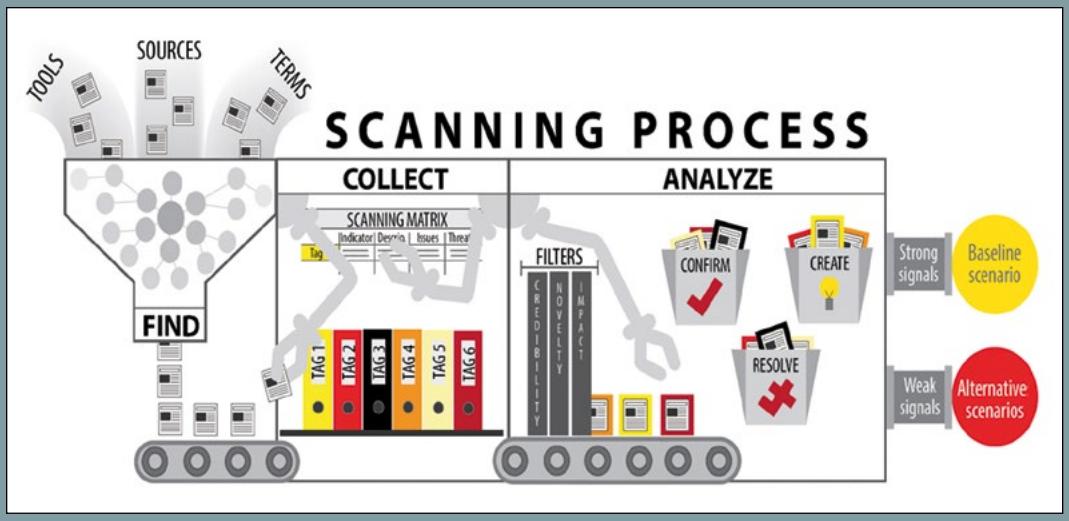
The Forest Futures Horizon Scanning Project



Forest Service
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Abstract

Horizon scanning is a method for detecting and interpreting the implications of emerging issues and other signals of change, both within and outside of an organization or field. Anticipating possible changes that may affect an organization is a first step toward strategic thinking, planning, and actions that can help prepare it for an uncertain future. Developing insight into emerging possible futures—or strategic foresight—can help decisionmakers respond proactively to seize opportunities and mitigate potential threats. Decisionmaking in forestry and other natural resource management fields has underutilized formal horizon scanning.

The USDA Forest Service, Northern Research Station's Strategic Foresight Group recently worked with the University of Houston Foresight graduate program to design and implement a formal horizon scanning system for the agency, with the goal of increasing strategic foresight. The nine papers in this report summarize the early phases of this process and lessons learned. Among the topics are the development of a method to identify useful scanning sources pertinent to forest futures, ways to analyze scanning hits, and distinguishing between current and emerging issues for the Forest Service. Also discussed is the range of communication products generated to date by the project. The report contains the complete guide written for those volunteering to do the scanning. This collection will acquaint forest planners, managers, and policymakers with horizon scanning as an integral step in anticipating the consequences of potential change and making better decisions in a rapidly changing environment.

Cover Art

Schematic of the horizon scanning process. Source: Hines and Bishop (2015), as cited in paper 1, this volume. Created by Maria Romero.

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The Forest Futures Horizon Scanning Project

Andy Hines, David N. Bengston, and Michael J. Dockry, compilers

General Technical Report NRS-P-187

ACKNOWLEDGMENTS

The compilers thank all the members of the horizon scanning team for their excellent work searching for signals of change that could help shape the future of forestry.

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INTRODUCTION: THE FOREST FUTURES HORIZON SCANNING PROJECT

David N. Bengston

The external environment in which forest planners, managers, and policymakers operate today is one of rapid, complex, and turbulent change. The broad social, economic, technological, and political contexts for forestry are constantly changing and the pace of change is accelerating (Steffen et al. 2015). The internal environment for forestry is also characterized by rapid and often surprising change, as new developments and emerging issues within the field continually appear and pose challenges for decisionmakers. To be effective in these changing internal and external contexts, forestry decisionmakers must anticipate emerging issues, trends, opportunities, and threats, and act proactively. They need to develop and apply strategic foresight: insight into how and why the future could be different from today (Lum 2016).

Horizon scanning is a method to help decisionmakers develop strategic foresight and achieve the broad forward view they need to prepare for change. Also known as environmental scanning, horizon scanning involves searching the internal and external environments for signals of change. Hines and Bishop (2006: 55) state that horizon scanning "involves identifying the *macro-trends* that will form the basis of the baseline forecast (or 'most likely future') and the *weak signals* that may portend discontinuities that drive alternative futures." Distinguishing characteristics of horizon scanning include its emphasis on weak signals (early indicators of potential change), comprehensive scanning of all domains (e.g., social, technological, economic, environmental, political), and the inclusion of possible wild cards (low-probability, high-impact events). Horizon scanning also tends to emphasize emerging issues in the *external* environment of a field or organization. This external emphasis is critical because experts within a particular field tend to focus most of their attention on developments and emerging issues within their field or area of expertise. But an internal focus creates the risk of being blindsided by surprising developments in the external environment.

Horizon scanning encompasses a wide range of techniques and organizational approaches for identifying and interpreting possible implications of signals of change (Bengston 2013). Techniques for systematically gathering and analyzing information about emerging external issues and trends were originally devised by military intelligence officers to gain insights into new developments in enemy countries (Cornish 2004). Scanning has long been standard practice in the military, the intelligence community, and the business world and is a core method in futures research. In recent years, horizon scanning has been used in a growing number of fields in the public sector. But the use of formal horizon scanning in forestry, natural resources, and conservation has been limited. A notable exception is the annual horizon scanning exercises on global conservation issues carried out for 9 consecutive years by Sutherland and colleagues (Sutherland et al. 2018). Though widely used in many fields, horizon scanning remains an underused tool for environmental and natural resource planning and decisionmaking (Sutherland and Woodroof 2009).

Although *formal* horizon scanning is uncommon in forestry and natural resource management organizations, all decisionmakers scan the internal and external environments in their organization or field to some extent and in some form. Most scan passively and informally, keeping their "antennae up" for signals of change that may be important. A few scan actively and formally. The research literature on scanning in business clearly shows the value of active and formal scanning

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(Choo 2002). Ideally, horizon scanning serves as an early warning system to identify potential threats and opportunities. More broadly, horizon scanning can help foster a culture of foresight in an organization.

The papers in this General Technical Report describe a formal and ongoing horizon scanning project—the Forest Futures Horizon Scanning system—developed by the USDA Forest Service (hereafter, Forest Service), Northern Research Station's Strategic Foresight Group and the University of Houston Foresight program. The overall goal of this report is to introduce forest planners, managers, and policymakers to horizon scanning and describe the lessons learned through the setting up and early implementation of this system.

The opening paper by Hines and coauthors, "Setting Up the Forest Futures Horizon Scanning System," describes the design of the system and the thought process behind it. The University of Houston Foresight program's "Framework Foresight" approach (Hines and Bishop 2013) provided the conceptual structure for the system. Key decisions involved in framing the domain for the system are outlined, steps in the scanning process are described, and lessons learned throughout the process of setting up the system and early implementation are noted.

In "An Innovative Method for Identifying Fruitful Scanning Sources for Forest Futures," Roe and Hines describe the method they developed for identifying a list of useful and relevant scanning sources for the forest futures domain. The Forest Futures Horizon Scanning project depends on volunteer scanners, who often have no experience with scanning. Therefore, it was important to find ways to help volunteers become productive scanners quickly and effectively. The table of scanning sources produced by this research is intended to help new scanners begin to identify relevant signals of change related to forest futures, and the method will be useful in any horizon scanning project.

A vital step in any ongoing horizon scanning process is regularly analyzing the growing database of scanning hits to identify emerging issues, shed light on possible implications of the emerging issues, and generate foresight. A paper by Bengston and others titled "Connecting the Dots in the Forest Futures Horizon Scanning Database: An Initial Analysis" describes a first step in "connecting the dots" in the Forest Futures Horizon Scanning system. The authors examine the descriptive tags associated with each scanning hit as a way to characterize the database, and then describe several broad themes that have emerged from multiple scanning hits.

A paper by Callaway and others, "Identifying Current USDA Forest Service Issues to Provide Context for Horizon Scanning," describes an effort to develop a list of current issues for the Forest Service to be used by scanners in the project. A key purpose of scanning is to identify new, emerging issues for the agency and its stakeholders. But in order to identify what qualifies as "emerging," the scanning team must first be aware of the *current* issues. Without a list of current issues, scanners from outside the organization are likely to have difficulty determining whether a scanning hit represents an emerging issue or whether it is well known and already on the organization's "radar screen." The authors developed a simple method for identifying current issues, and summarize 12 broad current issues that were found.

The next two papers use a futures research method called the Futures Wheel or Implications Wheel® (Bengston 2016) to explore possible direct and indirect implications of themes that emerged from scanning. The Futures Wheel is a structured "smart group" technique to explore possible consequences of any type of change. For the paper "Using the Implications Wheel in Horizon Scanning: Exploring Implications of Growing Apathy Toward the Environment," Bengston and coauthors conducted a small-scale, online Implications Wheel exercise to examine an emerging social trend: growing apathy toward the environment in the United States. Multiple scanning hits pointed toward this trend. Although

this was a small and exploratory exercise—with just six participants—many useful insights were generated. A total of 155 possible implications of growing apathy toward the environment were uncovered, many with important long-term consequences for public land management agencies.

In the second Implications Wheel paper, "Exploration of a Horizon Scanning Trend: Growing Indigenous Empowerment," DeVaney and coauthors explore the emerging trend of increasing indigenous empowerment and recognition of rights with respect to natural resources. This exercise was carried out with a group of University of Houston Foresight graduate students, faculty, and alumni at the annual "Houston Foresight" spring gathering. The exercise did not include American Indian or Alaska Native participants, and therefore should be viewed as an illustration of the usefulness of the method for exploring the implications of emerging issues identified through horizon scanning. Despite this limitation, the findings reveal a wide range of significant possibilities that could result from growing indigenous empowerment and suggest the importance of monitoring this trend as it unfolds.

In "Scenarios to Provide Context for Horizon Scanning: Backcasting North American Forest Futures from 2090 to 2035," Andy Hines and others report on a scenario backcasting project, an offshoot of the Forest Futures Horizon Scanning system. The horizon scanning team determined that it would be useful to provide context for the emerging issues identified through scanning by crafting a set of scenarios. Emerging issues could then be analyzed and understood in terms of how they related to the scenarios; that is, one could explore how the emerging issues might fare in different scenarios. A baseline scenario and three alternative scenarios for the year 2035 are presented. These scenarios for 2035 provide a context from which policymakers can craft responses to avoid scenarios they consider undesirable and work toward scenarios they consider preferable.

"Communicating Horizon Scanning" by Hines describes the importance of diverse outputs of horizon scanning to meet the needs of the various users of scanning information. Forest planners, managers, policymakers, social scientists, and other potential audiences are unlikely to have the time or inclination to peruse the large number of raw scanning hits in the cloud-based scanning library. To be useful for the intended audiences, this large volume of information must be communicated in a variety of formats that fit the needs of diverse users. Hines describes the range of communication outputs of the Forest Futures Horizon Scanning project, including the scanning library itself, blog posts about significant scanning hits or emerging themes, detailed articles and technical reports, presentations to a wide range of audiences, and input to other strategic foresight projects.

Finally, the scanner guide written for the project is presented in its entirety in a paper by Hines and coauthors titled "Forest Futures: A Guide for Scanners." A clear and concise guide for volunteer scanners is essential for creating a rigorous, consistent, and sustainable horizon scanning system. The guide includes a brief introduction; an overview of the Forest Service for scanners from outside the agency; an explanation of horizon scanning and its goals, uses, and stakeholders; a "how to" guide for using the Web-based system for collecting scanning hits; a description of the domain map used in tagging scanning hits; and a quick guide for getting started in scanning.

Collectively, these papers summarize the early phases of a core and ongoing project of the Northern Research Station's Strategic Foresight Group. The Forest Futures Horizon Scanning system is designed to help forest planners, decisionmakers, and policymakers identify important emerging issues, grasp their possible implications for the future of forestry, and act proactively. Hence, the goal of this formal horizon scanning system is ambitious: to increase strategic foresight within the Forest Service and beyond.

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1. SETTING UP THE FOREST FUTURES HORIZON SCANNING SYSTEM

Andy Hines, David N. Bengston, Michael J. Dockry, and Adam Cowart

Abstract.—The USDA Forest Service, Northern Research Station's Strategic Foresight Group partnered with the University of Houston Foresight program to design and implement a horizon scanning system for the agency. The guiding question for the project was: What emerging issues might impact forests, forestry, and the Forest Service in the future? The University of Houston's "Framework Foresight" approach provided the conceptual foundation for this horizon scanning system. Framing of the topic is described, including creation of a domain map, and identifying the geographic focus, timeframe, and stakeholders for scanning. Three principal steps in the scanning process are then defined: finding signals of change, collecting the signals in an online database, and analyzing the database in order to shed light on possible implications for the future of forestry. Lessons learned in the implementation of the horizon scanning system are discussed.

INTRODUCTION

The goal of horizon scanning is to identify, compile, and analyze the various signals of change that could affect the future of a particular domain. This paper reports on the design, development, and early-stage implementation of a horizon scanning system established for the USDA Forest Service (hereafter, Forest Service), Northern Research Station's Strategic Foresight Group and created cooperatively with the University of Houston Foresight program. The goal of the project is to develop an ongoing horizon scanning system as an input to developing environmental foresight: insight into future environmental challenges and opportunities, and the ability to apply that insight to prepare for a sustainable future (Bengston 2012). Broadly speaking, the objectives of the horizon scanning system are to find, collect, and analyze the signals of change, and to identify emerging issues suggested by these signals that could affect forests, the field of forestry, and the Forest Service in the future. This project will also use this information to support the development of scenarios of the future of forestry which integrate signals of change and emerging issues into each scenario. Once the scenarios are crafted, indicators based on signals of change for each scenario will be identified. The horizon scanning system can then be used to monitor these indicators and provide early warnings that the future seems to be moving toward a particular scenario (Schwartz 1996). This information can alert decisionmakers to adjust plans accordingly and take timely action where necessary.

Additionally, the horizon scanning system is supported by volunteers from within the Forest Service. By including participants from throughout the Forest Service, the project seeks to foster a culture of foresight within the organization and eventually to develop a more forward-looking organizational structure for the Forest Service and other natural resource management agencies.

The next section of this paper explains the approach taken to develop the Forest Futures Horizon Scanning system. This is followed by a summary of what has been learned so far, and next steps for the project.

KEY STEPS IN SETTING UP THE HORIZON SCANNING SYSTEM

The Forest Service partnered with the University of Houston Foresight program to design and implement the horizon scanning system, driven by a small core team with members from both organizations. The concept for this project was based on the University of Houston Foresight program's "Framework Foresight" approach (Hines and Bishop 2013), especially the first

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two steps of the approach: *framing* the topic and its boundaries and *scanning* to identify emerging issues. Framing and scanning provide the foundation for forecasting, depicted as the baseline and alternative futures in Figure 1. The baseline future or "business as usual" assumes continuity with the present without major surprises: Trends stay on track, plans are fulfilled, and mainstream projections are on target. Emerging issues, however, may indicate potential alternative futures, that is, alternative outcomes to the baseline. Thus, the identification of emerging issues or signals of change—the main goal of horizon scanning—provides early warning of potential shifts or discontinuities from business-as-usual and helps frame alternative future scenarios.

Framing

The process begins with framing the domain or topic to be explored. The goal is to set the scope of the topic so that it is neither too broad nor too narrow (Hines and Bishop 2015: 374). For this project, it was decided that forests and forestry are the core domain. Broader natural resources-related scanning hits (e.g., energy, water) could be included as they related to forests. Thus, scanners' primary focus is on forests, but other natural resource and environmental topics can be considered if they have a clear link to forestry.

Domain mapping

The domain map is a visual representation of the boundaries and key categories to be explored, or framed, in scanning. Simple diagrams can be used to represent key categories and subcategories. A domain map has three primary functions: defining the boundaries of the scanning world, organizing the data for analysis, and communicating among scanners. Detailed domain maps are helpful for those setting up and managing the scanning process. But for most scanners, especially in a volunteer capacity, a more streamlined or simplified domain map is more instructive and functional.

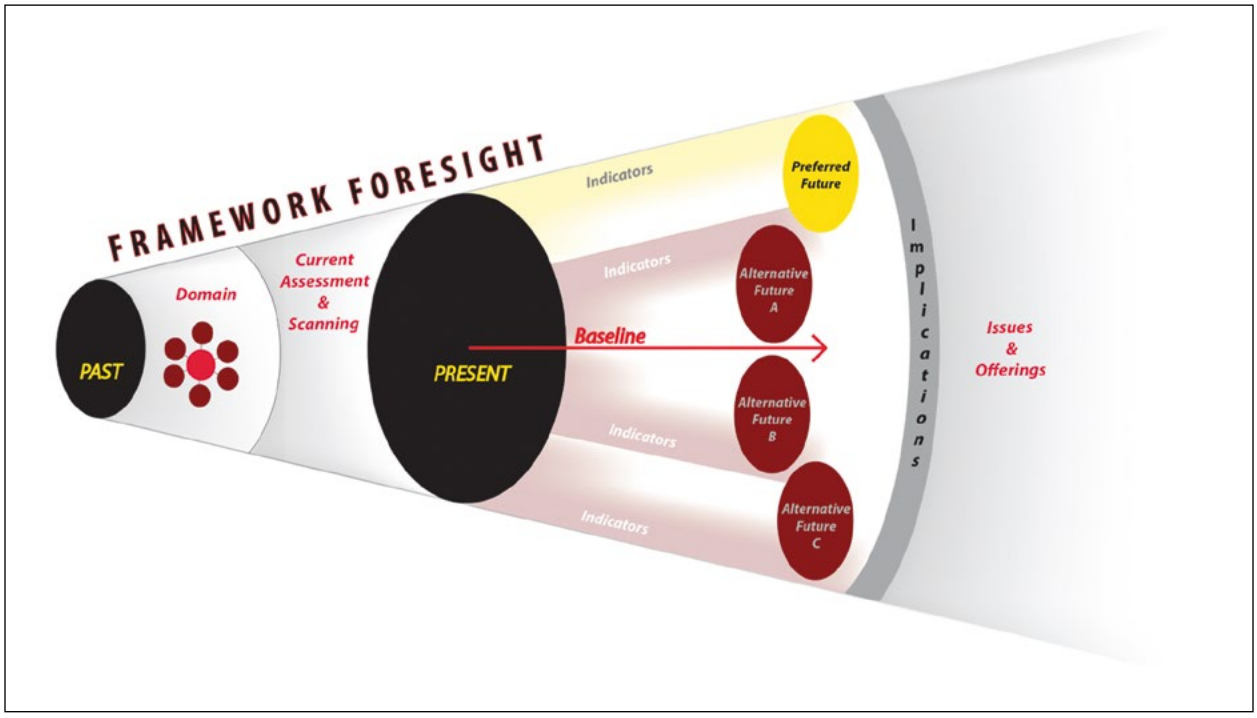

Figure 1.—Key "Framework Foresight" elements for horizon scanning projects. Source: Hines and Bishop (2013).

Important questions to help identify key topics in a domain map include:

- What are the key activities that take place in the domain?
- Who are the key stakeholders in the domain?
- What has been driving change in the domain?

In the Forest Service domain map, six first-level categories formed the core of the map. Twenty second-level categories were linked to them. Third- and fourth-level categories were identified as appropriate, resulting in nearly 100 categories in total. Each of the primary categories is represented as a main branch: ecosystem, industry, institutions, stewardship, climate, and STEEP (an acronym for the broad external change categories: social, technological, economic, environmental, and political) (Fig. 2). The standard STEEP categories represent the broader context for forestry. This broader context was important to depict on the domain map as a reminder to the scanners to include emerging issues from outside that could affect forests and forestry.

Preliminary scanning was carried out to gauge the usefulness of the initial domain map, and revisions were made as needed. Because the full, detailed map can be overwhelming at first, a simplified map was also created for new volunteer scanners.

Geographic focus

The geographic focus of scanning is the United States, but relevant emerging issues in other regions were deemed within the scope of the project. For example, a scanning hit describing a major nanocellulose project in Sweden (http://www.vireoadvisors.com/blog/2017/3/14/swedish-processum-to-lead-major-nanocellulose-project) indicates growing research activity related

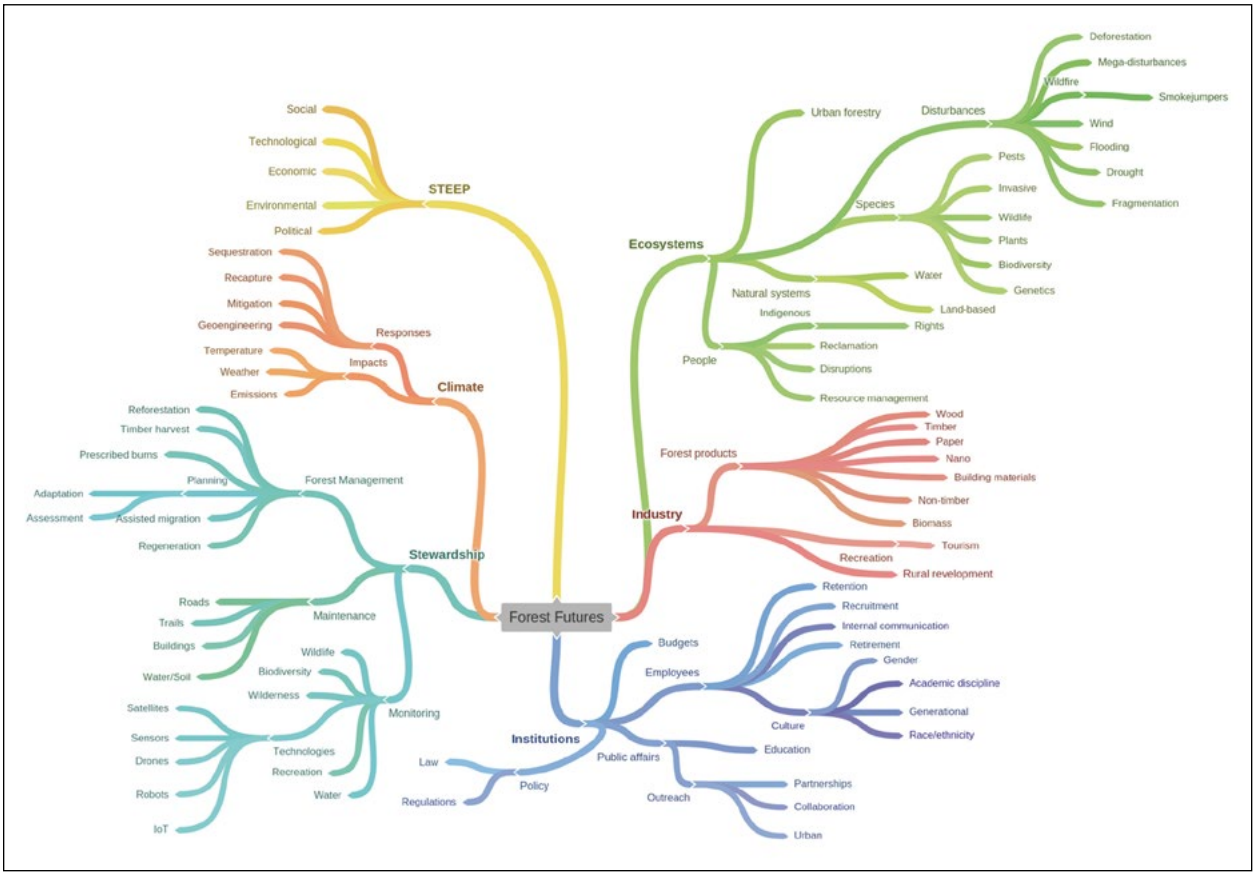

Figure 2.—Detailed version of Forest Futures Horizon Scanning domain map.

to wood-based nanomaterials outside of the United States which could affect developments in the United States.

Timeframe

Forest management and planning often look 50 or more years into the future, due to the nature of forest ecosystems. But technology and industry change much more rapidly, and public forest management agencies are influenced by the regular short-term nature of budgets and elections that affect any government agency. Therefore, the timeframe for scanning needs to be understood as multifaceted eras. For practical purposes, we used 2030 as the primary time horizon.

Stakeholder analysis

Another important aspect of framing is to identify stakeholders who could be interested in using the information, and who may have some influence over the project or power to make decisions based on foresight produced. Key internal and external stakeholders for the horizon scanning project were identified through discussions with the Forest Service team. Likely internal Forest Service stakeholders included the Chief's Office, Forest Service Washington Office leadership, regional foresters, national forest and regional office planners, research station leaders, and the Strategic Foresight Group itself. External stakeholders included state foresters, wood industry associations, environmental nongovernmental organizations, forestry societies and organizations, forestry academics and scientists, international forestry organizations, and the foresight community.

Guiding question

A guiding question captures why the topic is being investigated. The Framework Foresight approach (Hines and Bishop 2013) suggests that there are two useful types of guiding questions: strategic and exploratory. A strategic question guides a project motivated by a specific purpose, such as "Should we invest in blockchain technology?" The project is then designed to provide insight to help answer the question. An exploratory project, on the other hand, does not have a specific purpose and the guiding question is more open-ended and aimed at learning what the key issues or questions are for a broad topic. Our project was exploratory and the guiding question was: What emerging issues might impact forests, forestry, and the Forest Service in the future?

Framing sets the stage for the next step: scanning.

Scanning Process

Horizon scanning has sometimes been criticized for a lack of rigor, and even experienced scanners have difficulty communicating their process for scanning (Hines 2003). Scanning, and futures research in general (Burns 2005), is viewed by some as more art than science. Horizon scanning is often characterized more by informal guidelines than by methodological rigor. One way to increase the rigor in scanning is to define a systematic scanning process. The University of Houston Foresight program currently teaches a scanning process (Hines and Bishop 2015: 381) that suggests three principal steps in scanning: find, collect, and analyze (Fig. 3).

Find

"Find" is the process of searching for and identifying potential scanning hits. Scanning hits are new, unique, and potentially disruptive ideas that could at some point have important impacts or become drivers of change or emerging issues. The task of scanners is to seek out these ideas and capture them.

The domain map categories from framing provide a useful jumping-off point to organize the search. The categories in the domain map can be used as primary search terms, accompanied by futures-oriented terms, such as "future," "trends," "issues," "long-term," "change," "vision," or "2030." Getting the right search terms is less important than it was in the past, because many search engines now work well with natural language inputs. But having a list of potential search terms is useful to help beginning scanners get started. Many tools are available for finding and monitoring up-to-the-minute information, such as Internet feeds and alerts, as well as sources beyond simple search engines such as specialized databases.

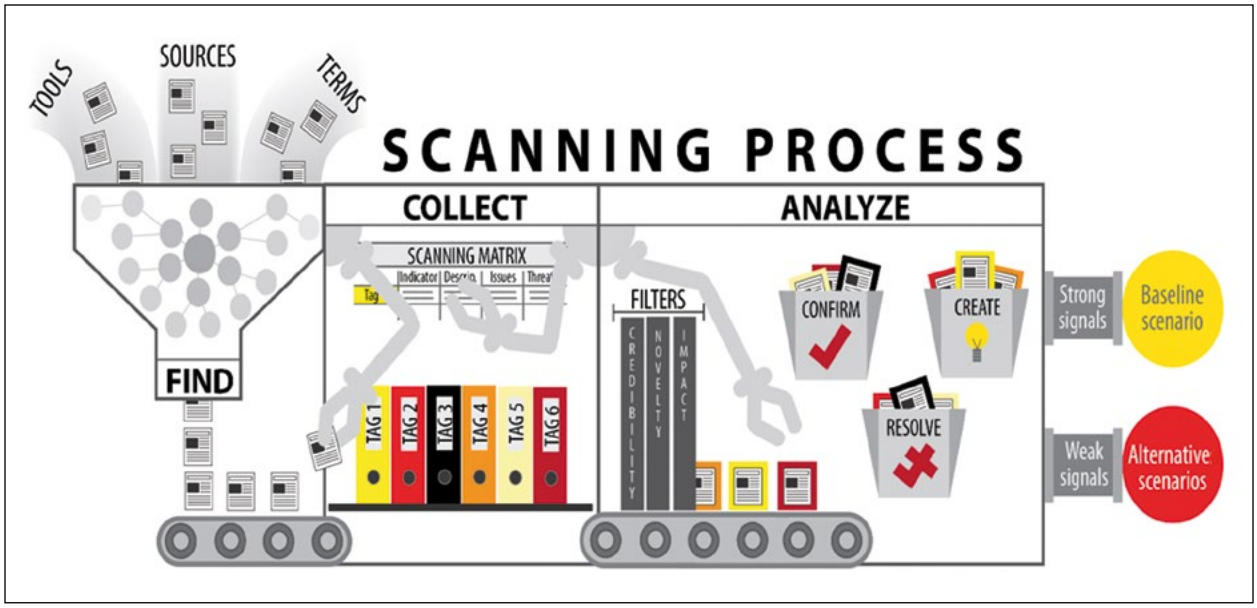

Figure 3.—Schematic of the horizon scanning process. Source: Hines and Bishop (2015). Created by Maria Romero.

Collect

"Collect" is the process of storing and categorizing scanning hits after they have been identified. There are several online cloud-based bookmarking tools with tagging capabilities that can handle group inputs. The convenience and functionality of these sites over an old-fashioned spreadsheet list and tags are compelling. Most importantly, members of a geographically dispersed team can add their scanning hits to a private project library at any time no matter where they are working. A spreadsheet can be used in a cloud-based file-sharing system as well, but it takes far more time and runs the risk of version-control problems.

The purpose of collecting is to keep track of the scanning hits that may provide the basis for identifying an emerging issue. As scanners find an article, blog post, video, or whatever item they would like to collect as a scan hit, they use a "diigolet" icon installed on their Web browser to link it to the team library in Diigo, an online collection database. The scanner guide provides instructions for scanners on how to set up their Web browser and link to the Diigo account. For each scanning hit, the scanner provides a short summary of why he or she selected the article. This can simply involve cutting and pasting a descriptive paragraph from the piece itself or can include commentary from the scanner. The scanner also adds a sentence or two about potential implications of the scanning hit for forests, forestry, and the Forest Service.

It is crucial that scanners tag their scanning posts with a set of descriptors. This step keeps the scanning library organized and easily searchable. The Framework Foresight process uses the domain map hierarchy as the basis of the tagging system. For example, if a scanner finds an innovative new use for a paper product, he would tag it with "Industry," "Forest Products," and "Paper." This is not an exact science, but more precise tagging aligned with the domain map leads to more efficient searching of the library of scanning hits and aids in the analysis and communication of results. The tagging system enables a visitor to the library to quickly access, for example, all the ecosystem-related articles. The library's front page keeps track of the top 10 tags, which can provide an indication of whether certain topics are being neglected or overemphasized.

A tagging system based on the domain map is useful in organizing the scanning library (University of Houston Foresight Program 2014). At a minimum, the first- and second-level domain map categories were to be used as tags for the Forest Service project. Third- or even fourth-level tags could be included, as could a few article-specific tags if necessary. Scanning is an iterative process and there is flexibility to add new tags or even edit the map as the scanners learn more about the topic and emerging issues.

Analyze

"Analyze" is a sensemaking activity that involves prioritizing the various scanning hits collected. The Framework Foresight approach suggests three degrees or levels of analysis, ranging from simple triage to multi-criteria rankings to sophisticated weighted indices. Some horizon scanning efforts include pruning scanning hits that are deemed less relevant. This is effective when the focus of the horizon scanning effort is more targeted. In our case, all scan hits were kept in the database.

The triage level of analysis involves making a quick judgment about a scanning hit. The Framework Foresight approach uses a simple three-level ranking system:

- A "1" or low score is assigned to those hits judged to be "confirming" what is already fairly well-known. In our terminology, it confirms the baseline future. An example is a scanning hit suggesting that wildfire management will consume a growing share of the Forest Service budget.
- A "3" or medium score is for those hits that "resolve" in favor of one of the major known alternative futures. It may be an issue in dispute, a driver that could play out in different directions, or a fundamental uncertainty, and the hit provides evidence for one of the possible alternatives. An example is a scanning hit providing evidence of a paradigm shift in fire management from the traditional "war on fire" paradigm to a "living with fire" paradigm.
- A "5" or high score is assigned to scanning hits that suggest a "novel" future possibility and have enough plausibility to be worthy of further consideration. An example is a scanning hit describing genetic engineering to reduce the impacts of forest fires by making trees less flammable.

The triage analysis can be used in several different ways depending on the goals of the analysis. It could eliminate scanning hits from analysis that were scored 1 if confirmational scanning hits were not important for decisionmakers in weighing possible future policy directions. Additionally, the triage analysis could just select the 5s if the goal is to provide information on novel emerging issues. There may also be a reason to tweak the scores in a particular project. For example, if decisionmakers are most interested in more plausible and less speculative futures, the resolving hits may be scored higher than the novel hits.

The second level of analysis evaluates the scanning hits that made it through triage. They are further filtered by using one or more of the following criteria: credibility, novelty, likelihood, impact, relevance, time to awareness (timeliness 1), and time to prepare (timeliness 2). Two or three criteria from this list are often sufficient for narrowing down the scanning hits at this level of analysis. Questions for each of the seven criteria can be used to determine the priority for a scanning hit. The questions are as follows:

Credibility

- Is the source reputable?
- Are there confirmations elsewhere?

Novelty

- Is the hit new? Or has it been widely reported?
- Is it new to the client or audience?

Likelihood

- What are the chances that the hit will occur?
- What is the likelihood that it will amount to something significant?

Impact

- Will it change the future?
- If it does change the future, how big a change will that be?

Relevance

- How important is that change to the client or the domain?
- Is the relevance direct or indirect?

Timeliness 1 (Time to Awareness)

- How long will it be before this information is widely known?
- When will it appear in a mainstream newspaper or magazine?
- Are there resources to influence the potential outcome suggested by the hit?

Timeliness 2 (Time to Prepare)

- How long before this hit begins to change the future?
- Is it too late to do anything about it?
- Is it so far off that action now would be premature?

Answers for each criterion will determine which scanning hits should be used in an analysis. As with triage, this is determined by the goal of the analysis. For example, if the goal is to find novel scanning hits from credible sources that take a long time to prepare for, those scanning hits can be identified and analyzed.

The third level of analysis is a weighted index. This can be done by using the seven criteria listed earlier and assigning more weight to the criteria deemed more important to the project. Then a total number can be calculated for each scanning hit, and scanning hits can be listed in order of importance according to the weighted criteria. This level of analysis is more than is needed for most projects. But in a scanning project in which the scanning hits themselves are the deliverable, this could be a useful option. Additionally, this analysis option could serve to give more weight to scanning hits with long or varied time horizons, which could be important for identifying emerging issues for forestry where the ultimate impacts to forests may happen decades or centuries into the future.

LESSONS LEARNED

This section describes what has been learned so far as the project enters its second year of operation.

1. Background Information Versus Scanning

The Framework Foresight process makes the distinction between background information that covers the recent history and current conditions of the domain being explored, and scanning that covers what might be changing in the future. Thus, scanning hits should be relatively new in terms of when they were published—within the last few years is our general rule of thumb. If something relevant to the scanning domain was reported years ago, that is history and part of background information. In some cases, information from years ago may have been largely ignored and thus appears as new information. Our view is that it is still part of history and background research.

2. "New to Me" Versus "New to the World"

This is similar to the preceding point, but can involve recent information. Everything can seem new and interesting to someone who is exploring a topic for the first time. But some of this may be "old hat" to those with experience in the field. Thus, it is important to calibrate whether something that seems new really is new. Involving forestry experts from the Forest Service was important in identifying forestry-related hits that were not new to the agency or the field of forestry but may seem new to student scanners. Ecosystem management and ecological forestry, for example, may sound like new concepts to those outside of the forestry profession; however, they are concepts with decades-old roots and far from novel within forestry.

3. How to Handle "Coaching" of Volunteers

Some volunteers may not read the scanner guide and just plunge in and add hits that are off-track or below standard. Coaching and other reminders about the goals of the scanning project can help keep scanners focused on useful hits. Our approach was to be careful to avoid being perceived as condescending or overly academic in giving feedback to volunteer scanners. If the feedback is seen as too harsh, the volunteers may become discouraged and drop out. Instead, we

conducted team "check-ins" to provide scanning tips. For instance, the issue of background information being tagged as new scanning hits (see lesson 1) prompted the suggestion to focus on recent emerging issues and developments—within the past year or so—rather than things that happened years ago. Other ways that scanners can go off-track are either being too focused on the present, so the hits proposed are not sufficiently future oriented (e.g., entering an article about ongoing deforestation in the Tropics), or entering hits that are potentially game changing but for a different domain (e.g., entering an article about the detection of gravitational waves to a horizon scanning effort about forestry).

4. Moving Beyond Forests and Forestry

A challenge for outside scanners, and in framing the domain, was trying to get "beyond forests" or "beyond trees." The Forest Service deals with many concerns affecting forests and forestry organizations: climate change, wildlife, outdoor recreation, water, grazing, urban forestry, indigenous rights, and many more. And all of these concerns are affected by social, technological, economic, and political change. For instance, the scanner guide suggests that scanners "focus mostly (but not entirely) on 'outside' issues and change, that is, things that are originating outside of the field of forestry and natural resources but could impact the field in the future…Many leaders and policymakers within the field are already aware of emerging issues and change originating within the sector." This issue inspired a special project to develop a list of fruitful sources for scanners to start with.

5. Staying Connected

Staying connected is the opposite of the previous issue. Some scanning hits seemed to be entirely disconnected from the concerns of forestry. Granted, an explicit goal was to connect the external world to the Forest Service, but there did need to be some connection. The suggestion here was to ask scanners to add a comment after the description of their scanning hit explaining its possible implications or relevance to forestry or the Forest Service. For example, a possible implication for forests and forest management of self-driving cars is that their adoption could encourage more sprawling development patterns—as long commutes are no longer wasted time—resulting in increased fragmentation of forests.

6. Stretching into the Future

The project team also sought to find a way to encourage scanners to get further into the future (Curry and Hodgson 2008). Scanners were asked to tag each of their hits with the appropriate horizon:

- **Horizon 1:** focuses on the current prevailing system—the baseline—as it continues into the future, which loses "fit" over time as its external environment changes
- **Horizon 2:** an intermediate space of transition in which alternative futures begin emerging as the first and third horizons collide
- **Horizon 3:** focuses on "weak signals" about the future of the system which may seem marginal in the present, but which could signal significant change in the long term

The judgment about which time horizon is most appropriate for a scanning hit is subjective, but the process of tagging hits with time horizons may encourage more long-term thinking and more Horizon 3 hits. That is, if a scanner sees that all her hits are in Horizon 1 or 2, she could adjust her scanning approach.

At the time of this writing, the breakdown of hits by time horizon is 42 percent Horizon 1, 38 percent Horizon 2, and 20 percent Horizon 3. It is not surprising that there are fewer Horizon 3 hits, but the distribution of hits will be monitored going forward.

7. Tagging Discipline

Tagging "discipline"—that is, accuracy and completeness in assigning descriptive tags to scanning hits—can be a challenge. The tagging instructions in an early version of the scanner guide reminded scanners to refer back to the domain map: "Tags should be 1st level [of the domain map], 2nd level, 3rd level, something specific to the piece, and then which time

horizon the hit targets." The Houston team has occasionally performed tagging tune-ups and edited the library of scanning hits. Tagging discipline will be increasingly important as the library grows. As of this writing, there were already more than 1,000 hits in the library, so finding items of interest would be a challenge without an accurate tagging system.

8. Current Issues

To properly frame emerging issues it is important to first identify a list of existing or current issues facing the Forest Service. There is no clear source with a formal list of issues for the agency. Therefore, the Forest Service-University of Houston team reviewed the Forest Service strategic plan (USDA Forest Service 2015) and other planning documents to identify current issues. Thirteen widely recognized current issues were identified, including the growing effects of climate change, more frequent and intense wildfires, and increasing forest fragmentation due to development. This list of current issues was added to the scanner guide to help scanners focus on additional emerging issues identified through horizon scanning rather than on well-known current issues.

CONCLUSIONS

The Forest Service-University of Houston Forest Futures Horizon Scanning project has provided an opportunity to experiment in real time with academic approaches and in-the-field practice of strategic foresight methods. Horizon scanning has often proven elusive to teach and to institutionalize within organizations. The project team has used a learning, iterative approach to develop the scanning process that we hope will be sustainable within the organization beyond the initial project. This paper has described the set-up process and what has been learned to date. The challenge ahead is for the process to produce useful results such that formal horizon scanning will become an indispensable component of the work of the Forest Service as it moves into an uncertain and challenging future.

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2. AN INNOVATIVE METHOD FOR IDENTIFYING FRUITFUL SCANNING SOURCES FOR FOREST FUTURES

Bo Roe and Andy Hines

Abstract.—The Forest Futures Horizon Scanning project depends on volunteer scanners, who often have no experience with scanning. Therefore, it was important to find ways to help volunteers become productive scanners quickly and effectively. This paper describes a method that was developed for identifying a list of useful and relevant scanning sources for the forest futures domain. The table of scanning sources produced by this research is a valuable first step to help new scanners begin to identify signals of change related to forest futures.

INTRODUCTION

The goal of horizon scanning is to identify early indicators of change that could affect organizations and other systems. Horizon scanning is an initial step toward developing strategic perspectives and actions to help organizations maximize benefits and minimize negative consequences by anticipating possible future changes. Scanning involves finding, collecting, and analyzing signals of change that may indicate shifts within a domain or topic area. The USDA Forest Service (hereafter, Forest Service), Northern Research Station's Strategic Foresight Group, in cooperation with the University of Houston Foresight program, has designed and is in the early stages of implementing an ongoing Forest Futures Horizon Scanning system as an input into a larger program of foresight research. The overall goal is to develop environmental foresight, defined as a combination of insight into future social and environmental challenges and opportunities, and the ability to apply that insight to prepare wisely for a sustainable future (Bengston et al. 2012, Hines et al. 2018).

This paper focuses on the specific challenge of identifying productive scanning sources related to the future of forests, forestry, and the Forest Service. The forest futures domain or topic area poses unique challenges, because forestry is a diverse field and it is closely connected with many other domains and fields, such as sustainable agriculture and climate change. The early experience with the Forest Futures Horizon Scanning system suggested that fruitful scanning sources relevant to the forest futures domain were difficult to identify for many scanners. Thus, a side project was launched to identify a list of relevant and fruitful scanning sources for the forest futures domain. This paper describes the method that was developed for identifying those sources and discusses opportunities for improving it in future iterations.

METHODS

The Forest Futures Horizon Scanning system includes a domain map: a simple visual depiction of the main categories and subcategories that are important for the domain. The domain map (Fig. 1) provides a set of convenient search parameters for scanners. The primary domain-related search categories are ecosystems, climate, industry, stewardship, and institutions, and the traditional STEEP (social, technological, economic, environmental, and political) categories (Morrison 1992). Attached to each category are subcategories that further refine the search. The master domain map for the project included at least two subcategories for each category and occasionally more. Individual scanners were initially assigned one of the primary categories and conducted Internet searches specific to that area to identify signals of change within each category.

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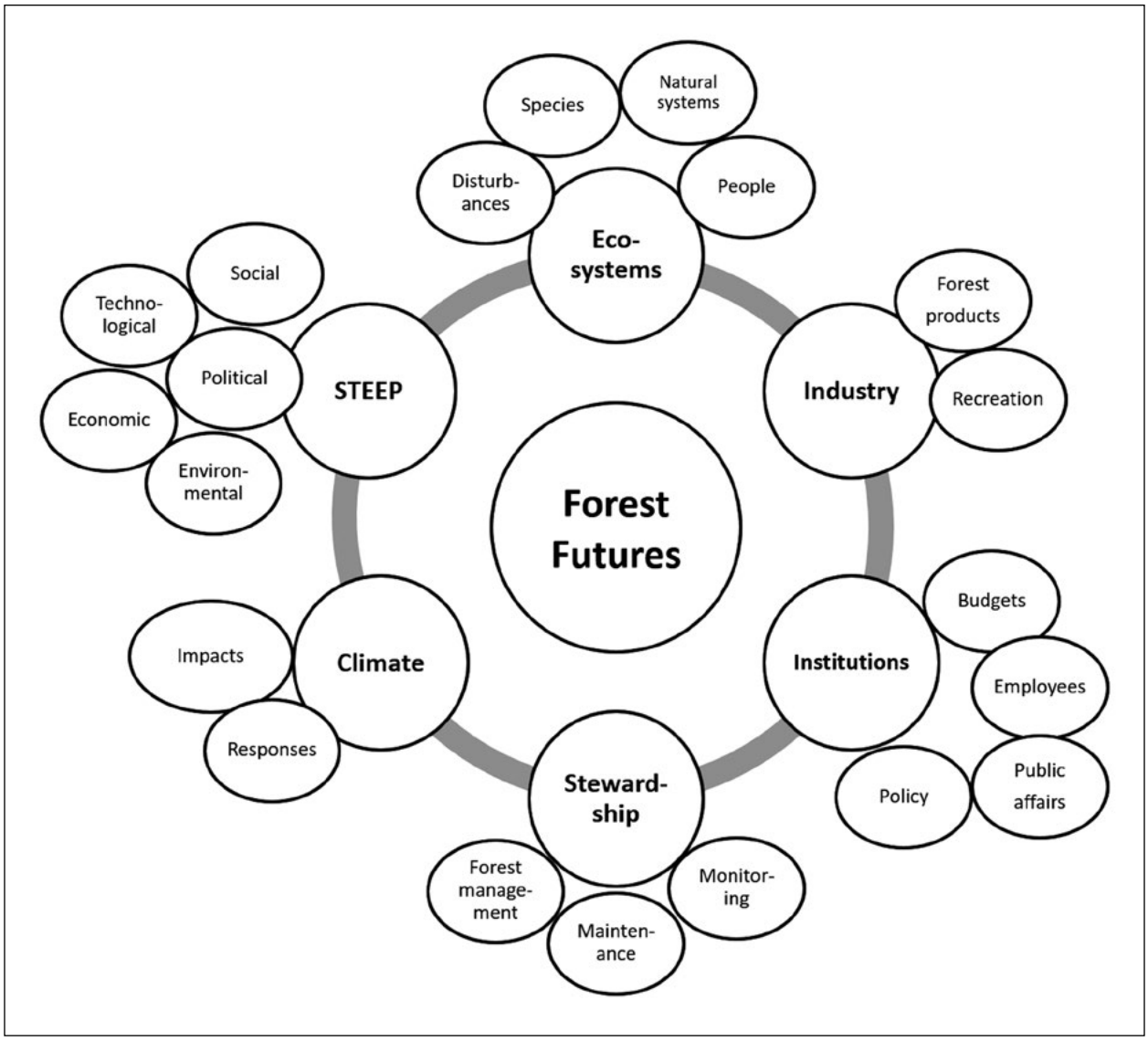

Figure 1.—Forest futures horizon scanning domain map.

The scanners typically drew upon a list of future-oriented keywords such as "of the future" and "long term" (see adjacent box). They were asked to scan across a range of sources including blogs, periodicals, news outlets, specialized industry Web sites, scientific and technical journals, and research reports. An individual signal of change is referred to as a "scanning hit." The individual scanning hits are cataloged in a database with hyperlinks back to the original sources.

Futures-related Search Terms

of the future, of tomorrow, implications, emerging, long term, trend, by the year, vision, scenario, wild card, sea change, the next * years, 2025, 2030, crossroads, dilemma, disruption

The scanning team has so far identified and collected more than 1,000 scanning hits in a private group on Diigo.com, a publicly available Internet bookmarking tool that provides an online tagging, annotating, and sharing service for Web-based content (pages or portable document format [PDF] files) that can be easily shared across a group of users and exported into multiple formats for further analysis. The scanning hits were all from publicly available Internet sources. Each hit is tagged by using a common nomenclature drawn primarily from the domain map, along with a keyword or two that are specific to the hit (Fig. 2). As part of the tagging process, the scanner indicates which time horizon she thinks that a scan hit represents. For this project, Horizon 1 is the present to 2025; Horizon 2 is 2025 to 2035; and Horizon 3 is 2035 and beyond (Curry and Hodgson 2008). See paper 1 in this volume for more detail on the three time horizons. The scanner also comments on potential implications for forest futures.

Steps in Creating the List of Sources

The Diigo scanning library was exported to Microsoft® Excel to facilitate the analysis. The following steps were taken to parse potential scanning sources to identify the most fruitful ones:

1. Isolate. The URL for each scanning hit was parsed to extract the root domain (e.g., "www.usda.gov"), and duplicates were removed to generate a list of unique and nonrepeating root domain sources. The number of scanning hits that the team had collected for each root domain was noted as one initial indication of potential for future relevance.

2. Investigate. Each of the target root domains was then investigated to determine the relevance of the source to the forestry domain, the likelihood of producing additional scanning hits, and the degree to which the scanning hits were unique or intriguing. A subjective scanning hit opportunity rating was created, using a 5-point Likert-type scale (where 1 was "low potential opportunity" and 5 was "high potential opportunity"). The composite subjective scale reflected the following six criteria:

- Which time horizon does the source cover (Horizon 1, 2, or 3)?
- How many total hits from this root domain source were captured by the scanning group?
- How many scanners captured hits from this root domain source?
- What is the likelihood that this root domain source will produce additional hits in the future?
- How relevant is this source to the domain map categories?
- How unique are the hits from this root domain source?

The root domain sources were also categorized to indicate the type of information that the site was most likely to provide. The following categories emerged: forestry, futures, science, technology, environment, government, culture, mass media, general news, political, and design. To simplify the analysis, these 11 initial categories were clustered into 3: forestry, futures, and general scanning hits.

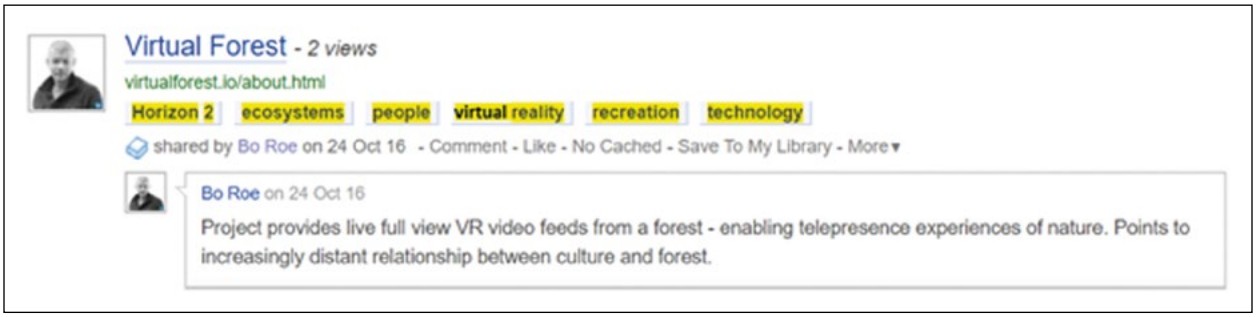

Figure 2.—A scanning hit with descriptive tags highlighted.

3. Abstract. To provide additional general information about each of the Web sources, a high-level overview of the purpose of the organization or entity associated with each site was captured from its "about" page or from Wikipedia where available. A scanning hit title and brief description from each root domain source were then captured as an example. These three points (root domain source overview, example scanning hit title, and example scanning hit description) form an abstract that indicates what each of these sources is likely to provide (Table 1).

4. Sort. The 5-point rating in Table 1 is based on a subjective judgment of how well each root domain source (not scanning hit) rates relative to the six criteria listed in the Investigate step (step 2). Sources with a scanning hit opportunity rating of 1 or 2 were eliminated as unhelpful. These scores did not reflect the content of the collected hits, but rather the potential of the root domain sources for future production of relevant and valuable scanning hits. Sources that rated from 3 to 5 were sorted into the first three of the following categories:

Table 1.—Sample abstracts of scanning sources

Scanning source title	Hyperlink	About (from site's "about" page or Wikipedia)	Category	Rating (1-5)	Scanning hit title	Scanning hit description
The Futures Centre	http://thefuturescentre.org/	Run by Forum for the Future, an independent, international nonprofit organization with a 20-year track record in driving sustainable development. Purpose is to accelerate the big shift to a sustainable future by transforming whole systems.	Futures	5	A bacterial ecosystem quickly restores unproductive soils	Forest management could be increasingly about soil management: harvesting, inoculating, and encouraging microbiomes to favor specific biomass species for unique forestry roles over much longer horizons.
Kurzweil	http://kurzweilai.net/	Launched in 2000, a network that explores the radical growth of pervasive technologies—both biological and machine—which are radically changing our world. Based on forecasts and insights originally articulated by futurist and inventor Ray Kurzweil.	Futures	5	Chemicals that encourage plants to defend themselves replace pesticides	Naturally occurring plant defenses could (if harnessed and activated by managers) replace existing pesticide applications to deter timber pests.

(continued on next page)

Table 1 (continued).—Sample abstracts of scanning sources

Scanning source title	Hyperlink	About (from site's "about" page or Wikipedia)	Category	Rating (1-5)	Scanning hit title	Scanning hit description
Futurity	http://futurity.org/	Features the latest discoveries by scientists at top research universities globally. The nonprofit site, which launched in 2009, is supported solely by its university partners in an effort to share research news directly with the public.	Futures	5	How to make asphalt soak up more greenhouse gases	A new form of porous asphalt can sequester 154 percent of its weight in carbon dioxide.
Resilience	http://resilience.org/	Supports building community resilience in a world of multiple emerging challenges, such as climate change and biodiversity loss, and the social and economic issues which are linked to these. Publishes news, research, and analysis in five areas (energy, economy, environment, food and water, and society).	General	4	Will Trumpism, Brexit, and geopolitical exceptionalism sink the planet?	"Indeed, the future pace of climate change will be determined as much by geopolitical factors as by technological developments in the energy sector."
GreenBiz	http://greenbiz.com/	Provides intelligent, focused content on business, technology, and sustainability for people from every industry and discipline. Since 1991, GreenBiz has chronicled and been a catalyst for thought leadership in aligning environmental responsibility with profitable business practices.	General	3	What if nature had the rights of a person (or a business)?	Granting personhood to forests (even specific forests) opens up new complexities for industry…weak signal, but very interesting.

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Table 1 (continued).—Sample abstracts of scanning sources

Scanning source title	Hyperlink	About (from site's "about" page or Wikipedia)	Category	Rating (1-5)	Scanning hit title	Scanning hit description
Forest Trends	http://www.forest-trends.org	Works to conserve forests and other ecosystems through the creation and wide adoption of a broad range of environmental finance, markets, and other payment and incentive mechanisms.	Forestry	5	Carbon marketplaces create a mechanism for forest carbon finance	Marketplace payments for carbon sequestration in forests continue to rise—future potential for "carbon farming" as a legitimate revenue stream…or carbon penalty for harvesting timber.

- ***Priority 1: Forestry-related sources***—directly related to the domain in addition to having a high degree of future-oriented content (Horizons 2 and 3). These sources are high priority for identifying future scanning hits.
- ***Priority 2: Futures-related sources***—considered a subset of more general sources, these sources have already done some of the hard work of creating future-oriented compilations. They provide context for Horizons 2 and 3, which support categories from the domain map.
- ***Priority 3: General sources (high ratings)***—not directly related to forestry, but provide a perspective on the future context. These sources have high potential for future scanning hits.
- ***Priority 4: General sources (low ratings)***—provided less interesting, more mainstream, or less domain-relevant information. While still worth reviewing for future scanning hits, these sources are less likely to produce significant, unique, or numerous hits, and are likely to remain focused on Horizon 1.

The sources were then documented in a table that was shared with scanners, with visual weight to the four priority categories just described.

5. Custom search engine—an optional fifth step. The purpose of the side project described in this paper was to create a prioritized list of sources to share with the scanning team. Roe (first author), however, thought it might be useful to take the work a step further and feed the output directly into a search engine. Therefore, the root domains identified as priorities 1, 2, or 3 were loaded into a Google Custom Search Engine (CSE) and prompted with the keywords "forest," "forestry," and "tree." Though not the intended purpose for Google's CSE application programming interface, this approach produced consistently relevant results (Fig. 3). Scanners can be provided a link to the resulting Web interface. They then have access to an additional scanning tool and new resources to leverage the existing scanning sources by searching for various keywords from the domain map.

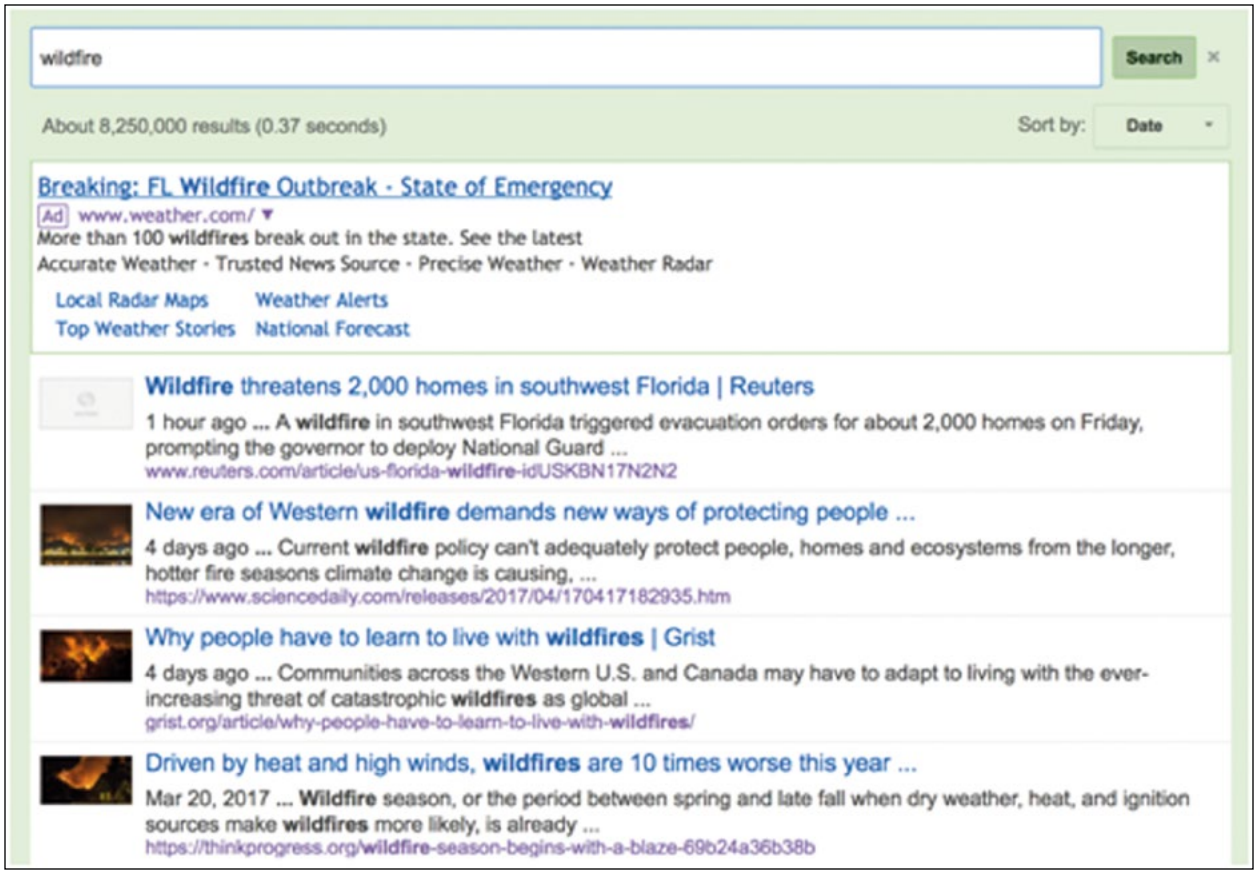

Figure 3.—Sample output from the Google Custom Search Engine.

DISCUSSION

The approach described here makes the most sense for organizations with a continuous scanning system. The setup time is worthwhile for ongoing scanning, whereas it may not be worth the effort for a short-duration scanning project.

Anticipated Uses

This research was part of a larger project to establish a horizon scanning system. A goal of the core team is to recruit a network of volunteer scanners. The volunteers have their "day jobs" and would be scanning primarily for goodwill, so the team is looking for ways to make the onboarding process as simple and effective as possible.
The table of scanning sources produced by this research—along with other tools described in the preceding paper—is a good first step to help new scanners quickly begin to identify potential signals of change related to forest futures.

Areas for Improvement and Further Research

This research project was informed by the early scanning work; in other words, the sources were the result of the initial rounds of exploration for the Forest Futures Horizon Scanning project. As a result of the use of these initial sources, future explorations would bring in whatever natural biases existed in the first phases of scanning. Therefore, it would be desirable for some scanners to scan outside the CSE and perhaps others would be specifically dedicated to finding new sources. It may make sense to revisit the sources in the CSE periodically and to include new sources identified as useful and relevant. They could pass through the same evaluation criteria; thus, the list would be a living document. It may also prove useful to limit the size of the list, so a "pruning" or elimination of the least productive sources could be done periodically as well.

A more rigorous rating system is likely to be worth the energy to create when practitioners are replicating this source prioritization method. Individual ratings for uniqueness, domain relevance, and the other criteria could be used to create a more consistent composite score. In this case, the root domain was isolated to generate distinct sources. In future replications of this method, this constraint might be relaxed, because some unique sources may originate from within the same root domain—as independent subdomain-level URLs or sources. This complicates the automation of the prioritization somewhat, but the effort may produce relevant information.

Though the Google CSE provides a very simple interface for cursory scanning, the results using only this tool would not be fully comprehensive. The tool is highly sensitive to the keywords and URLs loaded when constructed, and requires an administrator to make changes over time. However, the CSE does point to a future trajectory of simple custom scanning tools for projects that could bring inexperienced volunteer or client scanning teams into productive scanning quickly. While not a replacement for an active, informed, and skilled scanning process, the Google CSE output could be a beneficial introduction to the collection and processing of weak signals for new scanners. As these custom engines are based entirely on existing search parameters, the results will inherently be narrowed to previously identified areas. Though far from complete, it is a useful tool for getting new scanners up to speed.

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3. CONNECTING THE DOTS IN THE FOREST FUTURES HORIZON SCANNING DATABASE: AN INITIAL ANALYSIS

David N. Bengston, Nicole Zimmerman, and Kurt Callaway

Abstract.—A vital step in any ongoing horizon scanning process is periodically analyzing the growing database of scanning hits to identify emerging issues, provide insight into possible implications of these issues, and generate foresight. This paper is a preliminary and partial effort to "connect the dots" in the Forest Futures Horizon Scanning system. We examine the descriptive tags associated with each scanning hit as a way to characterize the database, and then describe several themes that have emerged from multiple scanning hits.

INTRODUCTION

Horizon scanning identifies "dots on the horizon"—indications that change may be coming. But the dots need to be connected and interpreted if they are to be useful. A vital step in any ongoing horizon scanning process is periodically analyzing the growing database of scanning hits to identify emerging issues, shed light on possible implications of the emerging issues, and generate foresight. Without analysis and sensemaking, horizon scanning produces a large number of individual scanning hits but little in the way of valuable foresight for planning, decisionmaking, and policy (Könnölä et al. 2012). This paper is a preliminary effort to "connect the dots" in the Forest Futures Horizon Scanning system. Far short of a comprehensive analysis, the paper is an initial and partial assessment of selected aspects of the horizon scanning database.

Currently, the Forest Futures online database contains about 1,200 scanning hits, collected over the past 2 years by a team of scanners and stored in a cloud-based bookmarking tool. The scanners tag each scanning hit with descriptive labels and add their initial thoughts about potential implications for forests, forestry, and the USDA Forest Service (hereafter, Forest Service). In this paper, we briefly examine the tags as a way to characterize the database, and then describe several themes that have emerged from multiple scanning hits. The emerging themes include (1) outdoor recreation in the age of social media, (2) the "coming age of wood," and (3) urban forestry 2.0. Other papers in this report analyze emerging issues in detail using the Implications Wheel® method: Bengston and colleagues examine "growing apathy toward the environment" in paper 5, and DeVaney and colleagues examine the issue of "growing indigenous empowerment" in paper 6.

TIMEFRAMES IN THE FOREST FUTURES DATABASE

The Forest Futures database includes individual scanning hits that represent a wide range of timeframes, from trends that are happening now to developments that could happen decades or even centuries from now. Scanners tag each of their hits with one of three time horizons (Curry and Hodgson 2008). Horizon 1 scanning hits are about an issue or event with an effect that is either current or imminent. They are related to the current prevailing system or baseline future, generally occurring from the present to 2025. Horizon 2 scanning hits may be related to events happening today or in a few years, but the impacts are likely to be many years off. They represent an intermediate time of transition in which alternative futures begin emerging as the first and third horizons collide. Horizon 2 scanning hits generally fall in the range of 2025 to 2035. Horizon 3 scanning hits indicate new ideas and potential developments so innovative and different that they would be likely to take decades to appear and have an impact. They are "weak signals" of change that

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may seem marginal or far-fetched in the present, but which could signal significant change in the long term. These visions of a new system are usually in a timeframe from 2035 and beyond.

The decision about which time horizon to assign to a particular scanning hit is subjective, but the three time horizon tags provide a rough idea of the timing of the impacts or potential impacts of hits. At the time of writing, the breakdown of hits by time horizon is 44 percent Horizon 1, 44 percent Horizon 2, and only about 13 percent Horizon 3 (Fig. 1). The relatively small share of Horizon 3 scanning hits suggests the difficulties for most scanners in identifying innovative and visionary signals of change. The paucity of Horizon 3 hits may also simply be due to an abundance of Horizon 1 and Horizon 2 signals of change relative to Horizon 3.

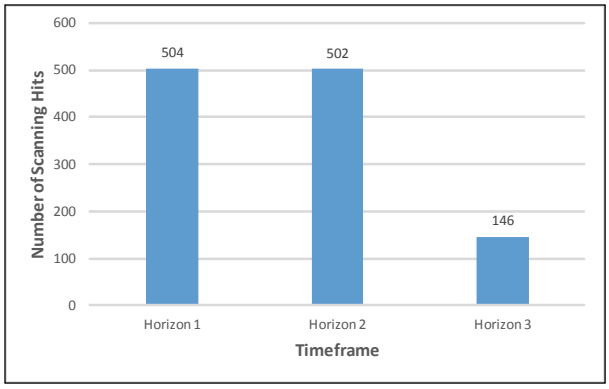

Figure 1.—Frequency of the three time horizons represented in the Forest Futures Horizon Scanning database.

THE 20 MOST COMMON TAGS

In addition to the three time horizons, hundreds of other tags have been used by the Forest Futures Horizon Scanning team to characterize scanning hits in the database. Some of these are from the "domain map" in the scanner guide (see paper 1, this volume), and many are additional keywords derived from the individual scanning hits. Of the 20 most frequently used tags in the database (not including the three time horizon tags), the "ecosystems" tag is used most often (Fig. 2).

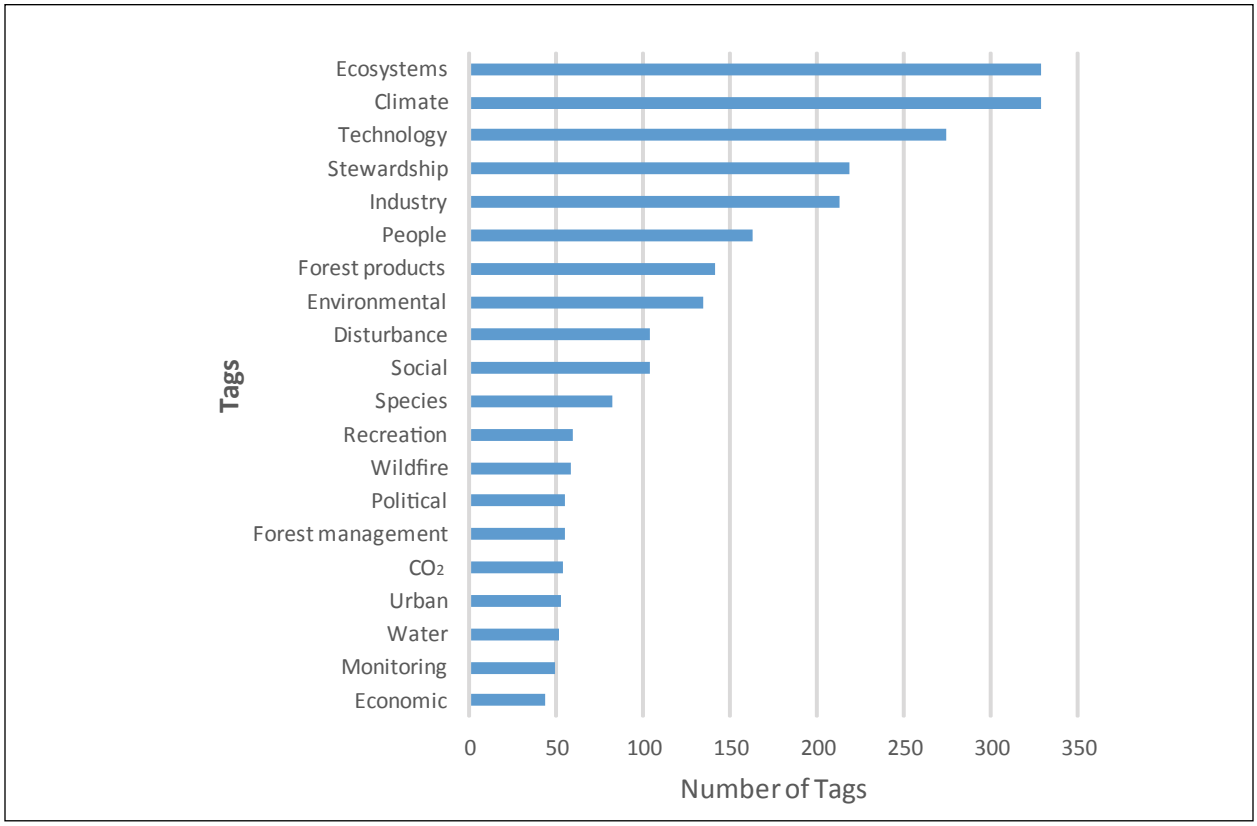

Figure 2.—Frequency of tags used to characterize scanning hits.

That the largest share of scanning hits points to change about ecosystems or change that could affect ecosystems is not surprising for a scanning effort focused on forest ecosystems. "Climate" is the second most frequent and shows the dominant force of climate change in shaping the future of forestry. Scanning hits tagged with "climate" include a wide range of possible effects of climate change on forests, as well as the role of forests in sequestering atmospheric carbon dioxide (CO_2) and mitigating climate disruption. All five of the STEEP tags—social, technological, economic, environmental, and political—are among the 20 most often used tags, suggesting the importance of external sources of change, that is, change coming from outside of forests and natural resources. External or "inbound" change is discussed in the following section.

INBOUND VS. OUTBOUND SCANNING HITS

Change and indicators of possible change can be inbound or outbound. As Bishop (2012: 13) explains: "Our personal and organizational futures are shaped by two sets of forces: change that happens to us (from the external world beyond our control, which we call 'inbound' change) and change that we create ourselves (based on our decisions and actions, which we call 'outbound' change)."

The scanning hits in our database include many that represent inbound change (for example, an article about the possible impacts of widespread adoption of self-driving cars: accelerating sprawling development, thereby increasing fragmentation of forests) and many that are outbound (for example, an article about a new paradigm in wildfire management proposed by wildfire ecologists).

Our scanners did not code their hits specifically for inbound (external) or outbound (internal) change. But the share of hits tagged with any of the STEEP categories could serve as a rough proxy for this dimension. Examination of Figure 2 shows that all five of the STEEP categories are included in the 20 most frequently mentioned tags. A total of 611 hits have been tagged with a STEEP category, more than half of the almost 1,200 hits in the database. Technology was clearly dominant among the STEEP categories of inbound change, accounting for about 44 percent of all STEEP tags.

The STEEP proxy for inbound change suggests that scanners have struck a balance in identifying inbound and outbound change. But forest policymakers may be more interested in inbound change than in outbound change. Many professionals within forestry are already aware of outbound change through internal information sources, and too little focus on inbound change could blindside forestry professionals.

SELECTED EMERGING ISSUES

This section describes three issues that have emerged from the Forest Futures database, and provides examples of scanning hits representing each of these emerging issues. The three issues are (1) outdoor recreation in the age of social media, (2) the "coming age of wood," and (3) urban forestry 2.0.

Outdoor Recreation in the Age of Social Media

Technology and social media are changing where and how people enjoy outdoor recreation. The Forest Futures Horizon Scanning database contains several hits on this topic, all of which have implications for forests and forest management in the immediate future and the potential for significant effects in the longer term. These hits include:

Instagram is Loving Nature to Death
Recreationists are increasingly picking where to go to experience the outdoors based on areas' "Instagrammability," or picture-worthiness, and land management agencies have been forced to play catch-up to accommodate crowds. For example, the number of visitors to Horseshoe Bend in the Glen Canyon National Recreation Area in Arizona has exploded from around 1,000 visitors a year to around 4,000 visitors a day. This increase in visitation can largely be attributed to the area's popularity on Instagram—the hashtag

#horsehoebend has been used over 303,000 times on the app (as of May 2018). At Glen Canyon National Recreation Area, the National Park Service has opted to build a new parking area and a viewing platform to accommodate the volume of visitors to Horseshoe Bend. Another popular spot on social media, Conundrum Springs in the White River National Forest in Colorado, has also seen an exponential increase in visitors in recent years—prompting the Forest Service to require permits and reservations to visit the area.

People Like to Watch Other People on YouTube

Similarly, a small but dedicated community of YouTube users watch and create videos recording hiking and camping trips. These videos allow users to experience recreation sites without leaving their homes and connect with other outdoor enthusiasts. They also serve as reviews for recreation areas. YouTube videos could drive potential recreationists toward or away from areas.

Hipcamp, the AirBnB for Camping, Allows Nature Lovers to Rent Land

Web sites like Hipcamp, Outrider, and Tentrr allow landowners to rent their land for camping and outdoor recreation over the Internet. Increased opportunities to camp on private land could reduce demand for campsites on national forests, but it could also change the demographics of people camping in national forests or increase the number of day-visitors to national forests if people are able to camp on adjacent private lands. Another variation on this idea is Trailhead Outdoor Journey Cooperative, a company and Web site that allows campers in the Washington, DC area to rent a set of camping gear and a car to get away for up to 4 nights.

RVs are Back and Better than Ever

Sales of recreational vehicles (RVs) are at record highs. This trend is driven, in part, by young consumers and has been attributed to smartphones, which make it easier to navigate the country. RV road trips often involve stops in national parks and national forests. Some Instagram users have glamorized endless road trips and living in a van. These users track their travels with the hashtag #vanlife and inspire their followers to try similar trips and visit public lands along the way. On the flip side, economic circumstances have led a growing number of Americans to become "nomads"—living in RVs and working seasonal jobs at warehouses for Amazon.com Inc. and on national forest campgrounds in order to get by and save money. Many of these nomads learned about this lifestyle through blogs and online forums; they use social media to find and gather with like-minded people on public lands in their free time (Bruder 2017).

Social media is changing our relationship to risk in the outdoors

Social media is beginning to collapse the boundaries between the digital and real world, which can affect people's assessments of how dangerous things are and result in deadly consequences in high-risk outdoor recreation activities like mountain climbing. High risk activities do not seem extreme or dangerous if you see enough Instagram photos of other people doing them.

Possible implications of social media for recreation on public lands include the following:

- Rapid and large fluctuations in the demand for recreation, depending on whether a location is trending on social media, could make recreation planning and management much more difficult.
- The continued growth of social media-driven nomadic lifestyles—among both the affluent and the poor—could significantly change the demands on public campgrounds, crowding out traditional recreationists and changing the nature of recreation experiences.

While many venture to the outdoors to unplug and get away from modern technology, it has become clear that separating the Internet from the rest of life—even in wild places—is increasingly difficult and rare. Further innovations in the way that people use social media are also likely to affect the way that people enjoy forests, and those responsible for managing outdoor recreation should take note.

The Coming Age of Wood

The idea of a "coming age of wood" and "the revolutionary role that it would play in our future" was first expressed by Glesinger almost 70 years ago (Glesinger 1949: 3). But many emerging innovations in wood products technologies suggest that a revolution in wood products may be finally getting underway. A recent report characterized this as "The Once and Future Bioeconomy" (Bowyer et al. 2017). Several wood products experts and the United Nations Economic Commission for Europe (UNECE) have declared that the 21st century could be the "century of wood" (UNECE 2016). The Forest Futures Horizon Scanning database includes many articles about significant innovations in wood products that could be game changers for forestry and forest products. Examples of these scanning hits follow.

Wood-based nanomaterials have been produced at a pilot plant at the Forest Service's Forest Products Laboratory in Madison, WI for more than 5 years. Other pilot plants are in operation around the world. There are thousands of uses for this renewable and biodegradable material, including computer chips, flexible computer displays, car panels, replacement human tendons, and coatings to keep food fresh longer.

Tall wood buildings or "plyscrapers" are sprouting up across the globe today, built with cross-laminated timber (CLT) and other "mass timber" technologies. CLT is made from layers of wood crisscrossed and held together by fire-resistant glue. It is as strong as structural steel, greatly speeds up construction, and has a much lower carbon footprint than steel and concrete buildings. Mass timber may be in the process of disrupting the construction and wood products industries.

3D printing using cellulose from wood pulp is just beginning, but cellulose could be cheaper, stronger, and more environmentally friendly than petroleum-based polymers currently widely used in medical devices, building materials, and many other products. This renewable material could replace a large amount of plastics.

Fabric made from wood fibers could revolutionize both the textile and forest industry. A company in Finland has developed a process that transforms wood fibers directly into yarn. It uses 99 percent less water and 80 percent less energy than producing cotton.

Wood nails offer many advantages over fasteners made of aluminum or steel. LignoLoc® nails (Beck Fastener Group, Mauerkirchen, Austria) are compressed with a resin to make them hard. Their mechanical properties allow the nails to be driven by a pneumatic nail gun into solid structural timber without drilling pilot holes.

Transparent wood that could substitute for glass has been produced by using a new process developed by Swedish scientists. The process chemically removes lignin from natural wood fibers to produce clear windows and solar cells. This could be a cheaper substitute for traditional silica-based glass. The new process is thought to be particularly well suited to large-scale applications and mass production.

Biodegradable electronics could be developed by using graphene made from wood in a new process created by scientists at Rice University. Graphene is usually a sheet of carbon just one atom thick—not practical to work with. The Rice researchers developed a way to make a three-dimensional graphene foam by heating a piece of pine with an industrial laser under very specific conditions. They believe that someday "wooden electronics" could help curb the problem of waste from electronic devices.

Two of the many possible implications of "the coming age of wood" are:

- Increased demand for wood and increased tree planting to meet the demand, resulting in increased absorption of atmospheric CO_2 and reduced effects of climate change
- Development of markets for wood currently lacking market value and thinning of overgrown forests with high fuel loads to supply these markets, resulting in decreased wildfire risk

Architect Anthony Thistleton has observed: "The 20th Century was the concrete age, it was all about the dominion of [humans] over nature." The coming age of wood suggests that the concrete age could be yielding to an era in which an ancient and renewable material takes center stage.

Urban Forestry 2.0

The Roman historian Tacitus recorded how Julius Caesar once interviewed men who had journeyed for 2 months from Poland to Gaul (France) without ever glimpsing sunlight due to the unbroken tree canopy. In modern times, civilization has seemingly been measured by how far the forest eaves could be pushed back from farmland and cities. But recent decades have begun to see a reversal to that way of thinking.

The idea of a next generation of urban forests coexistent with modern cities has taken hold and suggests a variety of ways to introduce significant greenery back into cities, not just as dedicated horizontal parks and street trees at ground level, but as an integrated approach to sustainable urban design. Forested stretches of old elevated rail lines are already a reality in New York City and Chicago, IL with other "high-line" parks in the works around the world. Forests entirely indoors have been proposed: In Belgium a huge abandoned industrial complex may become just that sort of multilevel, multiuse "green haven." In Asia, too, the first steps of reversing the long trend of cities encroaching on green space are being taken as China (whose capital, Beijing, is severely affected by air pollution) plans new buildings constructed from the ground up as "vertical forests".

Although the upward greening of the world's cities will not happen overnight, we can still ask what some of the advantages of this new trend may be. Besides encouraging biodiversity, the ascending concentration of planting will help improve air quality, reduce the need for expensive street-level space, and provide a welcome, even personal, environment for the human residents. Cities which used to compete to raise the highest skyscraper may instead vie to offer the most verdant and pleasant green cityscape.

Of course, the next generation of urban forests may also result in unintended consequences. Some cities, struggling to provide enough water for their human population, may find themselves having to make difficult choices in allocating that precious resource. Though the forests are expected to bring the return of many declining species, such as songbirds and bees, they may also exacerbate the problem of urban pests: those already entrenched in the city (rats, mice, raccoons, and ants), as well as new ones, such as ticks, beetles, borers, and moths.

Implications of urban forestry 2.0 are wide-ranging and could include:

- A long-term trend of decreasing visits to natural areas outside cities, as people feel less need to get away and experience nature outside urban areas
- Many health benefits including fewer respiratory illnesses due to increased air quality and reduced depression due to increased exposure to nature

CONCLUDING THOUGHTS

This paper described a limited analysis of the database of scanning hits produced by the Forest Futures Horizon Scanning project. It is a first step in a comprehensive approach to "connect the dots" contained in this rich and growing database. A more complete analysis could include the use of various methods to prioritize scanning hits through scoring and ranking (see paper 1). Other futures research tools can be used to analyze, synthesize, and interpret the meaning of scanning hits, including the nominal group technique, impact/likelihood assessment, the Futures Wheel, and cross-impact analysis (Bengston 2013). A goal of this ongoing scanning project is to produce an annual analysis of the most recent emerging issues, in addition to a variety of other outputs (e.g., blogs, newsletters, presentations) for communicating the results of scanning.

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4. IDENTIFYING CURRENT USDA FOREST SERVICE ISSUES TO PROVIDE CONTEXT FOR HORIZON SCANNING

Kurt Callaway, Andy Hines, and David N. Bengston

Abstract.—A key purpose of the Forest Futures Horizon Scanning system is to identify weak signals of potential future change and emerging issues for the USDA Forest Service and its stakeholders. An understanding of current issues facing the agency is a prerequisite for identifying weak signals and emerging issues. Scanners who work for the Forest Service generally have this understanding, but scanners from outside typically have little or no familiarity with current agency issues. This paper briefly describes an effort to develop a list of current issues for the Forest Service to be used by scanners in the Forest Futures Horizon Scanning project. Twelve broad current issues are identified and summarized.

INTRODUCTION

A key purpose for creating a horizon scanning system is to identify emerging issues. These are issues that have not yet been identified by decisionmakers as requiring attention or a policy response. Emerging issues can exist at various degrees of emergence—from just identified and a long way off to becoming well known and of imminent impact. Horizon scanning provides early warning of emerging issues, so that decisionmakers can prepare for them before they fully emerge and affect the sector or industry.

In order to identify what qualifies as "emerging," the scanning team must first be aware of what the *current* issues are for the organization or field for which the scanning is intended. Without a list of current issues, scanners—especially those from outside the organization—may have difficulty determining whether a scanning hit represents an emerging issue or whether it is well known and already on the organization's radar screen. It is not common for organizations to have a clearly articulated and agreed-upon list of current issues (never mind emerging issues). Such lists are sometimes prepared as part of strategic planning activities, or they may be developed as part of strategic foresight functions where these exist.

This paper briefly describes an effort to develop a list of current issues for the USDA Forest Service (hereafter, Forest Service) to be used by scanners in the Forest Futures Horizon Scanning project. The next section defines key concepts related to issue emergence and their relationships to each other, followed by a description of the simple method used to identify current issues for the Forest Service. The final list of 12 current issues is then presented.

ISSUE EMERGENCE: KEY CONCEPTS AND TERMS

The relationship between key concepts and terms in issue emergence can be illustrated by combining the public policy lifecycle curve (Bryson 2011, Molitor 2001) with the "Three Horizons" framework (Curry and Hodgson 2008) (Fig. 1). Key concepts in Figure 1 are:

- **Weak signals:** The first signs of a potential emerging issue
- **Emerging issues:** Issues that decisionmakers have not yet identified as requiring attention or a policy response
- **Current issues:** "Fundamental policy questions or critical challenges that affect an organization's mandate, mission and values; product or service level and mix; stakeholders, users, or citizens; cost, financing, organization or management" (Bryson 2011: 55)
- **Horizon 1:** The near-term time period from now until about 10 years into the future, focusing on current issues and the current prevailing system

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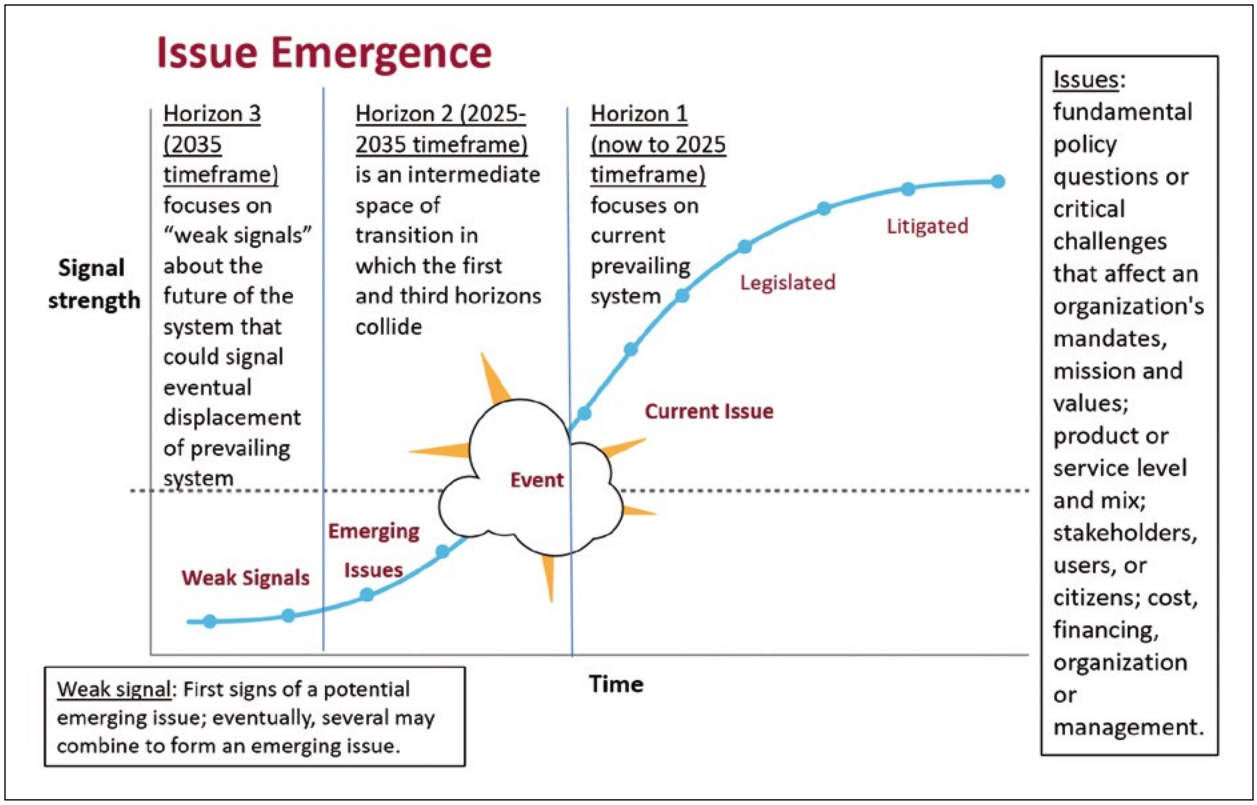

Figure 1.—The issue emergence process and the three time horizons. Sources: Bryson (2011), Curry and Hodgson (2008), Molitor (1977).

- **Horizon 2:** The intermediate-term time period of about 10 to 20 years into the future; an intermediate space of transition in which the first and third horizons collide
- **Horizon 3:** The long-term time period of about 20 or more years into the future, focusing on weak signals about the future of the system that could indicate eventual displacement of the prevailing system

The public policy lifecycle curve suggests that issues emerge gradually over time. They appear first as weak signals of change. These signals eventually coalesce into an emerging issue, which eventually develops into a current issue, typically when a significant event propels it into public attention and concern (Molitor 1977). Weak signals are associated with the Horizon 3 timeframe, because they signal potential long-term change. As weak signals gain strength and coalesce as emerging issues, they move into Horizon 2. Finally, when emerging issues mature and become widely recognized as current issues for an organization or field, they fall into the Horizon 1 timeframe. An understanding of the current issues facing an organization is a prerequisite for effective scanning and the ability to identify weak signals and emerging issues.

METHODS

Most organizations do not have an agreed-upon and explicit list of current issues they are facing. We were unable to find a published current issue list for the Forest Service, and therefore we took the following steps to create one. We:

1. Asked key Forest Service personnel whether an unpublished list of current issues might be available, for example, from the Policy Analysis Group (Washington Office) and Office of Communications (Washington Office). We were told that there is no formal or informal list.

2. Reviewed Forest Service policy documents for explicit and implicit current issues, such as the USDA Forest Service Strategic Plan: FY 2015-2020 (USDA Forest Service 2015), Future of America's Forests and Rangelands: Forest Service 2010 Resources Planning Act Assessment (USDA Forest Service 2012), and Future of America's Forests and Rangelands, Update to the Forest Service 2010 Resources Planning Act Assessment (USDA Forest Service 2016). Potential current issues were identified and collected.
3. Reviewed the "Horizon 1" scanning hits in the Forest Futures Horizon Scanning online library for potential current issues. There were more than 200 Horizon 1 scanning hits in the library at the time of this analysis. Potential current issues were identified and collected.
4. Compiled a master list of possible current issues, after combining similar issues from the policy documents that were reviewed and the Horizon 1 scanning hits.

RESULTS: CURRENT ISSUES FOR THE FOREST SERVICE

Our final current issues list contains 12 major strategic issues (Table 1). These are all well known to the Forest Service and other forestry professionals:

- **Climate change** is having growing impacts on forest ecosystems as well as social and economic impacts.
- **Wildfires** are becoming more frequent and intense and taking up a growing portion of the Forest Service budget.
- **Forest fragmentation and loss** is increasing due to land development.
- **Budget cuts** are straining the ability to effectively manage forests.
- Maintaining a **healthy forest products industry** is increasingly vital to a balanced forest management approach.
- **Exotic and invasive species** are growing threats to sustainable forests.
- **Biodiversity loss** is a growing challenge to forest resource management.
- **Improving forest resilience** to meet a wide range of future demands is a growing challenge.
- **Monitoring technologies** are improving capabilities to monitor and forecast forest health, and to inventory conditions.
- **Water quality protection and water supply** continue to be important.
- **Recreation patterns** are continuing to shift.
- **Urban forestry** is gaining increasing interest and importance.

There was some debate on a few of the issues on the list about whether they are current or still emerging. A challenge in making that distinction for scanning teams is that they may be more aware of issues than their clients. They will tend to see more issues as current because they have been trained to identify them and probably have been watching them for some time. In most cases, the issues that could be treated as either current or still emerging were put on the current list. This decision was made in part to make the scanning team "stretch" and identify truly emerging issues.

CONCLUDING COMMENTS

This paper described the need to identify current issues in horizon scanning and steps taken to identify current Forest Service issues to be used in the Forest Futures Horizon Scanning system. An understanding of current issues facing the agency is required for accurately identifying weak signals and emerging issues that the agency may need to address in the future. The 12 broad current issues that were identified can guide current and future horizon scanning efforts.

Table 1.—Current forestry issues, 2017

1. Climate change is having growing impacts on forest ecosystems as well as social and economic impacts. Climate change is a major driver of other issues relevant to forestry, with wide-ranging impacts from influencing the growing season and enabling the more rapid spread of invasive species to larger and more intense wildfires. These impacts appear to be increasing and cumulative, thus threatening the biodiversity and resilience of entire ecosystems. At the same time, forests could play a significant role in climate change mitigation.
2. Wildfires are becoming more frequent and intense and taking up a growing portion of the Forest Service budget. The increasing intensity and frequency of wildfires threaten natural resources and people's property. Wildfires are increasingly encroaching on the wildland-urban interface (WUI) as human settlements continue to expand. Responding to wildfires takes priority over other projects and consumes an increasing share of the budget. There is growing debate over the use or overuse of aggressive fire suppression versus a "learning to live with wildfire" management paradigm.
3. Forest fragmentation and loss is increasing due to land development. Forest land is being encroached upon by the pressure for development. These human settlements threaten the integrity and viability of forest ecosystems. There has been little public pressure to stop the fragmentation.
4. Budget cuts are straining the ability to effectively manage forests. As one of many agencies continually asked to "do more with less," the Forest Service is increasingly constrained by the resources allocated to it. Lower funding is often accompanied by greater demands.
5. Maintaining a healthy forest products industry is increasingly vital to a balanced forest management approach. The Forest Service must continue to balance the competing priorities of sustainably managing forests and helping to support a healthy forest products industry. Major innovations in wood products and in forest management pose challenges and opportunities for striking this balance.
6. Exotic and invasive species are growing threats to sustainable forests. Invasive species continue to spread through forest ecosystems. They are assisted by human global transportation networks, as well as a warming climate, which allows pests to spread to areas they could not previously tolerate. The results are corresponding declines or changes in native species that are threatened by exotics and invasives.
7. Biodiversity loss is a growing challenge to forest resource management. The influence of humans and economic development on forest ecosystems is a major driver of biodiversity loss, as habitats are disrupted. A key challenge is that much is still not known about the role of biodiversity in maintaining healthy ecosystems. Thus, some losses or shifts could have surprisingly significant negative effects.
8. Improving forest resilience to meet a wide range of future demands is a growing challenge. The growing range of challenges to forest ecosystem health puts a premium on resilience, that is, a system's ability to continue to function, absorb change, recover, and adapt in new directions. A resilient system includes some redundancies, backup, and inefficiency compared to an optimized system, but is better suited for long-term health.
9. Monitoring technologies are improving capabilities to monitor and forecast forest health, and to inventory conditions. Emerging technologies such as the Internet of Things, drones, robotics, and satellites are increasingly being incorporated into monitoring the health of ecosystems. They extend human capabilities to monitor remote areas, and go into greater depth.
10. Water quality protection and water supply continue to be important. Climate change could intensify pressure on water quality and water yield that could in turn pose greater challenges to managing ecosystem services.
11. Recreation patterns are continuing to shift. Nature-based recreation continues to decline, while new innovative proposals for getting people back to nature emerge. Ecotourism, for instance, has continued to grow even as the overall use of nature for leisure and recreation declines.
12. Urban forestry is gaining increasing interest and importance. Affluent societies are increasingly and overwhelmingly urban. More effort is being made to integrate forests and other natural areas into the urban environment, which brings a host of challenges and benefits.

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5. USING THE IMPLICATIONS WHEEL IN HORIZON SCANNING: EXPLORING IMPLICATIONS OF GROWING APATHY TOWARD THE ENVIRONMENT

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Abstract.—The Implications Wheel® is a structured brainstorming technique to explore possible consequences of any type of change. This paper describes an exploratory application of the Implications Wheel method to uncover potential consequences of important emerging issues identified through horizon scanning. The issue "growing apathy toward the environment" was explored. We found that even a quick, small-scale application of the method can identify many useful insights: 155 implications were generated, including many scored as highly significant.

INTRODUCTION

Over time, an ongoing horizon scanning process may produce hundreds or even thousands of "scanning hits"—indicators of emerging issues that could signal future change. Out of this large amount of data, the most important issues need to be identified, analyzed, and interpreted if they are to provide useful foresight (Könnölä et al. 2012). This paper describes an application of the Implications Wheel® method to explore potential consequences of high priority issues identified through horizon scanning. This method was applied to an issue that emerged from the USDA Forest Service-University of Houston Forest Futures Horizon Scanning project: the public's growing apathy toward the environment.

The Implications Wheel is a structured group process to explore possible consequences of any type of change (Barker 2011). An earlier version of this technique was proposed by Glenn (1972) and is called the Futures Wheel. Since it was first proposed in the 1970s, the method has been refined and applied thousands of times in many different contexts (Bengston 2016). The structured group process of the Implications Wheel 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 helps planners and decisionmakers to proactively consider potential long-term, higher-order effects of change in order to prepare for it.

The next section describes the issue explored in this Implications Wheel exercise. This is followed by an outline of the method, and a summary of the main results. A concluding section discusses the usefulness of the method in the context of horizon scanning.

ISSUE ON THE HORIZON: GROWING APATHY TOWARD THE ENVIRONMENT

One of the salient issues that was identified in the initial phase of the Forest Futures horizon scanning project was the public's "growing apathy toward the environment in the United States." This issue has been observed in public opinion polls since the early 1990s and in various studies examining the connection between people and nature. Evidence of this issue includes the following:

- A 2016 Gallup Poll found that 42 percent of Americans identify themselves as environmentalists, down from an average of 76 percent in the late 1980s and early 1990s (Jones 2016).
- Americans express less concern about most environmental problems now than in the late 1980s and early 1990s (Jones 2016).
- A growing body of research has shown an increasing disconnect with nature in our

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society and less participation in outdoor nature recreation (e.g., Balmford et al. [2002], Louv [2005], Kareiva [2008], Zaradic [2008], Zaradic and Pergams [2007]).

- Unlike in previous campaigns, environmental issues were largely ignored during the 2016 presidential campaign, especially in the general election, in which environmental concerns were scarcely mentioned by either of the major party candidates (Dolsak and Prakash 2016).

Kareiva (2008: 2758) asserts that if current trends in attitudes toward the environment and the decline in nature-based recreation continue, they could pose "the world's greatest environmental threat" because people care for and protect what they understand and value. The long-term implications of growing apathy toward the environment could be profound, and include important consequences for public land management agencies such as the USDA Forest Service (hereafter, Forest Service). These implications are explored in this Implications Wheel exercise.

METHODS: THE IMPLICATIONS WHEEL

The word "wheel" in Implications Wheel derives from the wheel-like structure to the notes that emerges as the brainstorming process proceeds. The change of interest is placed in the center—like the hub of a wheel—and then participants generate first-, second-, and third-order implications of the change that emanate outward from the center in concentric rings.

Implications Wheel exercises are typically carried out as a group process, with participants gathered in one location at the same time. This exercise was carried out remotely and asynchronously using the Implications Wheel online software. Each participant contributed individually online at her or his convenience. Due to the small number of participants—the authors of this paper—this exercise should be considered an exploratory application of the method, with the intent to examine its usefulness and limitations in horizon scanning.

The online exercise included three rounds of generating implications (first-, second-, and third-orders) and one round to score the likelihood and desirability of each implication. Participants first familiarized themselves with the details of the central issue and reviewed the Implications Wheel rules for generating implications. For example, participants are to assume that the central issue is occurring and will continue, generate implications that are a *direct* consequence of the preceding implication, include both positive and negative implications, and ensure that implications are specific and concrete.

Round 1 was open online for 3 days, during which participants could contribute at any time. Participants suggested 32 potential first-order implications for the issue "growing apathy toward the environment in the United States." This was far too many first-orders to deal with in a small, exploratory exercise and many of the 32 proposed first-orders were not direct consequences of the central issue. Therefore, we selected the following five first-orders for exploration based on their representing broad areas of potential implications and being direct consequences of the central issue. Growing apathy toward the environment in the United States may have the following results:

1. Political support for the Forest Service and other natural resource management agencies decreases significantly,
2. Younger generations grow up more disconnected and alienated from the outdoors and the environment,
3. A massive public education campaign is launched by a coalition of environmental nonprofit organizations, educators, land managers, and others to counteract growing apathy,
4. Apathy in the United States spreads to public environmental sentiment in Europe and across the Americas, and
5. The private sector takes on a significantly greater role in environmental leadership.

Given this set of first-order implications, round 2 was open for online submission of implications for 8 days and produced 25 second-order implications, 5 for each first-order. Round 3 was also open for 8 days and produced 5 third-order implications for each of the 25 second-order implications, resulting in 125 third-order implications and a total of 155 implications.

Following identification of implications, an online scoring process was conducted in which participants subjectively rated each implication for desirability and likelihood. Scoring highlights the most important implications and points out potential opportunities and pitfalls that can be addressed by planners and decisionmakers (Schreier 2005). Each of the first-, second-, and third-order implications was scored on an 11-point desirability scale from +5 (highly positive) to -5 (highly negative), and on a 9-point likelihood scale from 1 (highly unlikely) to 9 (highly likely). Desirability scoring was carried out from the perspective of public land managers. In addition to the standard scoring categories, special categories were used to identify high impact implications. An implication deemed to have extraordinarily positive impacts is termed a "triumph" and receives a score of +50. If an implication is considered to have unusually negative consequences, it is referred to as a "catastrophe" and scored -50.

RESULTS AND DISCUSSION

In the three rounds of online Implications Wheel submissions, participants generated far more third-order implications than lower-order implications (Fig. 1). The dominance of third-order implications is due to the structure and process of the method, which shift the focus from immediate, direct implications to longer-term, indirect consequences of change. This emphasis on the longer term fits with the future-oriented nature of horizon scanning. Without this structure, people tend to focus on direct and short-term implications (Schreier 2011).

Figure 1.—Number of first-, second-, and third-order implications, and the share scored as positive, negative, and neutral in an Implications Wheel exercise that considered Americans' growing apathy toward the environment.

Overall, half (78) of the implications were scored as negative, 67 as positive, and 10 as neutral, not surprising given the undesirable nature of "growing apathy toward the environment." The large share of positive implications produced by a negative issue illustrates that undesirable change can present opportunities for policy and management actions that create positive change in the future.

Highly Significant Implications

Two types of highly significant implications have special relevance for planners and policymakers. First, *likely strong negatives* are implications scored as high on the 9-point likelihood scale (7, 8, or 9) and strongly negative on the 11-point desirability scale (-4 or -5). Implications that are deemed both highly likely and strongly negative call for policies or management actions designed to decrease their likelihood or mitigate their undesirable effects. Second, *unlikely strong positives* are implications scored as both unlikely (1, 2, or 3 in likelihood) and strongly positive (+4 or +5 in desirability). Implications that are both unlikely and strongly positive may require actions to increase their chances of occurring.

Participants identified 27 likely strong negatives and no unlikely strong positives. The large number of *likely strong negative* implications indicates the many ways in which the issue "growing apathy toward the environment" could produce a cascade of highly undesirable results for the environment and society, such as:

First-order: A significant decrease in political support for natural resource management agencies, leading to

Second-order: The sale of public lands, slashed research funding, privatized campgrounds that exclude low income groups with high fees, and

Third-order: Unsustainable logging and mining on former Federal lands (likely strong negative).

First-order: Younger generations become more disconnected and alienated from the outdoors, resulting in

Second-order: Growing substitution of virtual reality for real outdoor experiences, and

Third-order: Increasing social and cultural stress among 18- to 40-year-olds (likely strong negative).

First-order: The private sector takes on a significantly greater role in environmental leadership, leading to

Second-order: The economic elite beginning to purchase and manage large tracts of land as a symbol of status, and

Third-order: Many farmers and ranchers priced off their land (likely strong negative).

The preponderance of diverse *likely strong negatives* generated in this exercise suggests that the central issue is indeed a very serious threat for public lands and land managers with potentially profound implications.

Wild Cards: Catastrophes and Triumphs

Wild cards are low-probability, high-impact developments that may be positive or negative, are unexpected, and have the potential to be game-changers (Petersen and Steinmueller 2009). Wild cards often emerge in Implications Wheel exercises, usually as third-order consequences. The special scoring categories of "triumph" (+50) and "catastrophe" (-50) are used to identify positive and negative wild cards. Our participants identified two wild card implications, both catastrophes and both arising from the same first-order implication:

First-order: Growing apathy in the United States spreads to public environmental sentiment in Europe and across the Americas (-4 desirability, 4 likelihood), leading to

Second-order: The acceleration of unchecked exploitation and neglect of natural resources internationally without regard for long-term consequences (-50, Catastrophe), and

Third-order: Widespread environmental collapse, causing public panic (-50, Catastrophe).

In addition to the two catastrophes, the following three likely strong negative third-order implications were also generated from the second-order just listed:

- Climate change ravages coastal cities (-5 desirability, 8 likelihood)
- Africa bears the brunt of natural-resource overuse with massive mineral exploitation through foreign direct investment and corrupt governments (-5 desirability, 7 likelihood)
- Unenforceable international agreements to offset environmental damage become irrelevant (-5 desirability, 7 likelihood)

This is an example of how a negative issue has the potential to accelerate and spread, eventually resulting in dire consequences. Knowing this well in advance, managers and other decisionmakers can monitor the issue and its possible trajectories through focused horizon scanning. If needed, they can develop plans and policies to reverse the issue and avoid highly undesirable consequences. Put another way: The results of an Implications Wheel exercise are not given outcomes; they are *potential* outcomes, allowing for early action to create a different, and more desirable, future outcome.

Emerging Future Themes

Finally, a thematic content analysis was carried out on the complete set of 155 implications to identify broad themes that emerged from the exercise. The "open coding" method of qualitative content analysis was used to identify major themes. Briefly, this method involves a process of repeated and careful reading of the textual data (i.e., the 155 implications that the participants generated), developing an outline of recurring themes, and cross-referencing each theme back to the original text. See Strauss and Corbin (1998) for details on the open coding method.

We identified 10 dominant themes and examples of specific implications of each theme that were generated by participants (Table 1). The themes range from a dissolution of the role of the Federal government or the Forest Service, to a growing substitution of virtual reality for the natural world, to rising environmental activism.

This is a surprisingly wide-ranging set of desirable and undesirable themes to emerge from a single social issue, and illustrates a core principle of futures research: Numerous possible and plausible futures could unfold (Bengston 2017). Many of the themes, such as commodification and increasing conflict, exemplify unexpected consequences of the issue "growing apathy toward the environment." Others, such as innovative approaches to environmental education and rising environmental activism, show that issues may create opposing forces or countertrends that operate at the same time (Marcus 2009). The future does not unfold along one straight line, but on many paths which may contain paradox and contradiction. The dynamic nature of emerging issues points out the importance of not viewing them as inevitable and instead actively looking for indicators of potential countervailing forces that could emerge and alter the direction of change (Weiner and Brown 2005).

CONCLUSIONS

This has been an exploratory application of the Implications Wheel with the goal of investigating its usefulness in the context of horizon scanning. We found that even a quick, small-scale application of the method can uncover many useful insights: 155 implications were generated, including many of high significance (i.e., those scored as likely and strongly negative, unlikely and strongly positive, and wild cards). Surprisingly diverse and wide-ranging themes emerged from a single issue, pointing to many potential dimensions of the future that are possible and plausible.

Conducting the exercise remotely and asynchronously—using the Implications Wheel online software—allowed us to include participants who were widely separated geographically, thus eliminating travel costs. Participants were able to join in the exercise at a time and place convenient for them. This is an important advantage that allows busy individuals to participate. A drawback of conducting the exercise online is a lack of direct interaction

Table 1.—Ten broad themes that emerged from the Implications Wheel exercise, and examples of implications related to each theme

Dissolution: deterioration of aspects of the Federal government or the USDA Forest Service • The Forest Service is disbanded as a Federal agency with powers given back to the States to manage existing Federal land resources • The research arm of the Forest Service becomes part of the U.S. Geological Survey
Privatization: shift away from the public sector • The Forest Service and other natural resource agencies are combined, fully privatized, and operated on a for-profit basis • Privatized campgrounds and hiking paths impose high user fees that exclude low income groups who are unable to pay
Global cooperation: extension or engagement across borders • International exchange programs significantly boost innovative approaches to sustainable natural resource management • The United States increases global environmental actions and collaboration because of the global reach and connections of the "green party"
Virtualization: replacement of the "real" or the natural • Virtual reality (VR) increasingly substitutes for real outdoor experiences • A significant and growing number of people become addicted to VR, spending most of their time socially isolated in VR
Rebellion: opposition to dominant norms or authority • Outdoor experiences become the counterculture, especially among rebellious teenagers • Younger generations rebel against the environmental apathy displayed by their parents and society at large
Education: innovations in environmental learning • Harkening back to the success of recycling programs in early childhood education, environmental nongovernmental organizations focus primarily on grade school intervention • Law schools strengthen their environmental law curriculum in response to increased litigation in the area of environmental justice
Activism: direct vigorous involvement to bring about change • Before the land is sold, protesters in many locations around the country create encampments on public lands to prevent sales • A grass-roots coalition sues the U.S. government on behalf of children and future generations for increasing neglect of the environment
International conflict: clash between countries • Existing international environmental agreements are negated, defunded, or deeply revised and plans for future agreements are halted • Countries are markedly divided into pro- and anti-environmental agreements. Geopolitical powers play a key role
Solidarity: unity or agreement of feeling or action • Local and regional solutions to immediate problems (such as sea-level rise) begin to emerge throughout the world • Environmental conditions reach a tipping point that triggers a growing shift away from environmental apathy
Commodification: treating nature as a product that can be bought and sold • Different tiers of forest membership are created, based on ability to pay for outdoor experiences • The Forest Service commercializes water, air, carbon, wildlife, and recreation

between participants that occurs when they are gathered at one time and in one place. But we found that some of the benefits of direct interaction and brainstorming were maintained in the online context, as participants saw the ideas contributed by others, which stimulated their own creative thoughts.

Given the large number of potentially important emerging issues generated in ongoing horizon scanning, multiple rapid and small-scale Implications Wheel exercises similar to the one described here could be carried out to quickly generate potential implications and explore possibilities. Such "mini-wheels" could produce useful foresight in a timely and cost-effective manner.

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6. EXPLORATION OF A HORIZON SCANNING TREND: GROWING INDIGENOUS EMPOWERMENT

Leif A. DeVaney, David N. Bengston, Michael J. Dockry, and Andy Hines

Abstract.—Growing indigenous empowerment and recognition of rights with respect to natural resources was identified as an emerging trend in the USDA Forest Service-University of Houston Forest Futures Horizon Scanning system. An exploratory Implications Wheel® exercise was conducted to uncover possible future implications of this trend. The exercise was carried out with a group of University of Houston Foresight graduate students, faculty, and alumni. The exercise did not include American Indian or Alaska Native participants, and due to this limitation it should be viewed as an illustration of the usefulness of the method for exploring the implications of horizon scanning hits. A total of 175 first-, second-, and third-order implications were generated. Analysis of the implications found nine emerging themes and four scenarios. The findings reveal the wide range of significant possibilities that could result from growing indigenous empowerment and suggest the importance of monitoring this trend as it unfolds.

INTRODUCTION

> "All or part of every national forest and grassland is carved out of the ancestral lands of American Indian and Alaska Native Peoples. Indigenous communities across the country still maintain strong historical and spiritual connections to the land, connections that have not been extinguished despite changes in land ownership."
>
> —*Leslie Weldon, National Forest System Deputy Chief, USDA Forest Service (quoted in: USDA Forest Service Research and Development [2016: 4])*.

American Indian tribes and Alaska Native communities are vital partners of the USDA Forest Service (hereafter, Forest Service) and other public land management agencies. The first objective of the Forest Service Research and Development Tribal Engagement Roadmap (2016: 2) is to "[b]uild and enhance existing partnerships with tribes, indigenous and native groups, tribal colleges, tribal communities, and intertribal organizations." This study examined possible future implications of an important emerging trend related to American Indian and Alaska Native communities: growing indigenous empowerment and recognition of rights with respect to natural resources. Growing indigenous empowerment was identified as an emerging issue in the Forest Service-University of Houston Forest Futures Horizon Scanning system. The goal of this system is to find important emerging issues and trends in the external environment of the Forest Service and forestry, and to explore possible implications of these early indicators of change for the agency and for the field of forestry in the future. We report on an exploratory Implications Wheel® exercise to examine possible implications of growing indigenous empowerment.

The following section describes the emerging issue of "growing indigenous empowerment." This is followed by an explanation of the Implications Wheel method, and a summary of selected results of the exercise. A concluding section briefly assesses the usefulness of the method and discusses the need to monitor the issue as it develops.

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GROWING INDIGENOUS EMPOWERMENT

The emerging issue examined in this study was "growing indigenous empowerment and recognition of rights regarding natural resources." Indigenous communities in the United States and around the world are increasingly demanding and receiving a stronger voice in the management of natural resources, including forest management, energy infrastructure, dams, environmental science, and other areas. This emerging trend could shift the debate about how public lands should be managed and change the way society approaches decisionmaking about natural resource management, land use, and the environment. Examples of signals related to this trend from the Forest Futures Horizon Scanning database are:

- "From the rocky, pebbled beaches north of Seattle, where the Lummi Nation has led the fight against a proposed coal terminal, to southern Utah, where a coalition of tribes is demanding management rights over a proposed new national monument, to the tiny wooded community of Bella Bella, British Columbia, 350 miles north of the US border, Native Americans are asserting old treaty rights and using tribal traditions to protect and manage federally owned land" (Johnson 2016: A12).
- In a ruling with substantial importance for water management in the American West, a U.S. appeals court upheld a lower court's decision that an Indian tribe in California's Coachella Valley has a right to groundwater beneath its reservation (Walton 2017).
- The Coquille Tribe in Oregon is regaining control over 5,000 acres of ancestral forest land (KCBY 2016).
- A growing number of U.S. cities and towns, and the State of Vermont, have renamed Columbus Day as Indigenous Peoples' Day in recent years (Evans 2016).
- A law passed on March 15, 2017 makes the Whanganui River in New Zealand a legal person, in the sense that it can own property, incur debts, and petition the courts. For New Zealand's indigenous Maori, the idea of the river as a person is nothing new and stems from their deep spiritual connection to the Whanganui (The Economist 2017).
- The President of Indonesia recently recognized the right of nine indigenous groups to manage the forests that they have traditionally occupied and managed (Gaol and Dahlia 2017).

These represent a sample of the scanning hits related to growing indigenous empowerment in the Forest Futures horizon scanning database, and they indicate the range of signals of change for this trend.

The Implications Wheel

The Implications Wheel is a participatory ''smart group'' method that uses a structured brainstorming process to identify possible first-, second-, and third-order consequences (implications) resulting from any type of change, and to score them for desirability and likelihood (Bengston 2016, Bengston et al. 2018). The structured group process of the Implications Wheel 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 helps planners and decisionmakers to proactively consider potential long-term, higher-order effects of change in order to prepare for these changes. The findings from Implications Wheel exercises can be used to develop strategies to increase the likelihood of positive implications, decrease the likelihood of negative implications, and identify information needs or gaps.

The word "wheel" in Implications Wheel derives from the wheel-like structure to the notes that emerges as the group process proceeds (Fig. 1). The change of interest is placed in the center—like the hub of a wheel—and then first-, second-, and third-order implications of the change are generated by participants and emanate outward from the center in concentric rings. For details on the method, see Bengston (2016).

Figure 1.—Simplified Implications Wheel structure. A complete wheel typically has about five second-order implications for each first-order implication, and five third-order implications for each second-order implication.

The Implications Wheel exercise reported on here involved 40 participants (16 women, 24 men). All participants were either current or former students, or current or former faculty members, in the University of Houston's Foresight graduate program. This group did not include American Indian or Alaska Native participants. The Implications Wheel method requires a diverse group of participants to provide as many perspectives as possible. The participants in this exercise had the advantage of being exceptionally well versed in futures thinking and foresight methods. However, because this group lacked American Indian perspectives, the results should be understood as possible implications from the perspective of nonindigenous people. Accordingly, the specific results should be viewed as incomplete and limited. Nonetheless, the exercise is a useful illustration of the Implications Wheel method for exploring possible implications of horizon scanning hits.

A total of 175 implications of "growing indigenous empowerment" were generated in this exercise: 7 first-order implications, 33 second-orders, and 135 third-orders. Implications were not scored for

desirability or likelihood due to a limited amount of time to conduct the exercise. We solicited ideas for first-orders from participants by email in advance. First-order implications should follow directly from the center issue, with no significant intervening events. Of the ideas submitted, the following seven first-orders were selected for exploration because they (1) follow directly from the center trend, and (2) encompass the range of issues covered in the full set of submitted first-orders:

1. An Indigenous People's political party is formed to promote interests and rights.
2. Increased indigenous rights and recognition of ownership cascade to other areas, beyond natural resources and public lands.
3. Traditional indigenous spiritual values, emphasizing that all life is interconnected and interdependent, begin to grow and spread throughout society.
4. Natural resources and environmental science majors are required to take courses in traditional ecological knowledge (TEK) at all accredited environmental programs in U.S. universities.
5. Treaty rights are broadened and Native American tribes construct resorts and tourist facilities on some public lands.
6. Hunting, fishing, and gathering activities on public lands by nonnatives are significantly restricted to allow greater harvest by Native Americans, in accordance with treaty rights.
7. Political powers and economic interests try to stop the trend of growing indigenous empowerment.

Participants were divided into seven groups of five or six people, and each group was assigned one of the seven first-order implications to identify possible second- and third-order implications.

EMERGING THEMES AND SCENARIOS

In this paper, we focus on two aspects of the results: (1) major themes identified from an analysis of the full set of implications, and (2) four broad scenarios (or scenario sketches) that emerged.

Emerging Themes

Major themes were identified through a thematic content analysis carried out on the complete set of 175 implications. These themes are not exhaustive, but they synthesize some of the most important recurring concepts uncovered in the implications. The themes are listed next, along with two specific implications identified by participants that illustrate each theme.

Regulation—In response to growing indigenous empowerment, increasing regulations affect the nature of activities on public lands.

- "Increased regulations for managing public lands"
- "Increase in taxes needed to support regulations"

Politicization—Decisionmaking related to natural resources becomes increasingly political.

- "Proliferation of single-issue based political parties"
- "Indigenous political party is formed"

Disruption—Significant alteration of governmental states of affairs occurs in response to rights claims.

- "Power of current political parties changes"
- "Direct military intervention on behalf of powers opposing indigenous empowerment"

Spirituality—Greater emphasis is placed on the reality and importance of a spiritual dimension to all of life.

- "Integration of 'whole person' perspective"
- "Reconceptualization of religious structures"

Academicism—The value of TEK is acknowledged in the academic world.

- "More indigenous students, greater ethnic diversity"
- "More research into indigenous knowledge—new PhD programs"

Commercialization—Tribes seek financial gain from treaty rights.

- "Many tribes begin planning resorts for public lands"
- "Online gaming and virtual-reality gaming businesses are developed"

Conflict—Significant opposition to indigenous values and empowerment is expressed.

- "Legal and logistical barriers created to squash human rights and ecological groups"
- "Suppression of indigenous tribal history and culture"

Justice—Concerns arise over the actualization of fair and equitable treatment.

- "Social injustice increases due to less revenue available for projects supporting equity"
- "United Nations talks to define rights of indigenous"

Identity—Opinions regarding conceptions of self increasingly diverge.

- "Pan-indigenous identity develops and becomes widespread"
- "Future generations of indigenous tribes lose their cultural identity"

Emerging Scenario Sketches

In addition to the nine focused themes, much broader themes or scenario sketches also emerged from analysis of the 175 implications. These mini-scenarios point to broad directions in which the future could unfold in response to a trend of growing indigenous empowerment. The four scenario sketches were titled: Growing Tension and Conflict, Backlash and Declining Empowerment, Indigenous "Ecotopia," and Indigenous "Disneyfication."

The *Growing Tension and Conflict* scenario is characterized by increased social tensions precipitated by restrictions on the use of public land by nonnative people. This tension leads to a cascade of effects, including escalating conflict related to the harvest of game and other natural resources. Issues become more political and red tape increases as new governmental institutions are created to transfer management responsibilities to indigenous groups and adjudicate disputes. Levels of racism and conflict surrounding indigenous groups increase steadily, even as indigenous empowerment continues to grow.

Backlash and Declining Empowerment begins with the formation of an indigenous people's political party to promote interests and rights. The hope is that this effort will attract and galvanize support for indigenous issues, but a backlash quickly develops as entrenched nonindigenous interest groups are threatened by an erosion of power. Loss of congressional allies leads to elimination of Bureau of Indian Affairs appropriations, and tribal lands begin to be seized by way of eminent domain. Tribal sovereignty is slowly worn down.

Indigenous "Ecotopia" is initially prompted by widespread gains in understanding and appreciation of native cultures and worldviews. This leads to large-scale questioning of predominantly Western societal values and structures and land management decisions. Universities add TEK requirements to curricula in many fields, including natural resources. Ecological and human rights groups align closely with indigenous groups. Eventually, stronger international bonds are formed between indigenous peoples across the globe. Treaties are universally honored and indigenous groups increasingly take over the stewardship of natural resources in many contexts.

Indigenous "Disneyfication" is characterized by a shift away from indigenous relationships to nature and toward a commercial relationship. Construction of resorts, theme parks, casinos, and other tourist facilities on public lands skyrockets, and many tribal investment groups are created. There is an upsurge in media attention to indigenous themes, with little emphasis on the accuracy or validity of the knowledge being portrayed. The rapid expansion of indigenous tourist facilities creates transportation bottlenecks, leading to an increase in road-building on public lands and stress on regional airports.

These four mini-scenarios portray different possible futures based on the implications and themes that emerged. The scenarios could be fully developed and used in participatory planning or foresight activities with tribes, public land management agencies, and other stakeholders. The use of emerging issues that were uncovered in horizon scanning (such as growing indigenous empowerment) in other foresight methods (such as Implications Wheels and scenario planning) suggests the importance of horizon scanning as the essential "feedstock" for many foresight activities (Schultz 2006).

CONCLUDING COMMENTS

This exploratory Implications Wheel exercise revealed the wide range of positive and negative changes that could emerge from growing indigenous empowerment. Due to the lack of American Indian and Alaska Native participants, however, the exercise should be viewed as an illustration of the usefulness of the Implications Wheel method for exploring possible implications of trends and issues identified through horizon scanning. A follow-up study with indigenous participants is needed to provide a complete exploration of this issue and its possible future implications. This study also revealed the ways in which horizon scanning can feed into other futures methods and analyses.

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7. SCENARIOS TO PROVIDE CONTEXT FOR HORIZON SCANNING: BACKCASTING NORTH AMERICAN FOREST FUTURES FROM 2090 TO 2035

Andy Hines, Johann Schutte, Maria Romero, and David N. Bengston

Abstract.—A scenario backcasting project, an offshoot of the Forest Futures Horizon Scanning system, was carried out for the USDA Forest Service, Northern Research Station's Strategic Foresight Group. The horizon scanning team, from the University of Houston Foresight program, sought to provide context for the scanning hits and emerging issues identified through scanning by linking them to a set of scenarios. Scanning hits and emerging issues could then be analyzed and understood in relation to the scenarios; the ways that emerging issues might develop under different scenarios could be explored. A baseline scenario and three alternative scenarios for the year 2035 were backcast from existing 2090 scenarios. These 2035 scenarios provide a context from which policymakers can track the emergence of scenarios and craft responses to avoid scenarios they consider undesirable and work toward scenarios they consider preferable.

INTRODUCTION

This paper reports on a scenario backcasting project carried out for the USDA Forest Service (hereafter, Forest Service), Northern Research Station's Strategic Foresight Group by the University of Houston Foresight program. The project is an offshoot of an ongoing horizon scanning system created by the two organizations to identify emerging issues in forestry (Hines et al. 2018). The horizon scanning team determined that it would be useful to provide context for the emerging issues by crafting a set of scenarios. The emerging issues could then be analyzed and understood in terms of how they related to the scenarios; that is, one could explore how the emerging issues identified through horizon scanning might fare in different scenarios.

Before embarking on developing new scenarios, we learned that a recent project had developed a set of scenarios for the North American Forest Commission (NAFC) out to the year 2090 (Bengston et al. 2018). While this long-term outlook makes sense given the generally long time horizon of forestry, it can be challenging for policymakers in the present to know what to do relative to this distant future. And the emerging issues identified by the horizon scanning system are likely to be influential well before 2090. Our experience is that a time horizon needs to be within the planning scope of an organization in order to be effective. Thus, a set of scenarios closer to the present would be more effective in terms of stimulating useful responses. The work of the NAFC scenario team was quite good and useful, but we needed a way to work the 2090 scenarios back toward the present in order to be helpful in providing context for horizon scanning hits and emerging issues.

METHODS

The team decided to try a backcasting approach. Lovins (1977) first employed the method in his search for achieving an energy-efficient future, although Robinson (1982) is generally credited with naming and codifying the method. In backcasting, one looks back from the viewpoint of specific images of the future (Kok et al. 2011, Quist et al. 2011, Robinson 1990). Forecasting extrapolates trends from the present into the future, whereas backcasting starts from the future and works back to the present. The typical approach in backcasting involves identifying a preferred future—a future that the client aspires to or would like to achieve (Bezold 2009)—and then specifying a pathway with milestones connecting to the present (Government Office for Science

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2017). The backcasting literature emphasizes developing the preferred future and working backwards from it to identify the pathway in order to suggest potential policy actions in the present. But there are generally few specifics on how to develop the pathway. Dreborg (1996) even suggested that backcasting should be thought of as a general approach rather than a method. The essence of the various approaches to backcasting is developing the pathway from the future back to the present. For example, Kok (2011) suggests three steps in constructing the backcast:

1. Select a vision used as the endpoint.
2. Indicate obstacles and opportunities.
3. Define milestones and interim objectives.

Strong et al. (2007) suggested that the key element for constructing the pathway back from the future involves the identification of signposts. They define a signpost as a "recognizable potential future event that signals a significant change." A "recognizable" event is one that reasonable people would agree has happened. The term "signals" is used because the signpost may embody the significant change, or it may only predict or enable it (Strong et al. 2007: 2). Signposts are identified at particular points in time to construct the pathway.

The literature provided only general guidance for backcasting and we had to craft a backcasting approach that fit our specific needs. Some of the major differences that set our approach apart were as follows:

- Our backcast started from three alternative scenarios (plus the baseline scenario) set in the year 2090, rather than starting from a single preferred future.
- Our backcast aimed at the year 2035, rather than backcasting all the way to the present.
- We needed to map the pathway back from the distant future to 2035, rather than directly identify specific policy actions.

To map the pathway, we used the broad drivers of change that were the fundamental building blocks of the 2090 scenarios. Each of 12 drivers was articulated in each of the three scenarios but, of course, they played out differently in each. The following list shows the 12 drivers of change[1]:

- Societal values
- Relation to nature
- Economy
- Climate change: temperature increase
- Climate change: impact on forests
- Forest agencies: wildfire and mission shift
- Forest agencies: organizational form
- Forest agencies: leadership culture
- Technology
- Ecosystems
- Industry
- Stewardship

To ensure the faithfulness of the trajectories along the timeline between the two scenario sets (2035 and 2090), midway descriptions were identified to act as beacons in 2060. Thus, the first "stop" in the backcast was 2060, 30 years before 2090. The scenario backcast team started with the first driver in the first 2090 scenario. It then imagined the status of that driver in 2060. After that, the team once again imagined the history of that driver, but this time in 2035, 25 years before 2060. The test, then, was to start with the driver from 2035, move to 2060, and finally 2090, and evaluate whether that pathway was plausible.

Next, that same driver was identified in the second 2090 scenario. The scenarios are by definition distinct stories, so the outcome of the driver would be different in this second scenario. The same process was followed: The team imagined this driver first in 2060, described its status, and then did the same for 2035. The plausibility of this pathway from 2035 to 2060 to 2090 was then evaluated and any needed adjustments were made. Finally, the first driver was identified in the third scenario, and worked back to 2060 and 2035, then tested for plausibility. With the three

[1] The last three drivers—ecosystems, industry, and stewardship—were not specifically identified in the NAFC 2090 scenarios, but were added to the backcasting analysis. These drivers were identified in the horizon scanning project.

pathways for the driver now sketched out, the team looked across the pathways to make sure that the drivers were set in a manner consistent with their outcome in the 2090 scenarios. This process was repeated for each of the 12 drivers in each of the 3 scenarios.[2] Once the team was satisfied with the consistency and plausibility of the pathways back to 2035, these 2035 drivers were used to craft a set of scenarios for the year 2035.

2035 Scenarios

This section presents the baseline scenario and the three alternative scenarios for 2035. Each of the three alternative scenarios is positioned on its own distinct trajectory, exploring the possible impacts on forestry and the Forest Service. A different author prepared the first draft of each alternative scenario. One scenario envisions an increased military presence in the environmental and forestry context, one focuses on the utilization of technology ("tech") to mitigate climate change, and a third scenario focuses on a radical cultural shift.

The three 2035 scenarios are alternative futures. But how do we get from the present to 2035? The team used the concept of the baseline future from the "Framework Foresight" method (Hines and Bishop 2013), which projects or extrapolates from the present situation into the future, without any major disruptions or surprises. The team's view was that the baseline forest future could plausibly extend out to about 2025. By this time, the baseline is likely to begin breaking down; that is, alternative futures would start to emerge in part or in whole. We called this baseline Stressed Forests. It is projected to ultimately give way to one or more of the three 2035 alternative futures. Of course, we do not know which one of these futures, or which variations of them, will emerge and eventually become the next baseline. It should also be noted that the dates of 2025 and 2035 are rough estimates—the alternative could emerge more quickly or more slowly than forecast.

[2] Contact the authors for a copy of tables describing the projected drivers for each scenario.

We wrote the baseline from the viewpoint of the present, because it is rooted in the present, and we describe the alternatives from the vantage point of the future. The following subsections discuss these scenarios: (1) Baseline: Stressed Forests; (2) Government Intervention: Curfew, Stay Inside; (3) High-tech Transformation: the Internet of Trees; and (4) Cultural Transformation: Nurture Nature.

Baseline Scenario: Stressed Forests

The prospects for North American forests for the next decade are not looking promising. Forestry decisionmakers confront a likely future of budget cuts and political turmoil. They are also likely to confront a worsening ecological situation. At current rates, average global temperature is projected to increase 2 °C (3.6 °F) beyond the preindustrial level by 2065, nearing 3 °C (5.4 °F) by 2090. Instead of being a sink for carbon dioxide, deforestation has actually led to a net release of forest carbon into the atmosphere. Forest leaders are likely to continue to be put in a position of "doing more with less," and being blamed for deteriorating conditions despite their best efforts.

Climate change is the overwhelming issue stressing forests. The expected steady increase in temperature is likely to lead to increases in wildland fires, the spread of invasive species, and a host of insect pests and pathogens. Some thresholds of forest adaptability are likely to be approached. Some say that in the more distant future many forests may convert to new types of ecosystems such as shrubland.

Growing public apathy toward forests is likely to continue. Forests are out-of-sight, out-of-mind, as visits to the forest are projected to gradually decline. The exception to the dwindling number of forest visitors is a not necessarily desirable growth in squatters: People increasingly desperate for a place to live are likely to migrate to public forest land in the wildland-urban interface (WUI). Even more challenging, they demand protection from wildfires; can a squatter lawsuit be far behind?

Numerous studies are warning about the looming trouble. Forest management agencies will almost

certainly face a growing number of wildfires as funding shrinks. Fire management will be the biggest part of the budget, but it is also likely to face cuts. Threats are clearly ahead, but will there be political will and budget support to confront them? Probably not. Governments have other priorities and citizens are too preoccupied with economic insecurity, fear of terrorists, and lost ways of life to make forest health a priority.

Forestry agencies are not likely to escape the automation of the workforce in North America and elsewhere. Robots and artificial intelligence are likely to increasingly replace forestry workers in the field, and they will be programmed to serve interests concerned primarily with cost savings and profits. There is some hope that automation will increase the productivity of the forest products sector, and that increased profits could be fed back into forest management and health. But not many are holding their breath for that. More likely is a growing incursion of investor and corporate groups buying up large swaths of private timberland and lobbying to keep government regulators "out of the forest."

The picture is not totally bleak. Although a weakening public sector role in promoting forest health is most likely ahead, there are positive signs. The forest products industry could follow a path similar to agriculture by taking advantage of developments in genetics that could allow faster growing species to be farmed in forest lands. This could accelerate fragmentation of forests into ecological niches—a checkerboard of remnant natural stands of trees, private lands open for development, and commercial timberlands where soils and plants are managed to optimize profits. This drive for profits does bring new technologies, such as sensor networks for water and fire management, which should subsequently become available to public forest agencies.

Scenario 1. Government Intervention: Curfew, Stay Inside

Sporadic societal insecurity due to the consequences of severe environmental changes demands permanent government and military intervention.

In the first quarter of the century, efforts to address climate change lagged. Immediately before 2020, the government's main priority was job creation, job security, and economic growth while growing concerns about climate were ignored. With strong support from small-town populations and the countryside to grow local economies, government strategy relied on traditional industries, which often played a substantial role in inducing climate change. Generally, the petroleum industry had newfound favor despite the global shift—even by China—toward the promise that the renewable energy industry held.

The momentum of the United States to address climate change began to significantly increase only in the late 2020s, when citizens became more directly affected by frequent natural disasters and experienced the impact that climate change had on some agricultural products such as coffee. Despite great advances in climate policies internationally, global efforts were too little too late. During this time there was a tremendous spike in nature tourism and public interest in the outdoors as people were starting to notice radical changes in nature and realized what they were about to lose. However, this spike was a short-term phenomenon as technology-related entertainment increasingly dominated consumer markets, drawing attention away from nature's transformation.

Fortunately, the growth of indoor entertainment did not deny nature its place on the political agenda. As new generations emerged in the mid-2020s and gained voting power, they shifted environmental issues and their consequent economic implications to the top of the political agenda. By then, the trajectory of climate change had become evident as an unseen tipping point had already been passed. The average temperature of the Earth was well on its way toward an expected increase of almost 2 °C in the 10 years that were to follow (at around 2035). Severe climate-induced catastrophes resulted in tremendous financial losses. The situation was aggravated when government's initial reaction to climate change was to promote policies favoring environmental protection. These actions inflated

the already sizable green economy bubble as well as local high-tech innovations and alternative food production methods. However, frequent bouts of protest erupted as the disconcerted public vented its anger against government for not acting sooner. Federal power consequently faded and the national ability to address climate change in a coordinated manner was hampered in the process.

The Forest Service itself had to deal with the increased intensity of heatwaves, droughts, and forest fires. By 2025, the government restructured the Forest Service to solely focus on "managing" and adapting to the inevitable outcome of climate change instead of prevention. The new structure effectively pivoted the whole organization around its newly created Climate Change Division.

Two great and ever-present threats had to be managed. First, frequent and massive forest fires proved traditional firefighting approaches to be inadequate and unsustainable. The National Interagency Fire Center and National Multi-Agency Coordinating Group's fire-suppression efforts now also involved permanent military participation and organization, with the military's stake increasing every year.

A second threat was the spread of tropical diseases and other harmful pathogens, as insects migrated into new ecosystems. Protecting humans from potential forest-borne pandemics became an increasingly important mission for the Forest Service. A productive partnership among forestry, the Centers for Disease Control and Prevention, the Department of Health and Human Services, and the World Health Organization in the 2020s initially included paramilitary organizations. But later, strong military involvement was called upon in efforts to quickly isolate compromised zones and mitigate potential outbreaks. Sadly, attention to fire mitigation and disease control in a frequent state-of-emergency context redirected valuable resources away from traditional ecosystem services such as flood control, carbon storage, wildlife conservation, and economic resilience of nearby communities.

The decade leading up to 2035 was characterized by an increase in the magnitude of severe natural disasters causing havoc. Along the Gulf and East Coasts, one or two high-category hurricanes made landfall each year. In late summer, flooding in the Southeast was commonplace, and despite constant military aid, the frequent California fires were extremely difficult to contain. Heavy and erratic snowstorms in the Northeast also caused frequent power outages. These disasters resulted in the frequent declarations of states of emergency by State governments requesting Federal support and official disaster declaration on a presidential level. Responses by the Federal Emergency Management Agency increasingly required a more substantial military involvement to assist civilian authorities, in close cooperation with the Forest Service, with regard to wildfires and forest-borne disease control.

Besides the growing economic impact of natural disasters, the economies of many breadbasket states were disrupted as crops favored new geographical areas while production in traditional areas dwindled. Simultaneously, new zones were conducive to reforestation efforts while some long-established forests increasingly struggled to persist. The latter were often left behind, taken over by invasive species due to a lack of funds and immediate focus on disaster management.

In 2029, the National Defense Act of 2008 was amended to accommodate the permanent return of a substantial section of the armed forces operating internationally. These troops were to be permanently deployed on U.S. soil and would be known as the Military Task Force for Public Protection. They would primarily reinforce the National Guard in its continual activities during the now frequent natural disasters, while also protecting U.S. borders if needed.

With the Forest Service beset by the magnitude of climate change management and adaptation responsibilities, it also had to strengthen its corporate relationships to fulfill its mission. Wood products corporations utilized CRISPR (clustered

regularly interspersed short palindromic repeats) genome-editing technology to modify tree species to be faster growing and less susceptible to fire. The rise in homogeneous genetically modified tree farms also served a carbon storage function. Corporate interests now demanded the fierce protection of forests with drones and high-tech fire monitoring systems, while public access was increasingly denied, often enforced by paramilitary organizations employed by corporations. By 2035, suburban expansion continued as the population generally migrated to metropolitan areas. People predominantly remained indoors as smart homes, entertainment technology, and effective global connectivity functioned as a shelter from the unforgiving and partially militarized outdoors.

Scenario 2. High-tech Transformation: the Internet of Trees

Technological innovation substantially mitigates the effects of climate change and gradually produces a hopeful future.

The aphorism that people mobilize only in response to crisis held true. Some said that the climate-induced disasters of the 2020s took humanity to the brink; regardless, these catastrophes provided a wake-up call and led to a mobilization that began to make a difference. There were plenty of signals that the climate was being seriously affected. Some saw the signals and raised the alarm. Some denied. Most just hoped that it would go away, or not be as bad as predicted. It took a devastating storm surge and sea-level rise in Manhattan, New York—as well as other global cities (e.g., Amsterdam, the Netherlands and Jakarta, Indonesia) and even entire countries (e.g., Mauritius)—to build enough consensus that something was really wrong. The water frequently flooded the subway and traffic tunnels. Some would say that when the New York Times building flooded, the media's interest really accelerated. It may have seemed like a wild card, but only for those not looking. The sea-level rise had been taking place for many years. Each disruptive storm and storm surge wreaked more havoc. The effects of a changing climate showed up in forestry in many ways but especially in increasingly destructive megafires. The insurance industry, which had made some attempts to warn about impending disaster, tabulated a bill that even the most hardline "business first" folks could not ignore. The failure to invest in infrastructure, despite repeated and frequent calls to do so, raised the total bill due. Temporary fixes and stopgaps were eventually overwhelmed.

It was not exactly smooth sailing at first. Awareness was the first step, but organizing coalitions for effective response to climate change was not easy and was not likely to get any easier. By 2035, however, ad hoc regional coalitions of countries with strong leaders became widespread. Yet there was still not enough support for global-scale action. This was challenging given the global-scale issue of climate change, but suspicion toward international organizations such as the United Nations and the various environmental nongovernmental organizations (NGOs) remained strong. The coalitions were similar to trading blocs; it is easier to leverage existing arrangements than to build new ones, after all. In the United States, for instance, the Pacific Northwest states and Canada worked together closely and provided a good model for climate change action coalitions.

But there were encouraging signs. For example, a flourishing of small-scale climate-related projects flew under the radar in the 2020s. Venture capitalists saw "green in green," and began funding climate- and resource-related projects. Of course, the impact of crowdsourcing approaches reshaped the nature of being a venture capitalist—social entrepreneurship ventures were as likely to get funded as standard money-making schemes. When the panicked calls to "do something" rang out, these projects were highlighted, funded, and perhaps a little overhyped as evidence that something was being done. There were some really exciting experiments going on. A key theme was land and forest restoration. Swarms of "farmer drones" could seed, fertilize, and water large swaths of remote land in a matter of days. Many cities had long participated in large-scale urban forest experiments that revealed several key benefits, such as stormwater mitigation, energy

savings from shading, greater aesthetic value, and improved air quality. Perhaps most importantly they seemed to account for an increase in community members spending time outdoors.

The role of forests as sources of drinking water was recognized and became part of the overall revival of interest in the value of forests. The problem with these efforts, well intentioned and productive as they were, was that they were piecemeal and not coordinated. They needed to be scaled up, and that is where government came in.

Perhaps the most significant technological interventions were related to information technology. One could argue that issues relating to forests and climate were fundamentally information issues, albeit very complex ones. Better data were needed to understand what was going on and what could be done. While many in the Forest Service or involved in forestry preferred a more hands-on and boots-on-the-ground approach to nature, there was a cadre who saw the power of information tools. Some laughed at these geeks, and in the 2020s it often seemed that a lot of data were gathered and not a lot of insight was produced. It took time for the information revolution to hit critical mass, but it finally got there. The Internet of Things for the forest—dubbed "the Internet of Trees"—effectively wired up the forest to produce an amazing volume of data about what was happening. Sensors everywhere (some wired, some smart dust, some drones, some robots, some satellite) provided enough coverage for the collection of sufficient data for assessing, monitoring, and eventually predicting what was going to happen.

The Internet of Trees also provided inventory and tracking systems that dramatically cut down on illegal logging. "Stolen" trees could be tracked. The impact of providing these monitoring technologies to countries with rampant illegal logging was huge. Predictive analytics gave managers the tools to simulate multiple courses of action and make more informed choices.

This suite of smart technologies also became a valuable partner in dealing with the rise of megafires. In addition to the better remote sensing, monitoring, and predictive analytics for tracking potential wildfire movement, there were significant technological advances in managing wildfire. Sensors immediately indicated when a fire started so that it could be managed—allowed to burn, put out, or watched—as appropriate. The firefighters themselves would hardly be recognizable to their predecessors; with full-body military exoskeletons, it was sometimes hard to tell them apart from their robot colleagues. Technology certainly helped with managing fires near population centers. But the biggest anticipated advances would use artificial intelligence, Big Data, and analytics to develop models that would help restore more normal fire patterns—knowing when to let nature do what it knows best how to do.

New biotech approaches to natural resource problems were also widely employed. The CRISPR genome-editing technology was used for creating biological responses to new pests in experiments carried out quietly during the 2020s, sometimes with overseas partners, where there were less public scrutiny and objection. Among the successful experiments were rather "simple" gene-splicing activities to improve tree health. Further, genetically modifying insects to eat so-called "bad" bugs or pests was becoming increasingly common. Alongside these efforts, however, experiments were going on in synthetic biology to engineer entirely new life forms designed for specific tasks. These efforts were tightly regulated at the moment over fear of potential unintended consequences of releasing new life forms. But given the serious condition of the biosphere, these efforts were gaining more attention and funding. There were also hundreds of small-scale biomass approaches using various wood-based inputs, from the nano-scale (wood-based nanomaterials with thousands of applications) to wood skyscrapers that were much more environmentally friendly than steel and concrete.

While technology was front-and-center as the world furiously scavenged for technological fixes, the evolution of social values was also influential, if somewhat below the surface. Above all, "modern values" that support competition

and achievement provided the motivation and entrepreneurial zeal to develop new technologies (Fig. 1). There was an immense proliferation of competitions, prizes, incentives, crowdsourcing, and open-source collaborations. Some complained that modern values were short-sighted, but they could definitely generate innovation when properly aligned. Postmodern and integral values also had some, albeit far less, influence. One way that this change became evident was the trend in diet away from meat. Vegetarians, vegans, and a complicated array of other dietary arrangements gradually became the mainstream. This reduced some pressure on resources, and combined with more effective distribution that reduced food waste, actually started "moving the needle," if ever so slightly. The values evolution had been very slow and gradual. Post-crisis, people became more vocal about what individuals could do.

The forest world of 2035 might best be described as entering "rehab." The stress of climate change and related impacts, such as nonnative invasive species, drought, increasingly intense storms, and more frequent ice storms, as well as inadequate budgets to deal with these stresses, had weakened the forests. Some approaches promised and might deliver remarkable results. Some would have unintended consequences. The jury was out on whether this approach would work. Comparing things to where they stood 10 or 20 years before, however, most people preferred this high-tech experiment over the alternative.

Scenario 3. Cultural Transformation: Nurture Nature

The environmental crisis really gained momentum in the 2020s in a continual stream of natural disasters that wreaked havoc. Besides the increased frequency of forest fires all over the United States, coastal regions also suffered severely. As global average temperatures continued to rise and sea levels followed suit, hurricanes became stronger and more frequent. These catastrophes prompted a set of additional regulations regarding homes and infrastructure along the coast in order to prevent flooding and provide added protection from hurricanes. The increased frequency of extreme weather events and consequent additional regulations had a severe, negative effect on the real estate market along the East, West, and Gulf Coasts.

Grassroots support was central to the growing environmental crisis. A long and failed track record of institutional fixes, policy initiatives, and other mechanisms associated with the status quo, led to the realization that the underlying values or culture was key. Until people's minds changed, nothing significant was likely to change.

Changing minds was not enough by itself—it had to translate into behavior. A sign of a new general cultural mindset, for example, was that people began generating solar and wind power at home and became more environmentally friendly with transportation. This "sustainability first" mindset

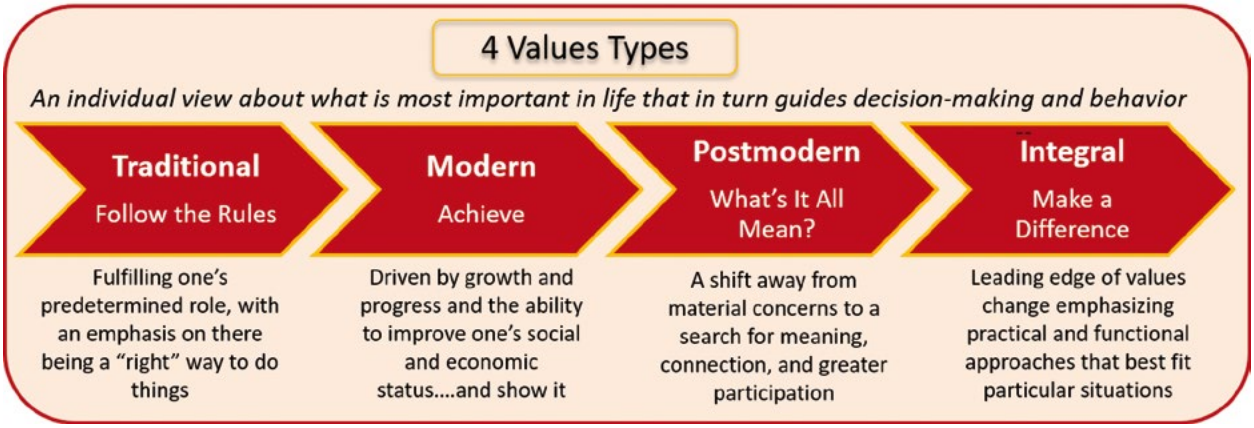

Figure 1.—Four value types that a person or organization may espouse. Source: Hines (2011).

permeated neighborhoods and cities as residents and planners promoted parks and small forests in city centers. Some cities were even rezoned as forests, similar to UNESCO heritage sites, as an official carbon capture method.

New social entrepreneurship initiatives blossomed. Many projects were funded through crowdsourcing campaigns. Even Silicon Valley became a venue for social entrepreneurs and funding initiatives for the burgeoning climate-tech industry. A perhaps subtle shift in values was toward seeing technology as a vital ally in the campaign for sustainability. While most foresters were not anti-technology, they could be classified as skeptics. Indeed, many had joined the Forest Service because they enjoyed nature and did not want to be technology saturated.

Part of the values shift was recognizing that technology could be an incredibly useful tool, thus the look to crowdsourcing sites and Silicon Valley for tech ideas that might help. The Forest Service took note of these developments and, thanks to the cultivation of local partnerships, many innovative technologies developed through these initiatives were tested in American forests. Within the timber industry, wood products enjoyed a renaissance as part of a move away from plastics, such as wooden sunglass frames, watches, and external casings of tech devices and displays.

Early on, the Forest Service and most other government agencies were divided about what the response to the growing environmental crisis should be. They recognized the need for action, but faced conflict and a stalemate around exactly what to do. Whenever there was agreement, the predominant focus was on scientific and technological solutions. For instance, the Forest Service began a nanosensor trial in the Apalachicola National Forest in Florida. However, the test met setbacks and took longer than expected due to the difficulty of tagging so many trees with sensors. There were not enough employees to effectively implement the trial. Agencies' commitment to this and other efforts was insufficient, and they abandoned the projects when they encountered obstacles.

An emerging wave of projects refocused attention on the human element. Rather than humans serving technology, the focus shifted to how technology could serve people in the field. For the Forest Service, this shift reinvigorated the ranks. They felt like their expertise was valued once again. After years of declining budgets, personnel numbers, and morale, being a forest ranger became cool again. Ideas that had been on the shelf for years were dusted off, revisited, and put into action. Forest Service employees would be able to make a difference.

This was not just an American phenomenon. There were also geo-regional advances, such as cooperative alliances. In 2031, Canada, Mexico, and the United States entered into a North American Fire Mitigation Treaty. Although still in its infancy, this coalition would be essential should a mega-wildfire threaten to expand over the border at locations such as the Superior National Forest in northern Minnesota. Since its ratification, all three parties had taken several preventive measures.

Native American protesters of the Dakota Access Pipeline through North Dakota, South Dakota, Iowa, and Illinois in 2017 and countless subsequent protests inspired many communities to be more active in working alongside environmental NGOs and government agencies. Initially such protesters were still in the minority, but a decade later, their values were at the center of the cultural transformation that reinvigorated the Forest Service and the Nation to actively deal with climate change.

Though climate change was the key focus, it was not the only problem. The high level of disturbance in urban and rural forest ecosystems alike diminished the productivity of these lands. It also resulted in a substantial decline in visitors to public lands. As a result, land management agencies were now highly focused on rehabilitating these natural habitats. At the same time, private companies set their goal to decrease waste and improve the efficiency of manufacturing processes so that limited availability of raw materials would not affect them as severely. It turned out that the shift in values showed up

everywhere: in government, business, education, and nonprofit organizations. The shift in mindset enabled the Nation to turn the corner.

DISCUSSION

It was noteworthy that the first drafts of each 2035 scenario, prepared by different authors, came back with a similar story of responding to a crisis. Whether government intervention, high-tech fix, or values-based cultural transformation, none was judged likely to emerge without first passing through a crisis threshold. It was clear that the team envisioned a common baseline heading to crisis, with various responses to that crisis being plausible.

Forestry and the forest products industry are particularly vulnerable to the effects of climate change. The analysis suggested that climate change—the "800-pound gorilla"—is such a big driver that to some degree it overshadows others. As a result, the scenarios explore the various responses to climate change-driven crisis and the impacts on forestry. The baseline scenario was tweaked slightly to emphasize the path to crisis. The three alternative scenarios assume the baseline crisis, and suggest three different responses: the first response, Government Intervention: Curfew, Stay Inside, is a worst-case scenario of policy failure; the second, High-tech Transformation: the Internet of Trees, mobilizes technology and the entrepreneurial spirit to get on with "fixing" nature and the forests; the third, Cultural Transformation: Nurture Nature, rethinks the approach to nature and rebalances the human approach primarily through a value shift.

These 2035 scenarios are waystations on the path to the long-term future. As we reprojected them forward—having arrived at them from a backcast in the first place—we slightly recharacterized the 2090 scenarios to tell a consistent story across time. The dystopic Curfew, Stay Inside scenario carried forward evolves into "Wasteland," a survival-of-the-fittest approach in the forest in which robots serving neo-lumber barons battle with squatters and scavengers for ever-scarce forest resources. The high-tech Internet of Trees scenario takes on a tech-fix mentality that sees no problem that technology cannot fix. In terms of the forest, large-scale restoration projects have been successfully launched and the latest move is into technological forest enhancement, a view that technology can improve upon nature. The values-driven Nurture Nature scenario evolves into "Holistic Stewardship," in which nature is once again valued as sacred and worthy of protection in its natural state, with technology in a supportive role and with humans as partners and stewards in a Triple Bottom Line approach.

These societal responses act as drivers to establish three different trajectories that provide disparate images of the future. All three scenarios have practical implications for present decisionmaking in forestry. Among many possibilities, the following three implications offer some perspectives on how these scenarios have current relevance and could help guide decisionmaking processes:

- *How can conservation-related technological innovation be fostered?* The forest sector can foster major technological innovation if it collaborates with entrepreneurs, tech companies, and venture capitalists in a timely manner.
- *How could society be influenced toward a value change?* The power of ideas should not be underestimated as the future first and foremost occurs in the hearts and minds of people. Increasing evidence of climate change will make it easier to leverage social media to influence societal values and attitudes for forest stewardship in a changing world. Technology can also be used as a creative gateway to nature, encouraging people to engage. If this route is not actively pursued, a dichotomy between the outdoors (which will increasingly be perceived as hostile) and indoors (increasingly high-tech and insulated) could grow.
- *How could our policies and actions foster a positive relationship with nature?* A reactive approach to climate change is increasingly likely to be built on fear and feeling threatened

by the growing impacts of a changing climate. This approach has the potential to alienate humanity from nature. An early, proactive approach will prevent a sense of victimhood and increase the odds of a favorable, hopeful environmental future.

Using Scenarios in Horizon Scanning

The 2035 forest scenarios described in this paper represent a set of plausible futures for forestry and forests in the United States. The reason for developing the scenarios was to use them to provide context and meaning for scanning hits and emerging issues identified through the Forest Futures Horizon Scanning system. Individual scanning hits often lack context, and a large database of scanning hits may appear to be a random collection of disjointed bits and pieces. The same is true for emerging issues based on multiple scanning hits. Tagging scanning hits with descriptive terms (see the domain map of tags in Figure 2, paper 1 and Figure 1, paper 2, this volume) is a first step in providing context. The tags show the connection between scanning hits and broader themes of interest within the forestry domain.

A useful and often neglected second step to create context is to link scanning hits or emerging issues to plausible scenarios for the domain. Scanners can tag hits with the appropriate scenario, and the database of scanning hits can then be sorted by scenario and analyzed to reveal which scenarios may be gaining traction or failing to emerge over time. Linking scanning hits and emerging issues to scenarios can help identify broader patterns of change and promote sensemaking out of what was an amorphous database of horizon scanning hits. This helps foster expansive thinking about the results of horizon scanning and allows us to track the early emergence of a scenario or disconfirm it.

The Forest Futures Horizon Scanning database contains many scanning hits that relate to one or more of the 2035 forest scenarios, including the following examples of confirming scanning hits for each scenario:

Government Intervention: Curfew, Stay Inside

"Water, climate and conflict: security risks on the increase?" is a scanning hit supporting this scenario. This hit summarizes a report exploring the relationship between increasing water- and climate-related stressors, and increasing conflict at multiple scales. One of the main conclusions of the report was that "[t]he complexity of the climate-water-conflict interaction requires policy development processes integrating economic, mitigation, adaptation, social, and security policies" (p. 1). A possible implication for forest management agencies is the potential for military involvement to deal with increasing security risks and the need to safeguard resources and the public, consistent with the Government Intervention scenario. Also supporting this scenario are scanning hits related to the growth of technology-related indoor entertainment, the spread of tropical diseases and forest-borne pandemics, and increased intensity of heatwaves, droughts, wildfires, and other extreme weather events and natural disasters.

High-tech Transformation: the Internet of Trees

Many hits in the Forest Futures Horizon Scanning database support this scenario. An example is "Report calls for national parks to get smart", an article summarizing a research report titled "Smart Parks: Bringing Smart Technologies to National Parks." The article describes how real-time information from environmental sensors could soon inform public land managers and decisionmakers about everything from the effects of climate change to when trash bins are full. Also supporting the High-tech Transformation scenario are scanning hits describing the development or application of a wide range of advanced technologies in forestry and natural resources, including drones, robots, and artificial intelligence.

Cultural Transformation: Nurture Nature

A scanning hit supporting this scenario is "A once and future forest". The article discusses the Coquille Indian Tribe of southwest Oregon preparing to manage its forest land by its own rules. Under Federal legislation signed in January

2018, the tribe is no longer required to follow the "standards and guidelines" of Federal agencies. This is one of many scanning hits in the Forest Futures database reflecting an emerging issue of growing indigenous empowerment (see paper 6, this volume). Also supporting the Cultural Transformation scenario are scanning hits that describe shifting environmental values and behaviors, rapid growth in environmentally friendly technologies, and a renaissance in the use of renewable materials such as wood.

Tagging scanning hits for the scenarios as they are entered into the database may be challenging for many scanners. An alternative would be to have a team of scanners or analysts to assign scenarios to scanning hits after they have been posted in the database, as part of the analysis phase of the horizon scanning process.

CONCLUSIONS

As the history of our engagement with climate change proves, the consciousness of a society is akin to a bulky cruise ship that is unable to quickly change course. Two of the scenarios, those relating to technological and cultural shifts, point to strong leverage points useful to shift society toward a favorable outcome in dealing with environmental change. Time is needed, however. The other scenario provides a warning: The more delayed our engagement, the more difficult it will be to handle our climate issues, potentially leading to our alienation from nature, and even from one another and ourselves.

These 2035 scenarios provide a context from which policymakers can craft responses to avoid scenario(s) they consider undesirable and work toward scenario(s) they consider preferable. For the horizon scanning team, the scenarios provide further context for scanning. A scanning hit or emerging issue can be evaluated for how it relates to the scenarios. A scanning hit may be tagged to indicate that it suggests movement toward a particular scenario. In providing further context for horizon scanning, as well as a more useful planning horizon for policymakers, we believe this backcasting process to be a promising approach.

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8. COMMUNICATING HORIZON SCANNING

Andy Hines

Abstract.—Horizon scanning produces a significant amount of information about potential change that may be on the horizon. To be useful for the intended audiences, this large volume of information must be sorted, condensed, analyzed, interpreted, and presented in formats that fit the needs of diverse users. This paper describes the various current and planned communication outputs of the Forest Futures Horizon Scanning project, including the scanning library, blog posts about significant scanning hits or emerging themes, a periodic digest summarizing interesting scanning hits, detailed articles and technical reports, presentations to a wide range of audiences, and input to other strategic foresight projects. A possible additional output would be to offer focused scanning services on priority issues to groups within the USDA Forest Service.

INTRODUCTION

The Forest Futures Horizon Scanning system is producing a substantial amount of information about the future of forestry. The core unit of information is the scanning "hit" stored in a digital library, which currently contains over 1,200 entries. This information is being collected by small scanning teams from the USDA Forest Service (hereafter, Forest Service), Northern Research Station's Strategic Foresight Group, the University of Houston Foresight program, and several volunteer scanners. Though it can be interesting and perhaps enlightening to browse through the large scanning library, it is unlikely that the intended audience—mainly forest planners, managers, and policymakers—will have the time or inclination to do so. Thus, from the beginning the project team has sought to develop a variety of outputs to effectively communicate insights from the scanning process.

The project team worked to clarify the intended audience of scanning, who might benefit from it, and provide insight for the communication strategy. Stakeholders for this horizon scanning system include both internal (Forest Service) and external users and partners:

- **Internal stakeholders** range from Forest Service Washington Office leadership to planners and managers on individual national forests.
- **External stakeholders** include a wide range of Forest Service partners and organizations involved with forestry and natural resource issues, such as wood industry associations, urban forestry associations, professional societies in forestry and natural resources, international forestry organizations, environmental nongovernmental organizations, State foresters, and forest academics and scientists.

The diversity of stakeholders suggests the need for a diverse set of outputs and a flexible communication strategy that can appeal to the differing levels of interest and different information needs. Currently, the following outputs are being produced or are planned:

- the horizon scanning library, which contains the unprocessed scanning hits;
- blog posts that highlight individual scanning hits or synthesize emerging themes from the scanning library;
- a bimonthly digest summarizing especially interesting or significant scanning hits;
- in-depth articles and technical reports that explore emerging issues and insights gained from scanning;
- presentations to a variety of internal and external audiences; and
- input into other strategic foresight projects.

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A possible additional output would be to offer focused scanning services on priority issues to groups within the Forest Service. The following short sections elaborate on each of these scanning outputs.

SCANNING LIBRARY

The scanning library is the repository for all scanning hits (see Figure 1). The project team developed a tagging system for each scanning hit based on categories in a domain map (see Hines et al. [2018] and papers 1 and 2, this volume) and three time horizons:

- Horizon 1 (the current system, from now to 2025)
- Horizon 2 (the zone of transition, from 2025 to 2035)
- Horizon 3 (visions of a new system, from 2035 and beyond)

The tagging system provides an easy way to search for relevant scanning hits in the library, and the scanning library can be opened to interested participants, who simply provide their email address. But exploring the large and growing library requires a level of interest and effort that is unlikely to extend much beyond the scanning team, suggesting a need to synthesize and summarize the results into more user-friendly formats.

BLOG POSTS

The first approach to synthesizing and summarizing the content was to develop a series of short blog posts (Fig. 2). Scanners were asked to identify interesting or favorite scanning hits and elaborate on them in blog posts of roughly 500 words (although many were longer). A key selection criterion for potential blog posts was novelty, given the goal of building interest in the scanning system and its outputs. The blog posts are currently being hosted on the Houston Foresight blog.

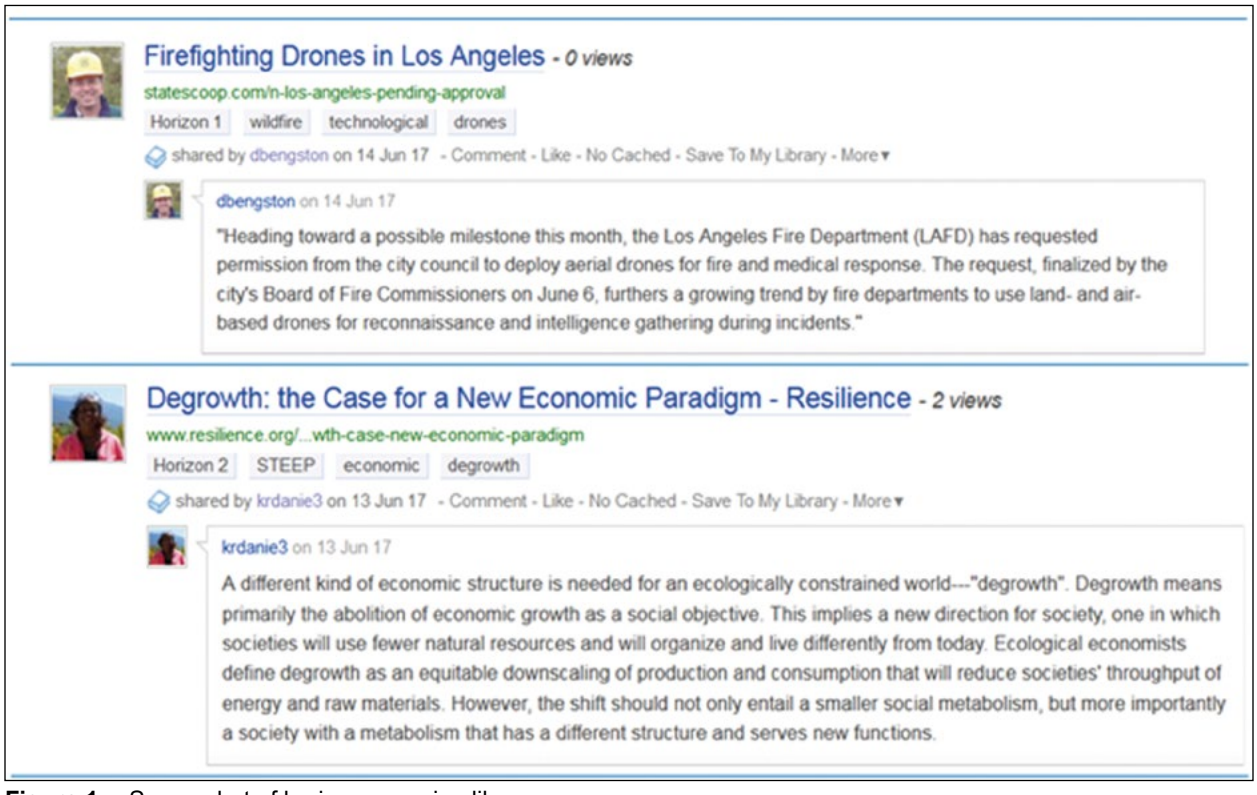

Figure 1.—Screenshot of horizon scanning library.

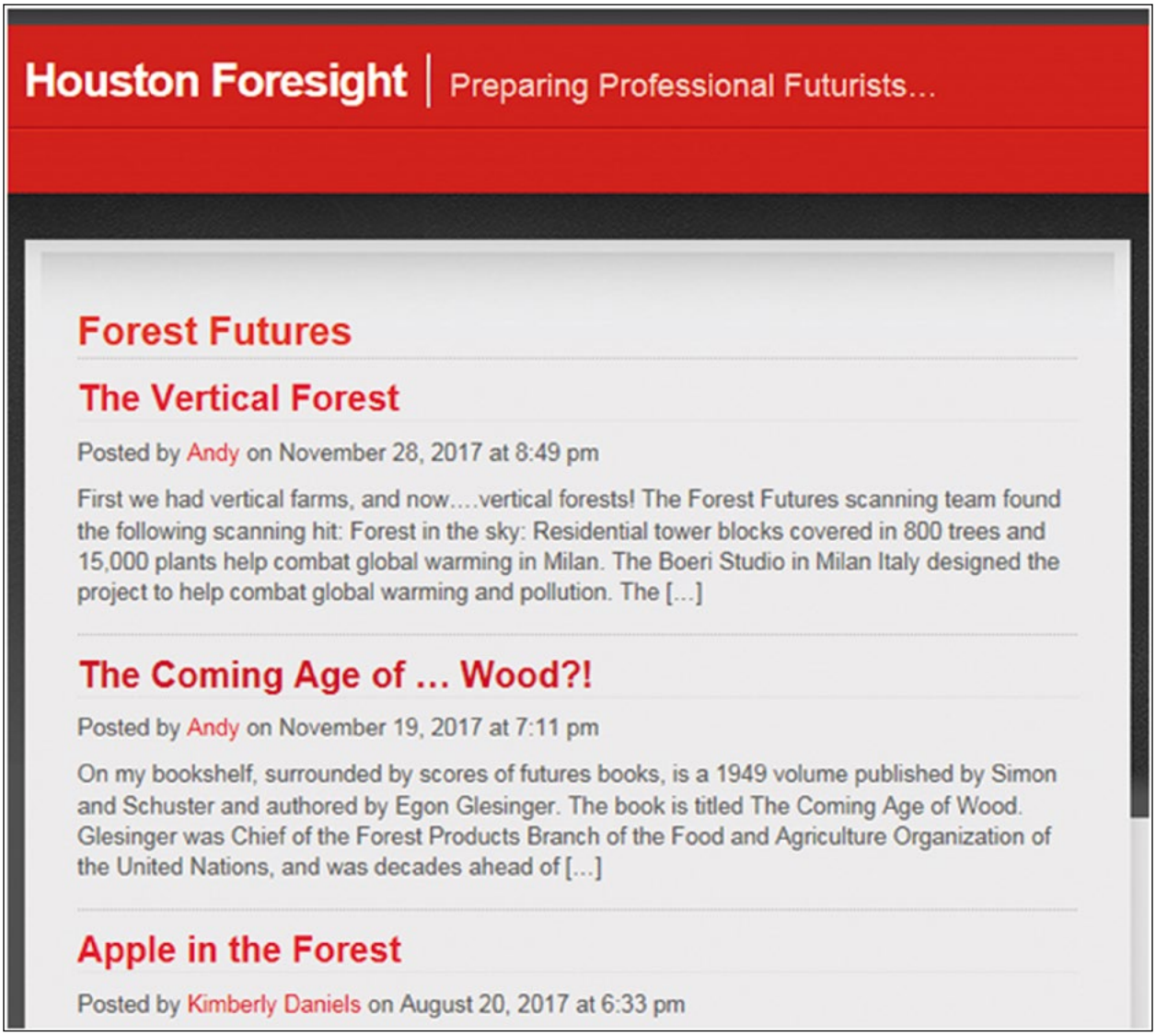

Figure 2.—Screenshot of Forest Futures blog (https://www.houstonforesight.org/?cat=1216).

There are now more than 20 Forest Futures blog posts hosted on the site:

- The Vertical Forest
- The Coming Age of … Wood?!
- Apple in the Forest
- Forest Futures: Economic Growth or Degrowth?
- Visualizing Forest Futures: Linking Traditional Knowledge with Modeling and Visualization
- Mimicking Mother Nature: Nudging Forests Toward Old Growth Conditions
- AI, the Forest, and Artisans
- Before We Let Robots Reclaim the Sahara...
- A Bionic Leaf: An Unsuspecting Hero?
- Coming Home to the Forest
- Catch 'Em While They're Small
- Flash Towns in the Forest?
- Increasing Resiliency
- From Christmas Tree to Coffee Table: Pine Needles are Full of Potential
- Knowing Each Tree in the Forest
- Promising Technologies in Forest Monitoring
- Wood Skyscrapers
- Concentrated Cities amongst Wilderness
- Hotdogs Made of Trees?

- Facetime the Woods
- May I Camp on You? The Future of Autonomous Ecosystems
- Forests as Therapy
- 3D Printing with Wood
- Forest Recreation in the Age of Social Media

DIGEST

A newsletter or digest of scanning hits is a planned output, but it has not yet been implemented. As envisioned, the digest would cover many categories included in our scanning database, such as industry, institutions, stewardship, ecosystems, climate, and the general categories of STEEP (social, technological, economic, environmental, and political) forces. An interesting scanning hit (or two) for most categories would be included in each issue, with a catchy title, short summary, and link to the original source article. A blog post would be featured in each issue as well.

The digest would be kept brief and easy to quickly read, enabling the reader to rapidly decide which hits to follow up on. The logic is to entice less interested readers with items that may raise their level of interest in a quick and user-friendly way.

ARTICLES AND TECHNICAL REPORTS

The horizon scanning team is producing a series of articles and technical reports, which have appeal to several stakeholder groups. These publications are expected to be of particular interest to the academic and research community as well as forest planners, managers, and policymakers motivated to pursue foresight activities. The first article, "Setting Up a Horizon Scanning System: A U.S. Federal Agency Example," has been published in World Futures Review (Hines et al. 2018). It outlines the process of setting up the system. Analyses of the possible direct and indirect implications of emerging issues and themes using the Implications Wheel® method have been carried out (see papers 5 and 6, this volume). This General Technical Report is another output, and a series of annual articles highlighting emerging issues, trends, and signals of change is planned.

PRESENTATIONS

The material produced by the project will also be used as the basis of agency and conference presentations. The first such presentation, "Forest Futures: Strategic Foresight and Horizon Scanning to Support Decision Making," was made July 24, 2017 to an audience at the Forest Service headquarters in Washington, DC.

INPUT TO STRATEGIC FORESIGHT PROJECTS

The results of horizon scanning can also be communicated indirectly as inputs to a variety of strategic foresight projects. Strategic foresight work based on the output of horizon scanning include:

- Implications Wheel analyses of scanning hits and trends (Bengston 2016),
- Scenario planning exercises in which horizon scanning informs the conception and design of alterative futures (Schwartz 1996), and
- Gaming methods (Milojević 2017) in which emerging issues identified through scanning are used in foresight card decks, board games, immersive role-playing experiences, and other gaming approaches.

The Forest Service's Strategic Foresight Group is an ongoing research unit that will draw on the output of the Forest Futures Horizon Scanning system as an important input to many foresight projects in the years ahead.

FOCUSED SCANNING SERVICE

Finally, a possible additional output of the Forest Futures Horizon Scanning system is to provide focused scans on priority issues upon request. To date, the effort has been limited to broad scanning of the entire external environment for forestry and the Forest Service, but it would be possible to offer focused scanning services on priority issues to groups within the agency. Horizon scanning sometimes focuses on a particular topic or domain considered to be most important, such as an emerging technology, a specific social or cultural trend, or an important issue.

CONCLUDING COMMENTS

The strategic approach to communicating the output of horizon scanning is to produce a variety of outputs—from the library of "raw," unprocessed scanning hits to highly synthesized products—that appeal to varying levels of interest. The true test, of course, will be in the marketplace. As the products are rolled out, the team will have a better idea of what is working and what is not, and can make the appropriate adjustments.

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9. FOREST FUTURES: A GUIDE FOR SCANNERS

Adam Cowart, Andy Hines, Kurt Callaway, David N. Bengston, and Michael J. Dockry

Abstract.—A clear and concise guide for volunteer scanners is essential for creating a rigorous, consistent, and sustainable horizon scanning system. The scanner guide written for the Forest Futures Horizon Scanning system is presented in its entirety. The guide includes an overview of the USDA Forest Service; an explanation of horizon scanning and its goals, uses, and stakeholders; a "how to" guide for installing and using the Web-based system for collecting scanning hits; a description of the domain map used in tagging scanning hits; and a quick guide to getting started in scanning.

INTRODUCTION

A "scanner guide" is a prerequisite for establishing an ongoing and internally consistent horizon scanning system. The goal is to provide guidance to support rigor and ensure consistency in the horizon scanning process. For the Forest Futures Horizon Scanning project, an important benefit of the scanner guide is to assist in building the volunteer scanning team: Horizon scanning is not part of anyone's official job description at the USDA Forest Service (hereafter, Forest Service) and the project therefore depends on volunteers. Volunteer scanners are drawn primarily from current and former Forest Service employees, and during the start-up period also include University of Houston Foresight program (hereafter, Houston Foresight) student interns. With volunteer scanners, a clear and concise scanner guide is needed for scanner training and engagement, and is essential to the success of an ongoing horizon scanning system.

A challenge in developing the guide was to make it relevant to the diversity of scanners: Forest Service scanners have more in-depth subject and technical knowledge, while the Houston Foresight students are already familiar with horizon scanning. For scanners associated with the Forest Service, the agency information in the scanner guide serves only as a general reminder, and the information about what scanning is and how to effectively scan is the focus. For Houston Foresight students, the main focus is on learning more about the Forest Service and forestry, while the scanning material is a refresher.

The scanner guide that follows is a living document that is updated as new insights into improving horizon scanning effectiveness are gained and horizon scanning processes are clarified. The project is already on version 9 of the guide, although many of the updates were minor. Contact the authors for the most current version. The guide includes a brief introduction; an overview of the Forest Service; an explanation of horizon scanning and its goals, uses, and stakeholders; a "how to" guide for installing and using the Web-based system for collecting scanning hits; a description of the domain map used in tagging scanning hits; and a quick guide to getting started in scanning.

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Forest Futures

A Guide for Scanners

[Version 9.4]

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INTRODUCTION

Welcome to the USDA Forest Service Forest Futures Horizon Scanning project!

This project is a partnership between the USDA Forest Service ("Forest Service"), Northern Research Station's Strategic Foresight Group (http://www.nrs.fs.fed.us/units/foresight_response/) and the University of Houston's Strategic Foresight Department (http://houstonfutures.org/). It is an effort to uncover emerging trends and issues, as well as to identify and analyze early indicators of potential change that may have important implications for forests, forestry, the Forest Service, and all forest stakeholders in the future.

We assume that you have some familiarity with the Forest Service, its mission, and its responsibility for America's national forests and grasslands. But if you would like more information, refer to The U.S. Forest Service—An Overview (https://www.fs.fed.us/documents/USFS_An_Overview_0106MJS.pdf) or visit the Forest Service's public Web site (https://www.fs.fed.us).

This document provides you with all the materials necessary to begin operating as a "scanner" to contribute to this exciting project, including:

- A brief introduction to the Forest Service
- A brief introduction to horizon scanning and how it supports other foresight work
- Stakeholders for this scanning project
- A "how to" guide for using Diigo (an online system for archiving scanning hits)
- A forestry domain map with categories for "tagging" your scanning hits
- Some pointers and tips from other Forest Service and University of Houston scanners

Let's get started!

INTRODUCTION TO THE USDA FOREST SERVICE

(Based on: http://www.fs.fed.us/about-agency/meet-forest-service)

What is the Forest Service?

- We are a Federal agency under the U.S. Department of Agriculture that manages and protects 154 national forests and 20 grasslands in 44 states and Puerto Rico. The national forests cover 193 million acres of land, roughly the size of Texas.
- In addition to managing the Nation's national forests and grasslands, we provide technical and financial assistance to State and private forestry agencies and make up the largest forestry research organization in the world.

When and why was the Forest Service established?

- Congress established the Forest Service in 1905 to provide high-quality water and timber for the Nation's benefit.
- Congress later directed the Forest Service to broaden its management scope for additional multiple uses and benefits and for the sustained yield of renewable resources such as water, forage, wildlife, wood, and recreation.

What is the Forest Service mission?

- The mission of the Forest Service is to sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations.
- We help people share and enjoy the forest, while conserving the environment for generations to come.

What is the Forest Service motto?

The Forest Service motto, "Caring for the Land and Serving People," captures the spirit of our mission, which we accomplish through five main activities:

- Protection and management of natural resources on lands we manage
- Research on all aspects of forestry, rangeland management, and forest resource utilization
- Community assistance and cooperation with State and local governments, forest industries, and private landowners to help protect and manage non-Federal forest and associated range and watershed lands to improve conditions in rural areas
- Achievement and support of an effective workforce that reflects the diversity of the American people
- International assistance to formulate policy and coordinate U.S. support for the protection and sound management of the world's forest resources

What is the Forest Service Horizon Scanning project?

- The Forest Service's Northern Research Station organized a small strategic foresight research unit in 2014 to bring futures research into forestry and natural resource management.
- The Horizon Scanning project was developed to identify and analyze early indicators of potential change that could impact natural resource management in the future.
- The goal of the Horizon Scanning project is to support Forest Service and natural resource decisionmaking, communicate with stakeholders, and form the foundation for additional futures research.

More information about the Forest Service:

- Agency organization: http://www.fs.fed.us/about-agency/organization
- Mission, vision, guiding principles: http://www.fs.fed.us/about-agency/what-we-believe
- History: http://www.fs.fed.us/learn/our-history
- Strategic plan: http://www.fs.fed.us/strategicplan
- By the numbers: http://www.fs.fed.us/about-agency/newsroom/by-the-numbers

USDA Forest Service national forests and grasslands:

http://data.fs.usda.gov/geodata/other_fs/docs/guide_to_national_forests_20060117.pdf

HORIZON SCANNING

Horizon scanning is the process of searching various sources for emerging issues in the internal and external environment of an organization or field. Distinctive characteristics of horizon scanning include an emphasis on "weak signals" (early indicators of potential change), scanning broadly (rather than focusing only on changes internal to the forest sector), and the inclusion of possible wild cards (low-probability, high-impact events or developments). The overall goal is to find emerging indications of important future developments that no one else has noticed yet, so that planners, managers, and policymakers can plan accordingly and take timely action well before those impending changes can become problems.

Scanning sources could include blogs, specialized Web sites, trade magazines, scientific journals, online videos, and many more. Since scanning is typically focused on new and emerging issues, scanners tend to focus on more alternative, atypical, non-mainstream sources

of information, although mainstream information sources (such as a newspaper or a leading scientific journal) may report on important emerging issues as well.

Your goal as a scanner is to contribute to a database of new, exciting, disruptive, or even strange ideas that could at some point have important impacts or become drivers of change in forestry. In your role as scanners, your primary task will be to seek out these emerging ideas and issues and to post them to Diigo, an online collection database which this project uses to aggregate and share the interesting "hits" that its scanners have found. Detailed information about installing and using Diigo is provided in a later section of this document.

One of the main uses for scanning results is to help shape and improve the crafting of alternative future scenarios. The Forest Service and the University of Houston have already created sets of possible forestry-related scenarios as part of an examination of where current conditions and trends might take us. The horizon scanning project can help significantly in this work. Each scenario typically identifies key drivers (values, events, trends, and issues) which would need to occur for the scenario to develop and continue to be plausible. Horizon scanning looks for the weak signals which can tell us how these drivers may be playing out. The hits that you find can be used by the foresight experts to support or confirm an existing forecast scenario. Or the hits may disconfirm a scenario, making it less plausible to occur. Best of all is when scanning hits provide a basis for creating a new scenario—in effect, signaling a possible future we hadn't considered before.

For additional information on horizon scanning, see:

Google Docs under "Framing and Scanning Basics" link: https://docs.google.com/presentation/u/0/

Bengston, D.N. 2013. **Horizon scanning for environmental foresight: a review of issues and approaches.** Gen. Tech. Rep. NRS-121. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 20 p. https://doi.org/10.2737/NRS-GTR-121.

STAKEHOLDERS FOR THE HORIZON SCANNING PROJECT

People and groups who may benefit from the results of horizon scanning are the stakeholders. They may use the scanning database to aid in their own foresight work or they may be the consumer of other teams' completed foresight products which used this scanning collection. The stakeholders for this horizon scanning system include both internal (Forest Service) and external users and partners:

- **Internal stakeholders** range from Forest Service Washington Office leadership to planners and managers on individual national forests.

- **External stakeholders** include a wide range of Forest Service partners and organizations involved with forestry and natural resource issues, such as wood industry associations, urban forestry groups, professional societies in forestry and natural resources, international forestry organizations, environmental nongovernmental organizations, State foresters, forest academics, and scientists.

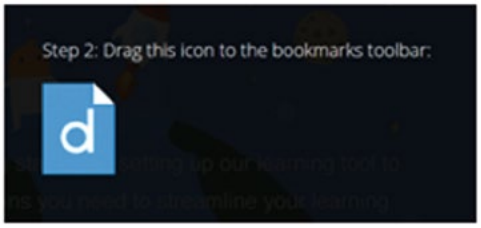
DIIGO "HOW TO"

Diigo is a Web-based system that we will use to collect horizon scanning hits. It's very easy to use—just follow these steps:

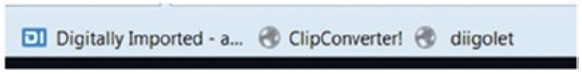
1. Go to https://www.diigo.com
2. Press the "Get started" button
3. Choose the "Free" plan
4. Create an account (username and password)
5. They will send you an email to confirm your account—in the email, click "activate your account"
6. This takes you to the "install extension" screen:

We recommend you select "diigolet," which is the simpler form of the Diigo user interface.

7. Then you literally drag the icon onto your bookmarks toolbar:

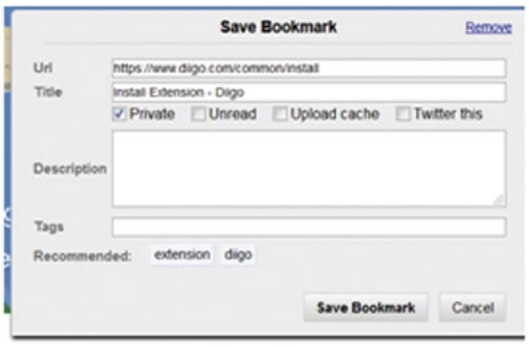


It will look like this (the other two icons are not related to Diigo):



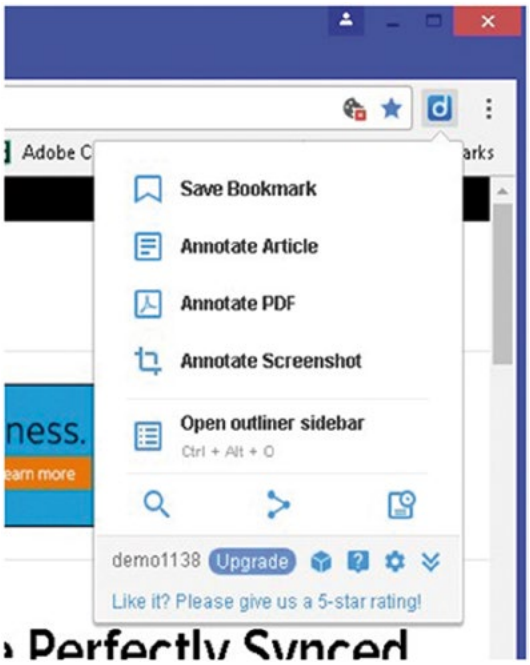
That's all to get it installed! When you find an article or Webpage you want to capture as a scanning hit, you click on the diigolet icon. (You may be asked the first time to sign-in to Diigo with your ID and password, but it will remember you from then on.) Here's what pops up:

Click on “Bookmark” and a screen will appear similar to the one here where you can enter the information about your article—a brief description and tagging terms. You then select the option to “share to a group,” which will be the “Forest Service” group. If you don’t see that in the list, you should contact the project administrator (on either the Forest Service or University of Houston side) and request access to the “Forest Service” group. You can still save the bookmark to your “My Library” and then share with the group later.



If you find the “diigolet” app doesn’t work in your browser, you can also choose to install a browser extension that provides the same ability for you to tag, save, and share interesting scanning hit articles. Diigo even has Apple and Android cell phone apps!

The following image is of a Google Chrome browser with the Diigo browser extension installed. Note the blue Diigo icon in the address bar, and the drop-down menu (with “Save Bookmark” as the first choice) displayed when the icon is clicked.



THE FOREST FUTURES HORIZON SCANNING DOMAIN

Domain Map

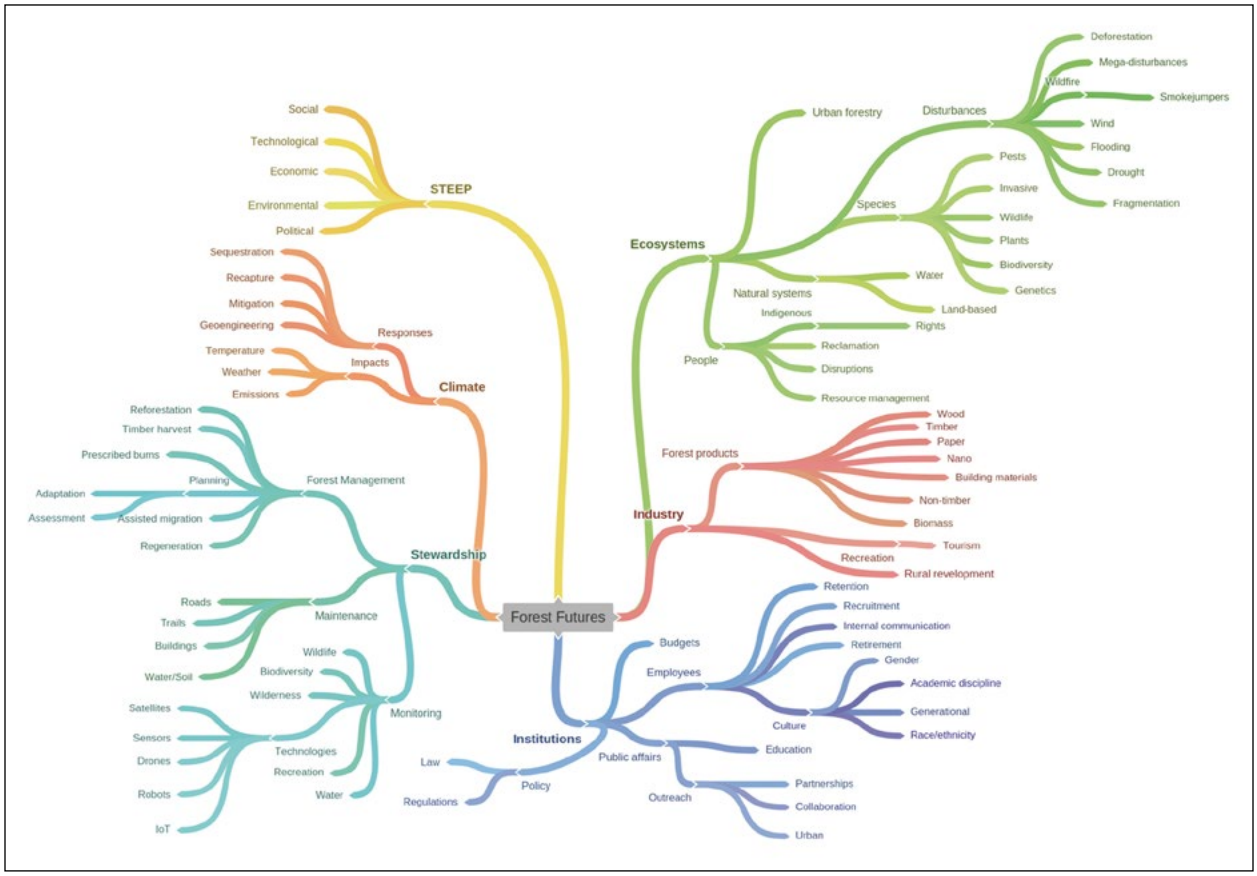
A domain map provides some loose boundaries of what is "in" and what is "out" in terms of the subject and content of a horizon scan, as well as categories used for "tagging" scanning hits.

As a scanner, you should tag your scanning posts based on the domain map hierarchy shown below. This will help keep scanning organized and easily searchable.

For example, if you find an innovative new use for paper,[1] then you would tag it with "Industry", "Forest Products", "Paper", and "Technology". This is not an exact science, but the more precise we are with our tags, the more efficiently the entire team will be able to search for relevant topics. If you think an article is relevant but does not logically fit into this domain, please do your best and create new tags where necessary.

The forest futures domain map is shown below. The full domain map is also available on Coggle at Forestry domain map.

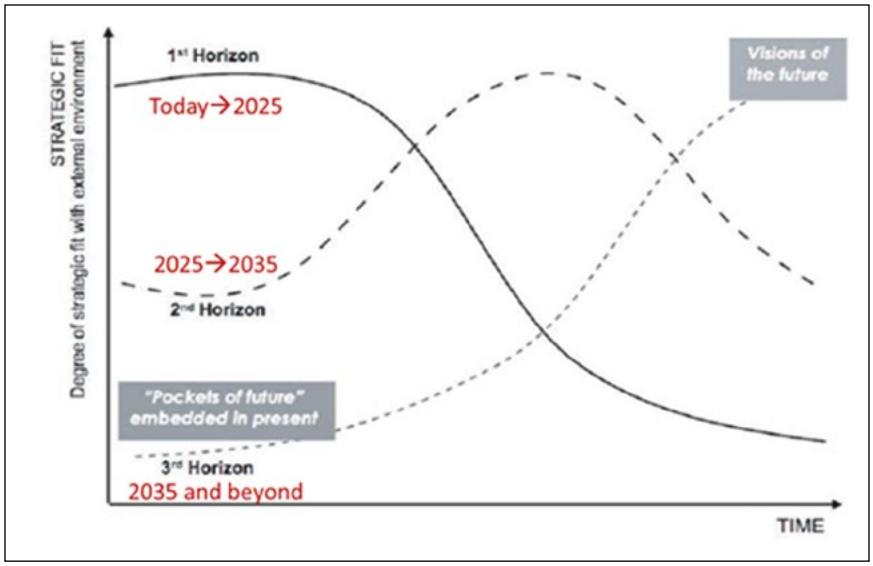
[1] For example, fuel cells made of paper (http://www.ozy.com/rising-stars/are-tomorrows-fuel-cells-made-of-paper-this-engineer-thinks-so/83354).



Major categories in the domain include **Ecosystems, Industry, Institutions, Stewardship, Climate, and STEEP** (an acronym for the broad external change categories: Social, Technological, Economic, Environmental, and Political). The STEEP categories represent dimensions of the broad context for forestry and forest institutions that could have significant implications for the field and the Forest Service in the future. For example, an article about a breakthrough in wood nanomaterials could be tagged "Technological" and "Economic", as well as "Industry", "Forest Products", and "Nano/Chemicals".

We also tag each post according to which of three time horizons it indicates. If the piece suggests a change happening around 2030, for example, we add the H2 tag for Horizon 2.

Another way to interpret the "horizons" is to think of Horizon 1 as "now" (the post is about something with an effect that is either current or imminent); Horizon 2 as "next" (the thing could be related to events happening today, but won't really start impacting things for some years); and Horizon 3 as "new" (ideas so fresh and different—but relevant—it would probably be decades before we experience the change they could cause).



READY TO START SCANNING?

Some search strategies to try:

1. Use general search engines (e.g., Google, DuckDuckGo, or Bing): Pick a domain map topic and combine it with one or more of the following terms: “of the future”, “of tomorrow”, “implications”, “emerging”, “long term”, “trend”, “by the year”, “vision”, “scenario”, “wildcard”, “wild card”, “sea change”, “the next * years”, “2020”, “2030”, “crossroads”, “dilemma”, or “disruption”.

2. Set up a daily or weekly Google Alert to automatically send you notices of relevant articles. See: https://support.google.com/alerts/answer/4815696. You may need to tune the alert if it doesn’t deliver useful scanning hits.

3. STEEP and general sources: There are many specialized Web sites that report on new developments in the STEEP categories or emerging developments in general. For example:

STEEP categories	Examples of Web sites
Social (includes demographic, cultural, etc.)	Population Reference Bureau (prb.org), UN Population Information Network (un.org/popin), US Census (census.gov), Arts & Letters Daily (aldaily.com), Variety (variety.com), Brain Pickings (brainpickings.org)
Technology	TechCrunch (techcrunch.com), Digg (digg.com), Wired (wired.com), Slashdot (slashdot.org), Science and Technology Daily (scitechdaily.com), Fresh Patents (freshpatents.com), KurzweilAI.net (kurzweilai.net), Singularity Hub (singularityhub.com), EurekAlert (eurekalert.org)
Economic	OECD Statistics Portal (stats.oecd.org), Innovation Daily (http://www.innovationamerica.us/in-the-news/innovation-daily-99998), The Economist (economist.com), IMF World Economic Yearbook (https://www.imf.org/en/publications/weo), UN Statistics Division (unstats.un.org), FastCoLabs (fastcompany.com), Venture Beat (venturebeat.com), Real-World Economics Review Blog (rwer.wordpress.com)
Environmental	Greenbiz (greenbiz.com), Resilience.org, Natural Resource Defense Council (nrdc.org), WorldWatch (worldwatch.org), Green Car Reports (greencarreports.com), The Watchers (watchers.news), Treehugger.com, NextCity.org, World Resources Institute (wri.org)
Political	CIA World Factbook (https://www.cia.gov/library/publications/resources/the-world-factbook/), Center for Responsive Politics, OpenSecrets.org, US Government News (https://www.opensecrets.org/orgs/news.php?id=D000022300&cycle=2018), Change.org, Project Censored (projectcensored.org), Technocracy (technocracy.news)
General	Reddit (reddit.com), FutureSeek (futureseek.wordpress.com), Shaping Tomorrow (shapingtomorrow.com), Trendwatching.com, FUTUREdition (futuredition.org), Futurity (futurity.org), World Future Society (wfs.site-ym.com), FutureAgenda (futureagenda.org), Flipboard (flipboard.com), Tumblr (tumblr.com), Futurists’ Blogs (vernewheelwright.com/id14.html), Google Trends (trends.google.com), TED Talks (ted.com)

Over time, the Forest Service and University of Houston team found the sites on this example list to be consistently useful. However, sources on the Internet come and go. Be sure to also scan less well-known publications and sites. Review topics and discussions on social media, too, for trends, ideas, what-ifs, and other interesting possibilities.

4. Next level: As you start to get the hang of it and want to move to the next level, check out this Scanning Sources Overview.

Some Tips from the Team on Horizon Scanning

1. Recent developments: Focus on recent developments—within the past year or so—rather than things that happened years ago (which may be interesting, but scanning hits should focus on new developments that signal potential future change).

2. Commentary: After the description of your scanning hit, please add an additional comment explaining its possible implications or relevance to forestry and the Forest Service. For example, a possible implication for forests and forest management of self-driving cars is that their adoption could encourage more sprawling development patterns (as long commutes are no longer wasted time) and increased fragmentation of forests.

3. Outside-in: Focus mostly (but not entirely) on "outside" issues and change, that is, things that are originating outside of the field of forestry and natural resources but could impact the field in the future, such as drones adapted for monitoring forests or fighting fires. Many leaders and policymakers within the field are already aware of emerging issues and change originating within the sector.

4. Wide-angle vision: To scan more effectively, read broadly and generally, and do not expect to discover a good scanning hit in every article from every source.

5. Check the library: Please check recent additions to the Forest Service Diigo library before posting, in case someone has beat you to that really great article you found. You can do this by searching for the article's headline. Always keep in mind that helping to scan isn't a contest or a race. Even if someone else found it first, go ahead and add a comment to that post, if you've noticed some implication or connection that the other person didn't.

Quick Strategies for Getting Beyond "Horizon 1":

One of the issues we found in the early phases of the project was a tendency to focus on change and scanning hits that were close to the present and near-term future, that is, Horizon 1. That's a natural approach to take, but indicators of more-distant change are more useful in horizon scanning. The following additional tips are provided to help you stretch beyond Horizon 1 into Horizons 2 and 3.

1. Don't start with articles listed at the top of page 1 of a Google Search. Try going straight to page 2, or 5, or 10, and see what comes up. These are more outlier posts: less relevant, but also more likely to be "outside the box" ideas on your search topic, or a related topic.
2. Try different (but related) words. Instead of "future of trees" try "future of plant life" or "future of vegetation".
3. Try including multiple words or terms that don't at first appear to have any relation, such as: "artificial intelligence forest management", "wood products and climate change", or "tourism and virtual reality".
4. Finally, most articles contain highlighted, underlined links to other sources that are referenced in the article. Clicking on these links can often lead to richer source materials which your original article only hints at.

QUESTIONS?

Please contact the authors for any questions you have about scanning and contributing to this project. And thanks very much for your participation!

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Horizon scanning is a method for detecting and interpreting the implications of emerging issues and other signals of change, both within and outside of an organization or field. Anticipating possible changes that may affect an organization is a first step toward strategic thinking, planning, and actions that can help prepare it for an uncertain future. Developing insight into emerging possible futures—or strategic foresight—can help decisionmakers respond proactively to seize opportunities and mitigate potential threats. Decisionmaking in forestry and other natural resource management fields has underutilized formal horizon scanning.

The USDA Forest Service, Northern Research Station's Strategic Foresight Group recently worked with the University of Houston Foresight graduate program to design and implement a formal horizon scanning system for the agency, with the goal of increasing strategic foresight. The nine papers in this report summarize the early phases of this process and lessons learned. Among the topics are the development of a method to identify useful scanning sources pertinent to forest futures, ways to analyze scanning hits, and distinguishing between current and emerging issues for the Forest Service. Also discussed is the range of communication products generated to date by the project. The report contains the complete guide written for those volunteering to do the scanning. This collection will acquaint forest planners, managers, and policymakers with horizon scanning as an integral step in anticipating the consequences of potential change and making better decisions in a rapidly changing environment.

KEY WORDS: horizon scanning, strategic foresight, futures, emerging issue

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