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

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.
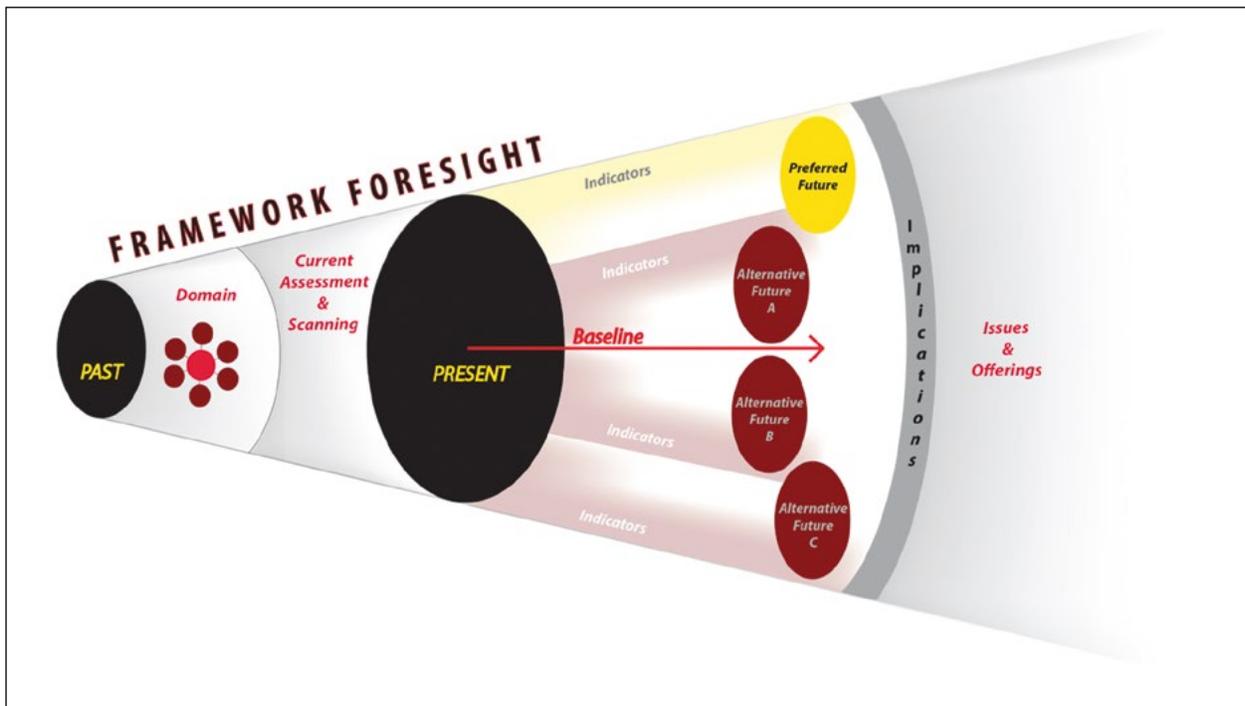

Figure 1.—Key "Framework Foresight" elements for horizon scanning projects. Source: Hines and Bishop (2013).

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
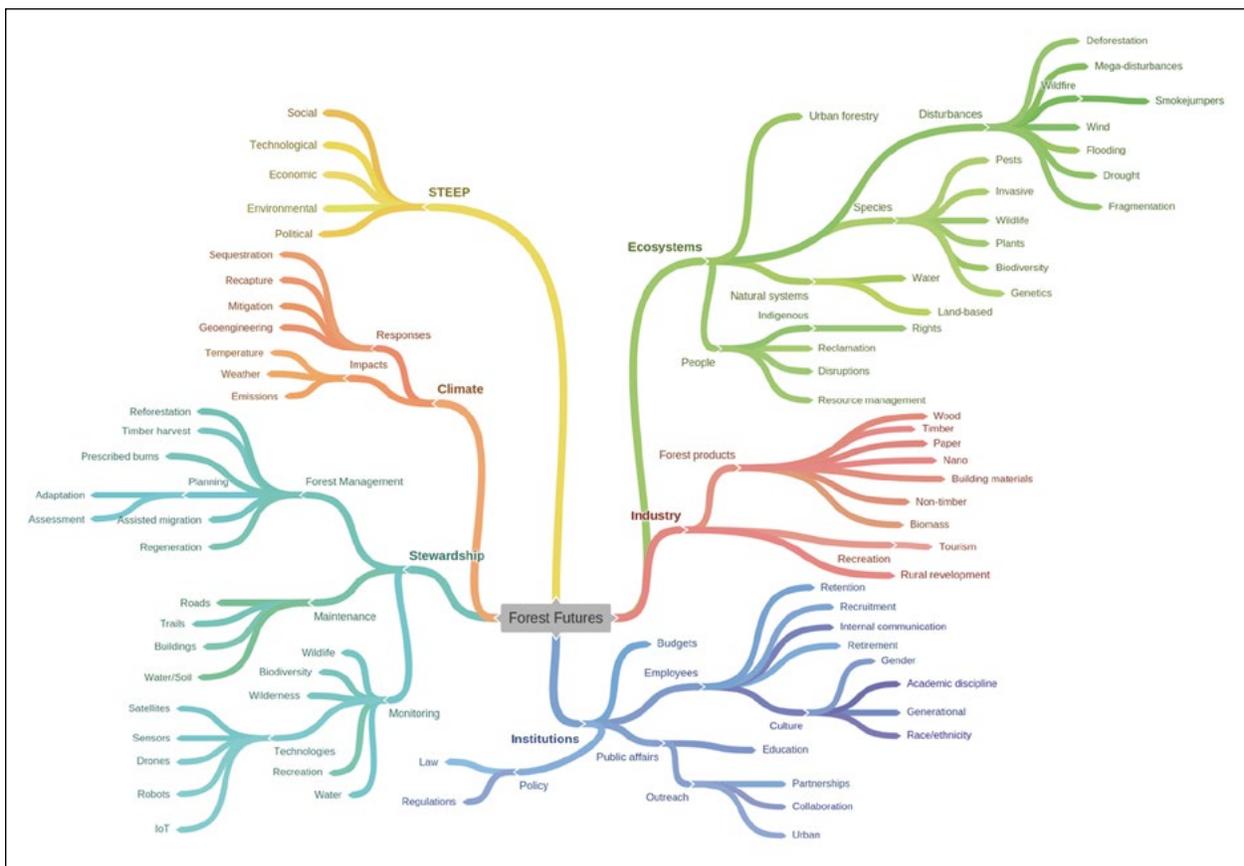

Figure 2.—Detailed version of Forest Futures Horizon Scanning domain map.

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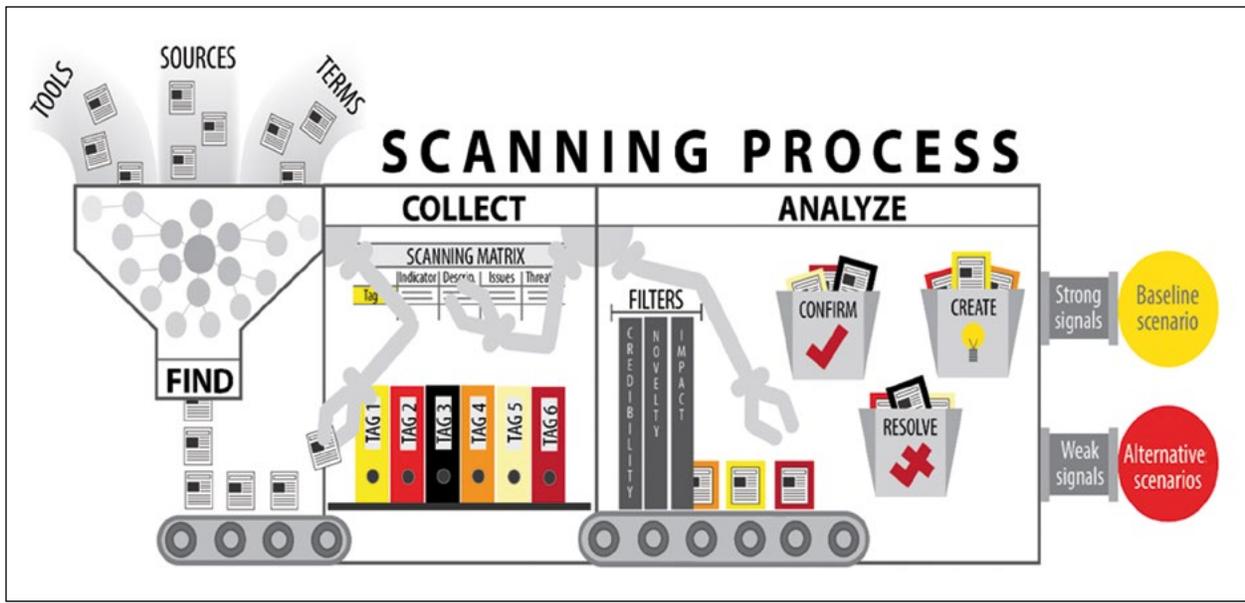
Figure 3.—Schematic of the horizon scanning process. Source: Hines and Bishop (2015). Created by Maria Romero.

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.

LITERATURE CITED

Bengston, D.N., comp. 2012. **Environmental futures research: experiences, approaches, and opportunities.** Gen. Tech. Rep. NRS-P-107. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 79 p. https://www.fs.usda.gov/treesearch/pubs/44822.

Burns, A. 2005. **Is futures studies a science or an art?** In: Slaughter, R., ed. The knowledge base of futures studies: professional edition. Vol. 1: Foundations [CD-ROM edition]. Indooroopilly, Australia: Foresight International.

Curry, A.; Hodgson, A. 2008. **Seeing in multiple horizons: connecting futures to strategy.** Journal of Futures Studies. 13(1): 1-20. http://www.jfs.tku.edu.tw/13-1/A01.pdf.

Hines, A. 2003. **Applying integral futures to environmental scanning.** Futures Research Quarterly. 19(4): 49-62.

Hines, A.; Bishop, P. 2015. **Thinking about the future: guidelines for strategic foresight.** 2nd ed. Houston, TX: Hinesight. 449 p.

Hines, A.; Bishop, P.C. 2013. **Framework foresight: exploring futures the Houston way.** Futures. 51: 31-49. https://doi.org/10.1016/j.futures.2013.05.002.

Schwartz, P. 1996. **The art of the long view: planning for the future in an uncertain world.** New York, NY: Currency Doubleday. 272 p.

University of Houston Foresight Program. 2014. **The future of student needs: 2025 and beyond.** Indianapolis, IN: Lumina Foundation. 174 p.

USDA Forest Service. 2015. **USDA Forest Service strategic plan: FY 2015-2020.** FS-1045. Washington, DC. 53 p. https://www.fs.fed.us/sites/default/files/strategic-plan%5B2%5D-6_17_15_revised.pdf.