Scanning the Horizon for the Future of Arboriculture

By David N. Bengston

Introduction

The "Great Acceleration" is upon us, an era of rapid and transformative change (Steffen et al. 2015). According to some observers, we have reached a historic inflection point in which multiple mega-trends—such as technological disruption, economic globalization, and climate change—are accelerating and interacting at the same time. Rapid social, technological, environmental, economic, and political change is the broad context for arboriculture in the 21st century. The recent past and business-as-usual thinking may not be good guides for navigating this turbulent future.

Faced with rapid, widespread, and accelerating change, what can we do to thrive and build resilience in our organizations and professional lives? The Forest Futures Horizon Scanning Project at the US Forest Service is an effort to proactively respond to the increasing pace and complexity of change, to "look beyond the headlights" in order to help the Forest Service and its partners better anticipate and prepare for change. Horizon scanning is a process for identifying early indicators of change in the external environment of an organization or field. The focus is on external change because most of us are already aware of internal developments through reading newsletters, magazines like *Arborist News*, and attending conferences. But external developments can blindside us if we're not paying attention.

Horizon scanning is one of the core tools of Futures Research (Bengston 2013) and is widely practiced in many corporations, every branch of the US military, and throughout the intelligence community. The basic idea is that although we can't predict the long-term future because of fundamental uncertainties, there are clues out there—indicators of change—if we search for them. Indicators of change include emerging issues, trends, counter-trends, and broad driving forces that could shape the future. Effective horizon scanning serves as an early warning system to identify potential opportunities and threats, enables decision makers to plan accordingly and take timely action, and fosters a forward-looking culture throughout an organization.

The Forest Service's Forest Futures Horizon Scanning Project was designed in collaboration with futurists at the

Bosco Verticale (Vertical Forest) is a pair of residential towers in the Porta Nuova district of Milan, Italy. Photo by Patrick Bombaert, https://www.flickr.com/photos/capture-creation/23388324221.

Foresight graduate program at the University of Houston (Hines et al. 2019). A diverse team of volunteer "scanners" was recruited to search a wide range of information sources for signals of change that might be relevant to forestry, urban forestry, and the US Forest Service. Scanners post these indicators of change in a searchable online database of "scanning hits," and we periodically analyze the database to find emerging themes and especially noteworthy scanning hits that could be game changers.

The next section describes a few examples of signals of change from our horizon scanning database that may be relevant for the future of arboriculture and briefly explores possible implications. The focus is on developments and trends outside of arboriculture that may not be on the radar screen of those within the field.

Signals of Change for the Future of Arboriculture

Vertical Forests

Vertical forests, or "treescrapers," are buildings that incorporate trees and other plants on the exterior of the building. The first vertical forest was the Bosco Verticale residential towers, completed in Milan, Italy in 2014 (Greenroofs.com 2018). The two towers are 350 and 250 feet tall respectively and are covered in about 800 trees, 5,000 shrubs, and 15,000 climbers and perennial plants. More buildings covered in trees and shrubs have been built, are being built, or are planned in cities around the world, including Europe, Asia, North America, and Australia. The most ambitious project is a "forest city" currently being built in Liuzhou, China with 70 tree-covered buildings that will include apartments, schools, hotels, and health care facilities (Bacialli 2018). Like all urban forests, vertical forests could bring many benefits, such as CO_2 absorption, cleaner air, reduced heat-island effects, visual appeal, and many other ecological and quality-of-life benefits.

The spread of vertical forests in the decades ahead could result in a significant increase in the demand for highly-skilled arborists. Tree care would be critical and challenging. New skills would be required, such as operating the electronic systems to monitor vertical forests and performing tree care at even more dizzying heights. Safety would obviously be a major concern, both for arborists and for pedestrians on the ground far below where falling branches would be much more serious! Water supply systems would need to be made failsafe with built-in redundancies to avoid a "towering inferno" scenario at all costs.

Bioluminescent Trees

Genetically modified trees are currently being developed under experimental conditions to improve disease resistance, accelerate growth, improve tolerance to frost, and modify other characteristics. Another idea for genetically engineered trees—which may sound farfetched—is to create "glow-in-the-dark" trees to replace streetlights

Genetically engineered glow-in-the-dark trees could someday replace streetlights. Photo provided by Studio Roosegaarde.

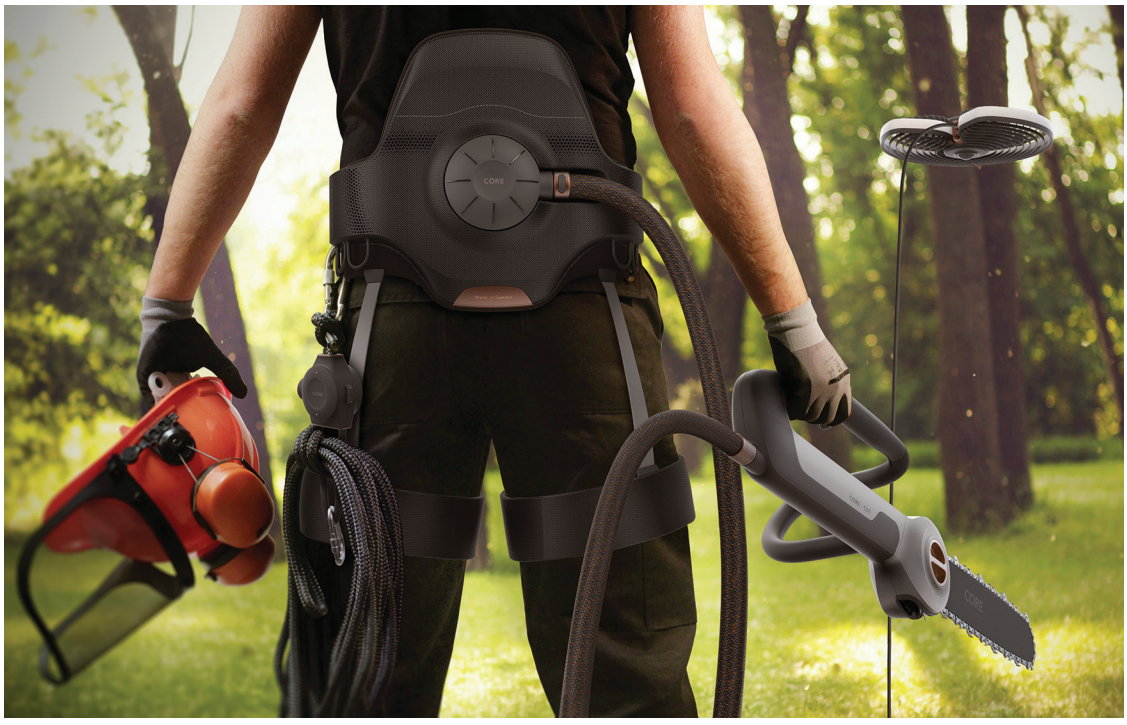
(Peters 2018). Part of the appeal—besides the wow factor—is cold, hard economics: tens of thousands of streetlights in large cities can be the largest single piece of a city's energy bill. Scientists at MIT have already successfully produced glow-in-the-dark plants (Bandoim 2018) and scientists at a number of genetic engineering companies and leading research universities have been working on bioluminescent trees for several years.

If bioluminescent trees become commercially available someday, arborists will be needed to plant and care for these living streetlights. New skills and knowledge would be required for optimal placement and understanding how to best light a city with trees. But there are many concerns and unanswered questions: what would the effect of glowing trees be on other plants and animals that live around and depend on trees? Would birds become confused and reset their internal clocks? Could genetically modified trees cross-fertilize with native trees and spread to parks and people's backyards? Biosafety concerns associated with releasing genetically modified bioluminescent trees would have to be thoroughly addressed in order to get regulatory approval.

Autonomous Vehicles and Greenspace

Self-driving cars have been imagined in science fiction for a long time, but they are no longer a futuristic idea: almost every car company is working on them, as well as many tech and ridesharing companies. Billions of dollars are being invested in this technology, and most automakers expect to have fully autonomous vehicles on the roads by the 2020s (Walker 2019). They're coming, and sooner than most of us think. Eventually, self-driving vehicles may transform transportation and mobility. The focus of most of the current work developing self-driving cars is ride-sharing applications first over individual buyers.

If self-driving cars are widely adopted over the next ten to twenty years as predicted, it's hard to overstate the countless impacts they would have on many aspects of our lives—several books have already been written about this. One of those many impacts could be a tremendous opportunity for arborists: the transformation of urban and suburban landscapes through the conversion of surface parking lots to parks and other greenspaces. Parked cars take up more than 30 percent of the space in most downtown areas (Ehrenhalt 2016). Cities are already beginning to convert valuable urban space into parks (Peters 2017). Self-driving cars would accelerate this trend because we won't need all those parking lots in prime downtown real estate or around suburban shopping malls and office parks. Self-driving ride-share cars will drop you off at your destination and move on to the next rider. If just a small part of the land now taken up by parking lots were converted to greenspace, it would be a busy time for arborists.



CORE - The Future Arborist. Red Dot Award Winner 2017. Design: Jens Rehammar, Joe Richardson, Sweden, United Kingdom. Photo courtesy of Red Dot.

Exoskeletons

Exoskeletons or exosuits are wearable frameworks that multiply a person's strength, endurance, and productivity. The robotic suits use motorized muscles or mechanical springs and pulleys to assist in handling heavy loads or repetitive tasks. Anything the wearer lifts feels much lighter or even weightless, reducing injuries and stress to muscles and joints. The first unwieldy exoskeletons were created in the 1960s, but development took off in 2001 when DARPA (the Defense Advanced Research Projects Agency of the US Department of Defense) began a major project called "Exoskeletons for Human Performance Augmentation" (Ferris et al. 2019). The idea was to create super-soldiers who would have a big advantage on the battlefield, like a real-world Iron Man. Today, practical exoskeletons are being widely tested for use in medical rehabilitation, emergency services, manufacturing, and construction (Esler 2019).

Specialized exoskeletons would enable arborists to climb trees and work with ease while reducing fatigue and injuries. This could provide a real advantage for early-adopters of "robo-arborist" exoskeletons. They could become standard equipment for arborists if they perform as promised.

Growing Distrust of Experts

One of many social trends that has emerged from our ongoing horizon scanning project is a growing distrust of experts. This trend is sometimes called the "death of expertise" or, in the case of scientific expertise, the "war on science." Examples range from anti-vaxxer beliefs to rejection of the scientific consensus about climate change. These and many other similar beliefs are indicators of a growing distrust of expert and scientific knowledge. Part of the reason for this trend may be that many see themselves as experts because smart phones provide easy access to a world of information—why should anyone believe the so-called experts when we all have instant knowledge at our fingertips? But the "University of Google" often only gives people the illusion of knowledge and expertise: "These are dangerous times. Never have so many people had access to so much knowledge, and yet been so resistant to learning anything" (Nichols 2017).

If this trend continues, we could see growing hostility towards experts (including arborists), increasing rejection of expert knowledge, an epidemic of misinformation, and a gradual undermining of organizations like the ISA that are all about expertise and professional knowledge. If people increasingly don't value the professional expertise of arborists, this could be a real challenge for the future of the field.

Arborists as Mental Health Providers

The ISA website proclaims that ISA is "Showing the World the Benefits of Trees." Arborists and urban foresters have long known that trees provide countless economic, ecological, health, and quality-of-life benefits. A recent US Forest Service study found that every $1 spent on planting trees in urban areas in California delivers about $5.82 in public benefits (McPherson et al. 2016). But there is growing evidence of the benefits of trees for psychological health: researchers have found a direct link between mental health and access to green space. For example, a large medical study found a significant relationship between access to greened vacant lots and improved mental health for those living nearby (South et al. 2018). Even though the greening of the lots was limited and inexpensive (see the before and after photos in Figure 4), participants reported a remarkable 40 percent reduction in feeling depressed and a 50 percent reduction in feelings of worthlessness. This is a very cost-effective way to improve mental health! "Eco-therapy" is becoming more common, as some psychiatrists are prescribing park visits rather than anti-anxiety drugs for anxiety in their patients.

Images show blighted preperiod conditions and remediated postperiod restorations. Adapted from South et al. 2018. JAMA Network Open.

As the connections between access to trees and improvement in mental health become better understood and well-established, arborists may increasingly think of trees as public health infrastructure and of themselves as mental health providers. Arborists could explore financing of tree planting and care through public health institutions.

Urban Heat Waves

Climate change is a major driver of change on a global scale. Many extreme weather events are beginning to be experienced from climate change, including extreme urban heat waves. Heat waves are projected to increase in frequency, intensity, and duration in the future. The number of cities exposed to extreme temperatures—cities with average summer highs of 95° F (35° C) or greater—will almost triple over the coming decades (UCCRN 2018). Beyond these average summer highs, heat waves will produce temperatures at which many human health, social, and ecological problems occur.

Extreme temperatures during extended heat waves could make it impossible to work safely outdoors at times. Increased green infrastructure can help increase urban resilience to extreme heat by decreasing the urban heat island effect. Adequate tree cover can reduce temperatures by several degrees, which can be lifesaving. Green space and increased tree cover will be much more important in the future, as will selection of "future-adapted trees" to plant and matching trees to the changing climate.

Connecting the Dots

These are just a few "dots on the horizon" from the database of the Forest Futures Horizon Scanning Project—a very small sample of emerging trends and technologies that could help shape the future of arboriculture. Some of these signals of change could be significant opportunities for arborists, while others present challenges. Some could redefine what it means to be an arborist.

In addition to ongoing horizon scanning to identify emerging signals of change, in-depth exploration of the possible implications of especially significant changes is also important. Futurists have developed tools to help "connect the dots" and better understand the consequences of change. For example, the futures wheel is a highly structured group brainstorming process to uncover the positive and negative, direct and indirect impacts of change (Bengston 2016). The foresight generated in a futures wheel exercise can help design strategies to proactively plan for potential game changers.

We live in a time of increasingly rapid and disruptive change. Early identification of signals of change and understanding their potential impacts is essential in this age of accelerations.

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