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

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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.

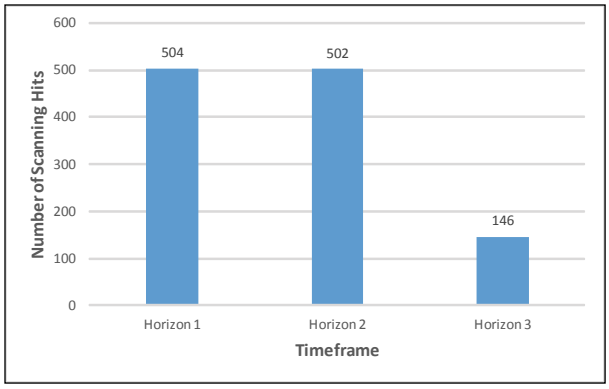

Figure 1.—Frequency of the three time horizons represented in the Forest Futures Horizon Scanning database.

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).

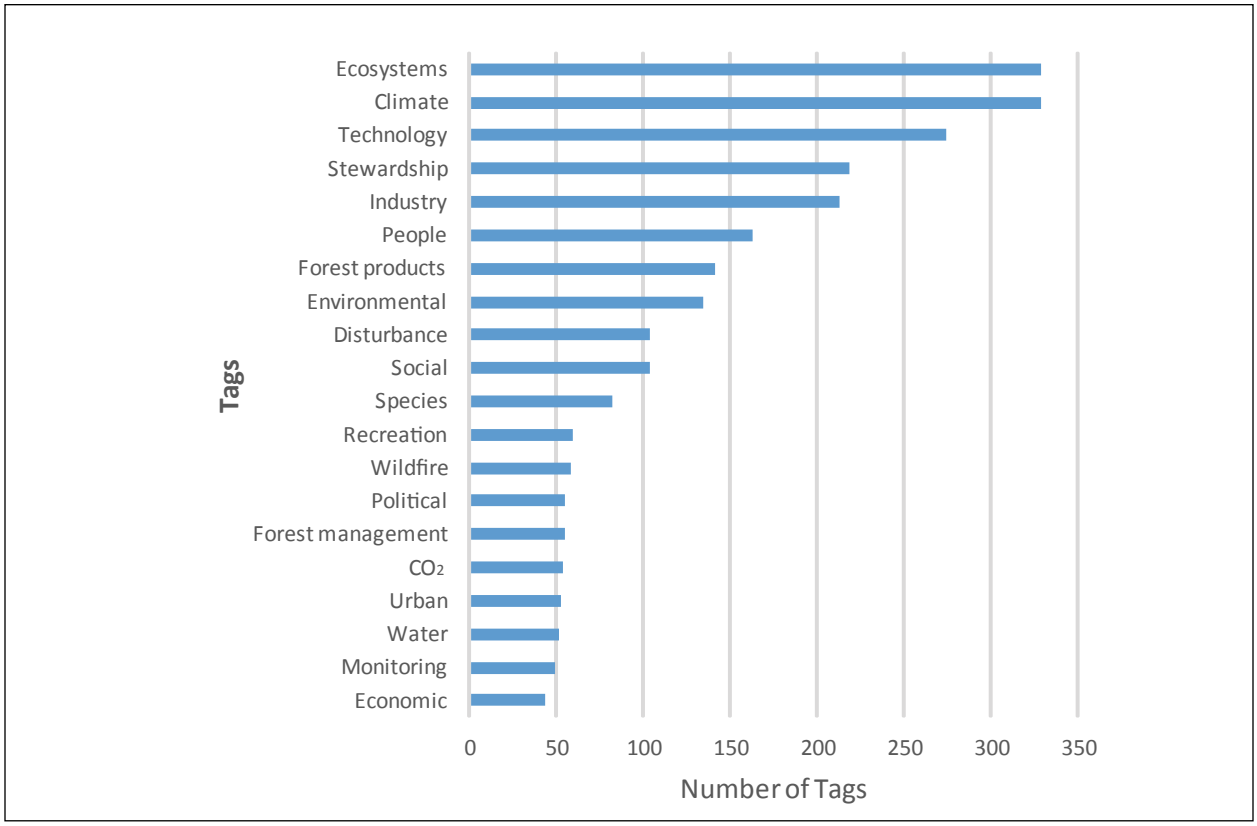

Figure 2.—Frequency of tags used to characterize scanning hits.

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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