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Editor's Note: When I asked Peter Koch to give us the benefit of some of his recent thinking in an editorial for *Wood and Fiber Science*, he sent me the following. It is more an essay than an editorial in the usual sense. However, it presents a view of problems and challenges in wood utilization that we often do not see and consider. Peter's perspective from his home in western Montana reflects a view of the forest that is worth our consideration when we ask ourselves, as we must, "Why are we working to expand the horizons of wood and fiber science and what does it mean to the world?"

BILLIONS OF SMALL TREES IN OUR WESTERN PUBLIC FORESTS—A PROBLEM REQUIRING EXPENSIVE SOLUTIONS, OR AN IMPORTANT NATIONAL ASSET

All people familiar with the trend of increasing world population and with the steadily increasing global per capita consumption of wood must be cognizant of the need to increase forested land area and sustainable wood production in the world. Because of resulting adverse effects on the environment, massive replacement of wood by more energy-intensive substitute materials is not a viable strategy.

Drushka and Kontinen (1997), in their book *Tracks in the Forest* make some particularly cogent points and raise some insightful questions, abstracted as follows:

The conservation movement which arose about a century ago . . . was as passionate and as powerful a movement in its time as the environmental movement is today. It was opposed to the prevalent assumption of the time that forests were an impediment to civilization and should be permanently removed. . . . Paradoxically—by current standards—the emergence of a forest industry with an interest in perpetuating itself assured the survival of North American forests.

My father, Elers Koch, was a pioneer forester in the United States. Following achievement in 1903 of a Master's degree in forestry from Yale University, he worked as one of "Gifford Pinchot's young men," who established the boundaries of most of our present

National Forests in the West, and he subsequently served through all the formative years of the USDA Forest Service until his retirement in 1944. In the present climate of environmental debate, it is worth remembering the commitment and dedication of those involved in the conservation movement in the first years of the 20th century.

Drushka and Kontinen go on to ask:

What is a forest? Quite clearly a treed area in the Amazon which has never been logged is a forest. But what about a treed area in the American South, which was allowed to revert to tree cover after it had been cleared in the early years of this century and used for decades to grow cotton or tobacco? And if that is a forest, what about an exotic eucalyptus plantation on land in Portugal that never, in human history, has been covered with trees? Are plantations even forests? . . . Will the people who manage them be able to operate them within the different parameters which apply to agriculture?

No one can predict the future path of technological developments in the wood industry. But one can express some needs. Without engaging in the issues inherent in management of untrammelled forests versus management of treed plantations, we need thoughtful discussion of management of our western National Forests that lie somewhere between untrammelled wilderness forests and plantations.

The literature is replete with articles lamenting the overcrowding of many forest stands in the northern Rocky Mountains and Intermountain Region, and the inability to economically act on a broad scale to destroy or utilize unwanted small trees in these stands, thus releasing desired crop trees to grow at an accelerated rate and to improve the visual appearance of the stands. For example, nearly 40 years ago, Wikstrom and Wellner (1961) wrote about forests in the northern Rocky Mountains and Intermountain Region as follows:

Much of our attention until now has been directed toward the more conspicuous problem of understocking, and relatively little toward the problem of overdensity. Yet this latter problem is far more serious than most people realize. Unless we deal effectively with the matter of sheer number of trees, the very prolificness of nature will sharply limit future timber yields. Conversely, the yields possible by opening up young stands with thinning will be truly startling to persons conditioned to the low productivity of overstocked natural stands so common in the area. . . . [Also] millions of acres in the northern Rocky Mountain Region and Intermountain regions support timber that has grown beyond the ideal stage to start thinning. No doubt these older, overstocked stands present the most serious management problem we face. To thin them would be very expensive.

Addressing the same subject a year later, Hutchison and Roe (1962) wrote about the forests in west-central Montana as follows:

The two big problems that must be faced in timber management are that there are too many trees in most stands and not enough in the rest. . . . When all the pluses and minuses of timber reserves and growing stock conditions are added together, the commercial forest of the Clark Fork Unit currently appears to be just about one-third as productive as it should be. . . . [Moreover] the growing stock of this unit is undergoing a subtle, unnecessary, and undesirable deterioration. As a result, the timber we are growing is poorer than the timber we are cutting. . . . Unless substantial effort is put into cultural work, future yields are likely to be disappointingly small and of disappointingly low quality.

The words of the specialists quoted above have proven prophetic. Unfortunately, in my view, the cultural practices advocated by them have been implemented only on a very small scale. Now, in the closing years of the 20th

century, there are millions of acres of stands in the northern Rocky Mountain and Intermountain regions that are overcrowded with excess numbers of small-diameter trees, many of which are of species not desired for the site.

The reasons for this condition are several, but many believe that suppression of wildfires after the 1910 holocaust in northern Idaho and western Montana is the major cause. That is, frequent but low-intensity ground fires will kill fire-sensitive species but spare most of the larger thick-barked trees such as ponderosa pine and Douglas-fir.

It is well to remember, however, that the journals of 19th-century travellers through the region contain many accounts of encountering forest stands so dense with small trees that a loaded packhorse—or indeed, a mounted horseman—had great difficulty in traversing the country. For example, see Andrew Garcia's 1879 account of a pack train traverse of the Sapphire Mountains from the Big Hole Valley to the Bitterroot Valley in Montana (Garcia 1967). During the same time period, many of these travellers also comment on parklike stands of ponderosa pine encountered, in which there was very little understory or undergrowth. But I suspect that the acreage of overdense stands far exceeded that of parklike stands even in the 1800s. From my own boyhood experience over 60 years ago riding many times and hundreds of miles through what is today the Bob Marshall Wilderness—a wilderness untouched by industrial harvesting and little protected from wildfire at the time—I conclude that for every acre of parklike ponderosa pine (for example, the area at the confluence of White River and the South Fork of the Flathead River), there were several acres of overly dense stands difficult to traverse by horse if off a trail.

PROBLEM AND PROPOSED SOLUTION

The problem is not that there are too many trees/acre per se, but that there has been no economic way of removing the unwanted trees at a profit. That is, the traditional market price

for small stems has not exceeded the cost of harvesting them in a thinning operation.

One alternative, which at the moment seems to be strongly favored by many opinion leaders in the USDA Forest Service, calls for prescribed underburns to kill a high proportion of the unwanted trees in the understory—with no thought of utilization of the wood fiber so destroyed. And, it seems to me, with insufficient thought given to the probable natural regeneration of the understory from seeds of the surviving trees—not all of which will be of the desired species—thus perpetuating the problem of too many small trees in crowded understories.

A different approach calls for physical removal of the excess trees by selective harvest to leave only those trees prescribed by Forest Service specialists as desirable specimens to carry to some rather long rotation age. In many, many stands, this approach would entail removing 500 or more trees per acre, leaving only 60 to 100 trees selected on the basis of species, size, and potential for enhancing the ecology of the area. Understocked areas within treatment boundaries would be planted with desired species at desired spacing. Some of the larger trees removed, including those of unwanted species, would provide sawlogs for the existing forest products industry. But most trees would be of sub-sawlog diameter and would require special manufacturing procedures to add sufficient end-product value to cover harvesting and conversion costs plus profit. In the northern Rocky Mountain region, diversion of sub-sawlog-size wood to pulp mills does not appear to be a viable option because the market for pulpwood is intermittent and unpredictable; moreover, the pulpwood market is usually too weak to pay harvest costs plus a reasonable profit. Neither are harvests of small wood to fuel stand-alone power plants, or harvests for wood conversion to liquid or gaseous fuels, economic alternatives in this region, which is rich in coal, oil, natural gas, and hydroelectric power.

Thus new value-added and species-tolerant manufacturing procedures for small-diameter

wood are needed, and an assured supply of such wood is required to energize investment in the new procedures. The problem lies not so much in devising manufacturing procedures (for example, see Koch et al. 1989, pp. 30–31) but in the administrative process required to remove the unwanted trees from the public forests, while leaving those trees prescribed by forest specialists for retention.

At the risk of oversimplifying an extremely complex problem, I propose research having the primary objective of developing a legally defensible contract that can be widely applied by the Supervisors of the National Forests in the northern Rocky Mountain region to treat annually a significant acreage of National Forests to bring them to a state desired by the Forest Service as prescribed by silviculturists and other specialists in the Service, and to accomplish this transition from overcrowded stands without incurring net costs to the Region, Forest, or District budgets—all with public consensus, and without incurring objections from the Environmental Protection Agency related to air pollution from widespread prescribed fire. In stage one of implementation, the contracts would be restricted to overstocked commercial forestland containing a significant component of sawtimber in excess of the desired stocking level on slopes less than 35 percent and within economic forwarding range of existing roads.

A secondary objective of the proposed research would be to develop a continuous and reliable supply of low-cost, small-diameter wood to an emerging value-added wood conversion industry in the region.

A third objective would be to accomplish a significant and reliable flow of conventional sawtimber (trees 7-½ inches in dbh and larger to a 6-inch top diameter inside bark) to the existing wood products industry.

Under the proposed contract, treatment areas would be so delineated that sawlog volume and value (based on tons or scale of sawlogs removed) would more than offset all contractor-incurred costs of leave-tree marking, physical removal of unwanted trees from the delin-

eated area, burning at the delimiting site (or elsewhere) excess piled slash unsuitable for either sawlogs or small-log conversion, planting understocked sites within the treatment area, and executing other provisions of the prescription. Zero stumpage would be assessed against sub-sawlog-size small-diameter wood suitable for the new value-added conversion plants. Net return to the Region, Forest, and District from the treatment areas would therefore be positive but reduced by these costs. To achieve this balance of revenue against expenses, revenue from sawlogs scaled on removal would have to be returned to the Region, Forest, and District as an offset against these contractor-incurred costs. Mandated payment by the Forest Service to the counties for the benefit of public schools and roads would be based on 25 percent of the scaled value of the sawlogs removed.

A major administrative problem needing solution is the excessive expense and length of time currently needed to prepare a contract. The ponderous procedure presently used removes virtually all flexibility to act promptly and intelligently in response to industry innovations or to market fluctuations.

To accelerate and significantly lower the cost of administrative procedures, to capitalize on the vitality and inventiveness of the forest products industry, and to achieve the desired prescription at low cost and still realize fair value for the sawtimber harvested, maximum discretion would be allowed the contractor as long as the end results prescribed by the Forest Service (species favored, trees/acre, basal area, replanting of understocked sites, limits on fuel load after treatment, degree of soil disturbance, etc.) are achieved. The professional foresters employed by the contractor should be able to mark the leave trees and execute other activities to meet the treatment prescription. Moving to such performance-type specifications would correspond to the engineering profession's movement away from micromanaging material-property specifications and toward performance-based specifications and toward load resistance and factor design—

moves that are designed to capture the inventiveness of industry.

Finally, the contracts would not be rigidly awarded to the highest bidder, but would be awarded to the contractor that, in the view of the District Ranger and the Forest Supervisor, is best qualified and most likely to meet the prescription and still pay a reasonable market price for the sawtimber harvested.

To develop such a contract, I propose that from several western National Forests a total of six or eight representative 200-acre or larger tracts needing restorative treatment be assigned to the appropriate Forest Service Research Station to design and execute experimental contracts of the type described above—all based on results-type prescriptions prepared by professionals of the National Forests involved.

OVERVIEW

Now 77 years old and facing my own mortality, I look back over the decades of my acquaintance (and my father's acquaintance) with the USDA Forest Service, and it seems to me that the first three decades of existence of the Service were characterized by National Forest delineation and acquisition driven by a passionate conservation ethic, and by development of a lean but highly competent and cost-conscious young staff. In the decade just prior to World War II, the Forest Service was showered with more-or-less inefficient manpower provided by the Emergency Relief Administration (ERA), the Works Progress Administration (WPA), and the Civilian Conservation Corps (CCC)—a phenomenon that permitted accomplishment of many worthwhile tasks, but also seriously eroded the Agency's ethos demanding a lean and cost-effective organizational structure.

The four decades following World War II saw a huge expansion of overhead staff and physical plant to produce from the National Forests the vast quantities of wood required to house, and otherwise supply the needs of, the returning veterans and their aspiring baby-

boom offspring—and to meet the ever-increasing demands mandated by Congress.

It may be that the beginning decades of the 21st century will see attention riveted on significant downsizing of the agency to return to a leaner and more cost-efficient structure, accompanied by a trend toward outsourcing many of the agency's present activities—a trend parallel to that now occurring throughout all industry. Activity will be focused on mission definition, and long-range improvement of forest health, habitat, and productivity while at the same time producing a reliable, but reduced volume of industrial wood during the near term, with expectation of greater wood production during the 22nd century.

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