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Bending, Like the Reed in the Wind: A System to Restore Northwestern Forests

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Joint Fire Science Program
Fire Science Brief
RESEARCH SUPPORTING SOUND DECISIONS

With over 100 years experience on the ground and in the forest, land managers are adding flexible new concepts to silviculture and forest regeneration practices. Credit: ©marcopolo@dreamstime.com.

Bending, Like the Reed in the Wind: A System to Restore Northwestern Forests

Summary

Silviculture is the study, cultivation, and management of forest trees. It is rooted in science, but often is an art based on the experience of the forester. This story explores free-selection, a silvicultural system developed by scientists that allows managers and stakeholders greater flexibility in growing new forests. By using this system for applying treatments, managers craft a vision of the desired short- and long-term conditions of the forest. The focus is placed on how the remaining forest components will function, rather than focusing on stand structure guidelines that dictate stand treatments and tree removal.

Key Findings

- The free-selection system allows managers to select and apply treatments such as thinnings, plantings, and reductions of surface fuels at different times, based on a vision for creating desired forest conditions in the short and long term. Each effort or "entry" depends on how the stand develops.
- After three entries over a ten year period using free-selection principles in one moist forest, surface fuels and canopy continuity decreased, which also reduced fire hazard, and a functioning forest promoting complexity was maintained.

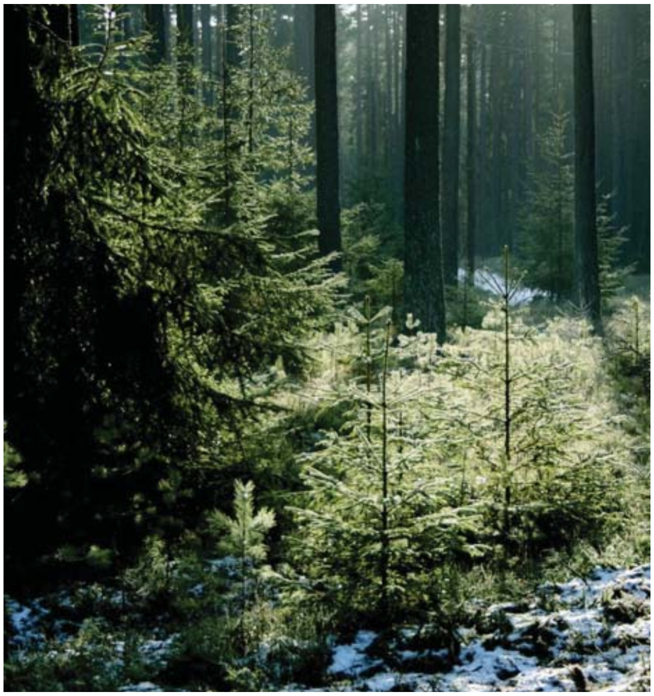
Introduction

Our minds, Darwin believed, evolved as well as our bodies. He described what he saw as evidence of problem solving, in varying degrees, throughout a wide array of organisms, even in worms. With the anthropocentric thinking that held sway in the 20th century, accounts of animals exhibiting higher cognitive abilities were regarded as amusing, or ludicrous, mere anecdotes. Recent studies have shown that chimpanzees, New Caledonian crows, dolphins—creatures of the earth, air, and water—exhibit mental flexibility: they employ creative effort to affect their environment. Changing an approach, working to solve a problem—we are not alone in this ability. But no other creature has this mental gift to the extent we possess it, and our evolving sensibilities drive us to seek better ways of operating. Silvicultural practices, that promote the growth of trees in the forest for products (such as lumber) and features (such as water quality or carbon sequestration) can result in reducing the complexity of forest structures and systems, as Russell T. Graham, research forester with the Rocky Mountain Research Station, and his team found. Rather than using existing guidelines for stand structure and treatments, they developed a system for planning and implementing a "vision" of a future forest. Their flexible system integrates the best knowledge of how forests function, from the roots below soil to the tip of the canopy.

Freedom of choice

Consuming less is a twenty-first century mantra. So is reduce-reuse-recycle. But human population continues to grow, and we still need. We still need houses, for example; we still need wood. Timber is a highly valued resource, and many forests are managed with this as one of many important objectives. Many tracts of land and forest were first set aside over the last century with the aim of protecting water quality: Late in the nineteenth and early in the twentieth century, Americans experienced catastrophic fires in the West that damaged watersheds. Our aims evolve, and along with values protected in earlier eras, we seek to protect additional values—the biodiversity of plant and animal species, the preciousness of old-growth, the characteristics that make forests fire resistant and ecosystems resilient.

Graham and his team found that traditional silvicultural practices can be flexible, but contemporary public values for a forest may not be easily measured, calculated and quantified into precise stand prescriptions. Complicating the issue is that many western forests no longer look, or function, as they did over a hundred years ago, and current conditions may enable outbreaks of insects, disease, or severe crown fires.

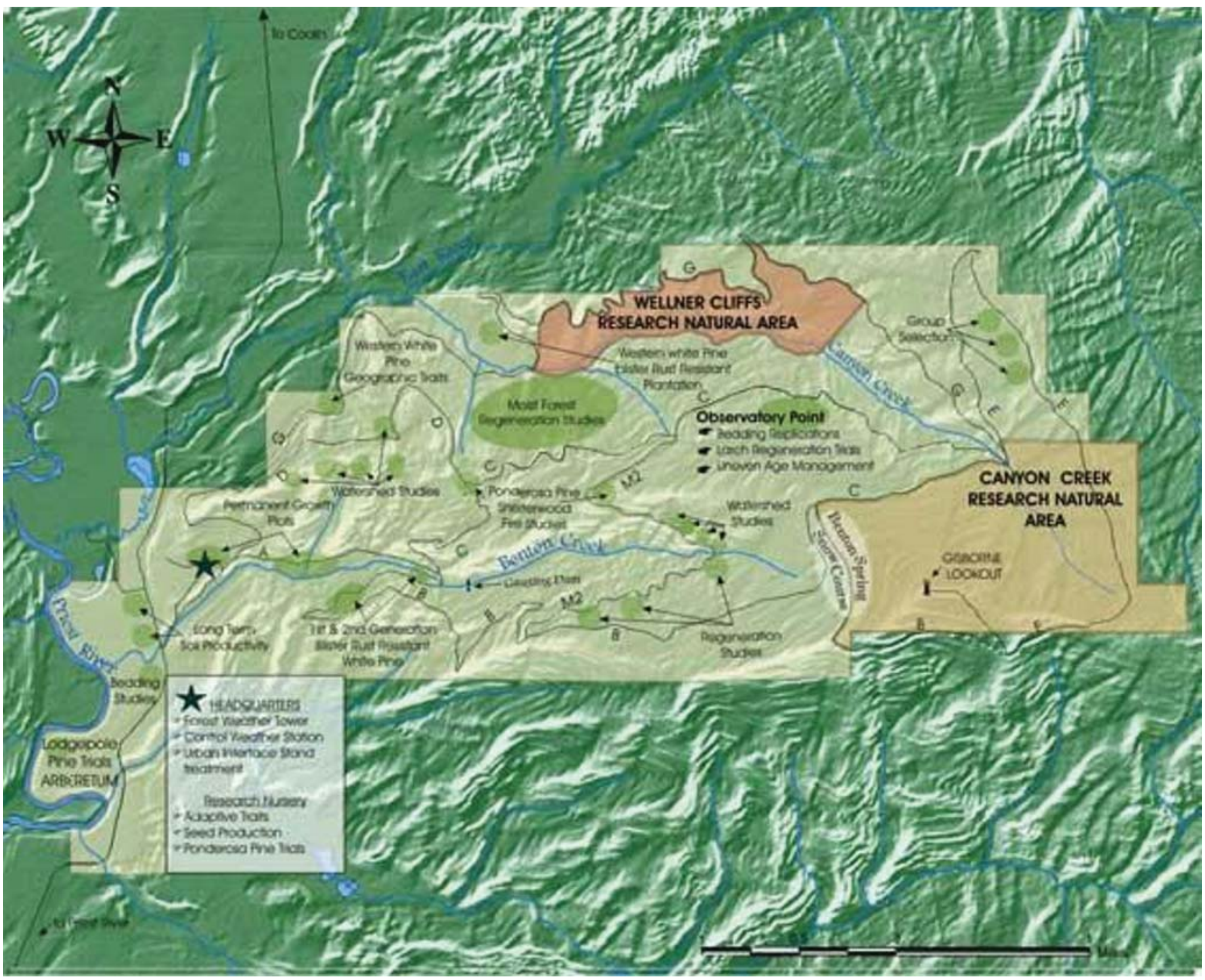


(Top) Silvicultural practices that harvest trees for lumber products often leave even-aged stands. Credit: camelotimage@dreamstime.com. (Bottom) Uneven-aged stands like that shown above promote healthier forest ecosystems for plants and animals by containing trees of different ages, species, sizes, health conditions, stand densities, and habitat opportunities. Credit: ©pontuse@dreamstime.com.

Silviculture practices can produce even-aged stands, and uneven-aged ones, and Graham and his team took elements from both systems to create a hybrid system they call "free-selection." Their system allows managers to select treatments such as thinnings, plantings, and the like at different stages to create and promote desired forest conditions. Patches of trees, in different sizes for instance, varying densities, sizes, structures, ages, maybe some snags, dying trees, downed logs, interlaced crowns—these can all be developed and maintained through each effort, or "entry" on a forest according to the driving vision for a particular forest. "The term 'free,'" Graham explains, "indicates that the frequency, kind, and intensity of entries are undetermined, but will depend on how the forest develops within the context of the biological and physical environment when fulfilling the desired conditions. However, thresholds or triggers could be described that would indicate the timing, kind and intensity of treatment required to ensure the forest develops as desired." Graham and the team urge managers to regard free selection as an appropriate choice of system when what is left in the forest after treatment is critical. Rather than using silvicultural systems that select trees for removal based on age or diameter, free selection is guided by the vision for development of desired forest features across the land and over time. The team tested their system in moist and dry forests of the northwest, where Idaho did double duty in providing locales.

A heritage place in the woods

In the moist Priest River Experimental Forest of Northern Idaho, western hemlock, grand fir, western redcedar, Douglas-fir, western white pine, western larch, ponderosa pine and lodgepole pine grow in a hodgepodge. Different species, sizes, ages, and health conditions create a complex mosaic, where windthrow, insects and diseases more often disturb the forest features than wildfire. With fire's historic interval lengthened, when it does occur, it can burn intensely, since smaller fires of milder severities (that could reduce fuels) have decreased. As any camper

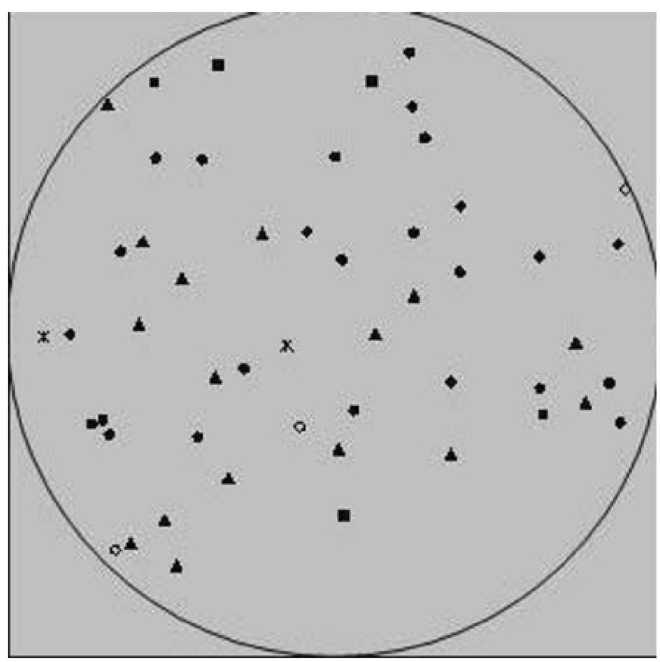


Map of Idaho's Priest River National Forest.

knows, who has ever tried to build a fire for dinner, getting wet wood to burn is difficult. In moist forests, it is decomposition that plays a greater role in reducing woody fuels. The massed wooden accumulations surrounding the Works Progress Administration (WPA) and Civilian Conservation Corp (CCC) buildings constructed in the 1930s provided an opportunity for the team to test their system on the Priest River site. Since the structures are listed on the Register of Historic Buildings, they have high value and protecting them from wildfire is a priority, a scenario that could translate to other high priority wildfire concerns along the wildland-urban interface in northern Idaho.

The team set up a 100-acre study site that surrounded the historic buildings. They would modify the canopy, ladder, and surface fuels. They would select trees to be removed. They would test different kinds of treatments on surface fuels such as lopping and scattering, piling with a grapple machine (so fuels could be burned), or chunking logs with a mastication machine. Before they undertook any of this, the team began by looking ahead. Like doctors performing a physical, the team looked at the trees' bodies. Could they stand up to wind? Were they resistant to disease? What was the shape of an individual tree's crown, and how would that relate to its development? How would a tree respond to being wounded? What was a tree's life expectancy? What features would a tree need to regenerate—an open gap in the canopy, certain soil characteristics, and release from competition? What was a tree's tolerance to fire? Did the tree function as part of a group? Graham and the team explain that answers to these questions are important not only for any immediate treatment, in deciding which trees or groups of trees to take, for example, but also for future treatments. The treatments that the forest of the future will need are based on what the forest has become. At each interval—immediately after treatment, and later, when plant communities developed in response to the treatment, the scientists looked at plant species, structures, compositions, and combinations.

In the first treatment, the team cut a large number of standing dead trees, and salvaged them as lumber. Four years later, they applied another treatment—they removed trees that could fall and damage the historic buildings. Another three years after that, the team treated the stands near the buildings, marking trees to be cut based on free-selection principles. For the woody debris left behind, the team applied different treatments—prescribed burning, mechanical chunking, mastication, and piling and burning to reduce a portion of the surface fuels while allowing a portion of some coarse woody debris to remain to replenish soils and offer habitat. "This is an example of how a comprehensive view of forests," Graham explains, "incorporated in a vision, is more than tree composition and structure." After three efforts, or "entries" in treating the study area over a ten year period, Graham offers this demonstration as a testament to the system's success: surface fuels and canopy continuity decreased, thereby decreasing fire hazard, and a functioning forest that promotes complexity survived and thrived. How this forest will need to be tended in the future (such as woody debris reduction and canopy cutting), the team emphasizes, depends on how the groups of plants located in the forest develop. Treatments must help maintain representative species, and preserve the hodgepodge mosaic of forest structures.



(Left) After cutting and harvesting standing dead trees and trees that could fall on the buildings, the density of the forest in the 100-acre area study area was reduced. (Right) The stand map shows the uneven distribution of trees that characterized the treated forest using free-selection principles. Credit: Joint Fire Science Brief, Final Report 00-2-20.

Siding and insight

"With free-selection, forest products would still be produced, though obviously in flexible quantities and at flexible times, since tree removal would not be based on targeted production numbers, but on maintaining the integrity and function of forests as ecological systems," Graham explains. And adapting our thinking, as Darwin might have added, is an evolutionarily successful strategy.

Management Implications

- In situations where it is difficult to quantify management objectives, free selection can be used as an alternative to traditional even-aged and uneven-aged silvicultural systems. Managers can prepare a comprehensive "vision" for short and long-term forest conditions which can be shared with various stakeholders.
- Rather than focusing on which trees to remove, managers can use free selection to focus on what remains in the forest—soil, trees, shrubs, and disease—and how those forest components would behave in the near and distant future.

Further Information: Publications and Web Resources

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Scientist Profiles

Russell T. Graham is a Research Forester-Silviculturist with the Rocky Mountain Research Station, Forest Service, with over 32 years of research experience in the Rocky Mountains. His principle research involves understanding long-term forest productivity and landscape processes along with understanding and describing northern goshawk habitat. He led the Hayman Fire (Colorado) Study Team and presently co-leads a team reviewing the impact of the Cascade Complex of wildfires that occurred in central Idaho in 2007.

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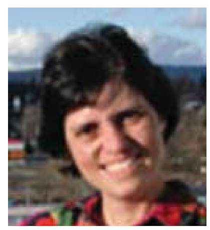

Theresa B. Jain is a Research Forester-Silviculturist with the Rocky Mountain Research Station, Forest Service, with 6 years of research experience and an additional 15 years of experience as a professional forester in the Rocky Mountains. She currently leads research teams relating forest structure to wildfire burn severity, describing the disposition of coarse woody debris post-wildfire, and developing, and describing different method of treating fuels applicable in Rocky Mountain forests.

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Results presented in JFSP Final Reports may not have been peer-reviewed and should be interpreted as tentative until published in a peer-reviewed source.

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