

WHAT DOES MODERN TECHNOLOGY PORTEND FOR UNEVEN-AGED SOUTHERN PINE SILVICULTURE?

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ABSTRACT. Recent changes in forest technology and market influences may impede the practice of uneven-aged (UEA) silviculture. For example, the use of tree-length systems with mechanized harvesters can unacceptably reduce the density of advanced regeneration, making it difficult to maintain the desired size class distribution. Changes to tree utilization standards, limited competition control options, and regulatory and insurance constraints have contributed to practices that further impact the ability to recruit submerchantable stems. We provide suggestions that should improve the application of UEA silviculture in loblolly pine-dominated stands in the Midsouth, even though some significant changes to harvest operations and the regulatory environment may need to happen first.

KEYWORDS. herbicides, loblolly pine, logging damage, single tree selection, workman's compensation insurance

Introduction

Uneven-aged (UEA) management has long been a viable option for southern pine forests of the Midsouth. However, the science behind these techniques was refined many years ago, and changes in forest technology and other outside influences are beginning to make UEA silviculture difficult. Specifically, operational factors such as the rising cost of workman's compensation insurance, improvements in harvesting, site preparation, and competition control, and changing mill technology have all noticeably altered the viability of UEA practices. In turn, this has led to questions about the long-term sustainability of UEA silviculture in southern pine forests. Our paper will describe recent experiences in using single tree selection prescriptions on the Crossett Experimental Forest (CEF) and some recommendations related to the problems we encountered.

Impacts on the Crossett Experimental Forest

Much of what we now know about UEA silviculture in southern pines was developed at the CEF in southern Arkansas (Figure 1) before 1970. Using a careful mixture of intuition and science, early researchers were able to develop an UEA system that for decades proved remarkably robust in the loblolly (*Pinus taeda* L.) and shortleaf (*Pinus echinata* Mill.) pine forests of the Upper West Gulf Coastal Plain (Reynolds et al. 1984, Baker et al. 1996). Two long-term (65+ years) demonstration areas on the CEF, the Good and Poor Farm Forestry Forties, have been presented to generations of foresters and landowners as prime examples of the effectiveness of single tree selection.

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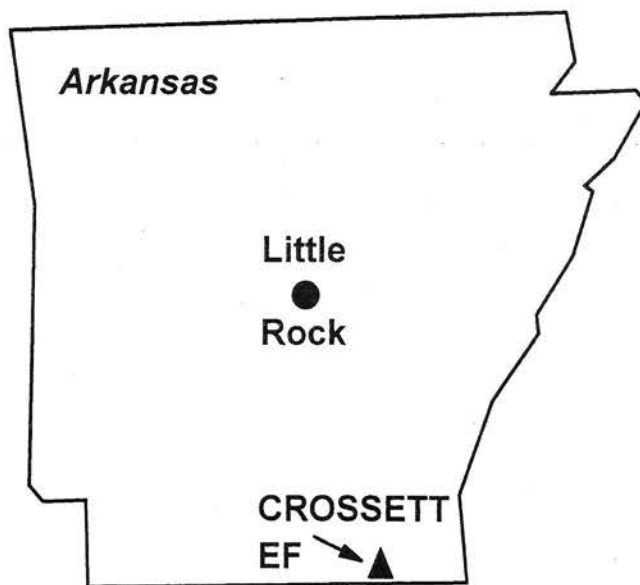


Figure 1. Location of the Crossett Experimental Forest in southern Arkansas.

However, recent observations have shown that these demonstration areas are having problems maintaining the desired size class structure because of a sustained drop in the recruitment of pulpwood-sized pines. Traditionally, single tree selection following the volume-guiding diameter limit or BDq approaches has tracked a reverse J-shaped curve in their diameter distribution (Figure 2). In other words, it takes many small diameter trees to produce a few high quality sawlogs. An examination of the diameter distribution of

the Good Forty from recent decades shows a pronounced shortfall in the pulpwood and small sawtimber size classes, and a compensating increase in large sawlogs (Figure 2). The paucity of smaller-diameter trees makes this stand vulnerable to events that may further decrease submerchantable size classes and could eventually lead to poorer quality sawtimber and longer intervals between cutting cycles.

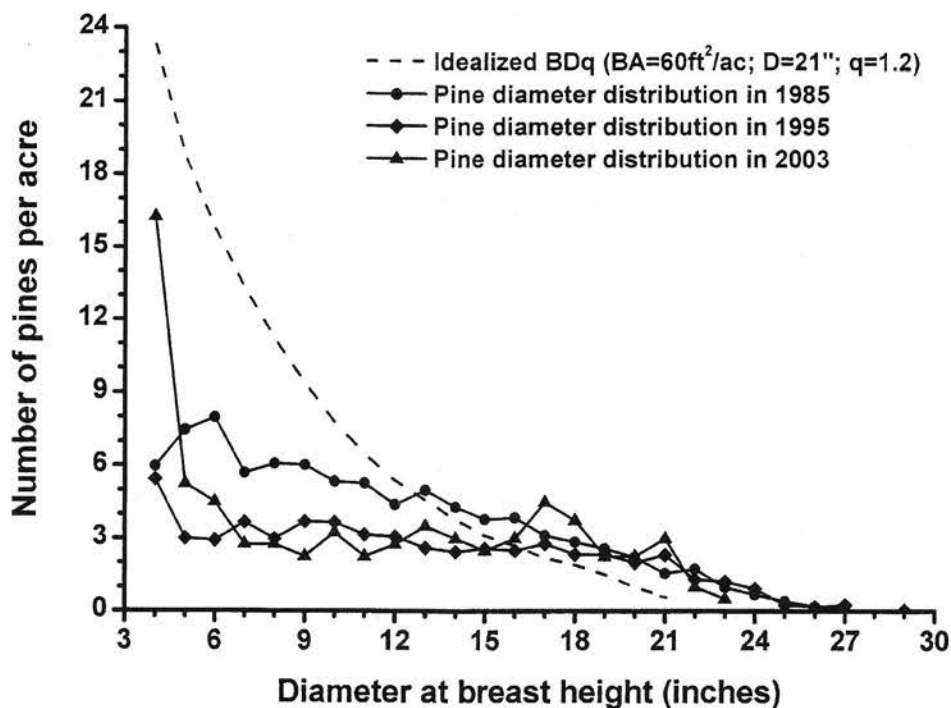


Figure 2. Idealized (dashed line) versus recent diameter class distributions on the Good Forty of the CEF. Note the shortfall in saplings, pulpwood, and small sawtimber.

Probable Mechanisms of Change

Sapling and pulpwood-sized pines are vulnerable to natural disturbances such as ice storms, wind, and fire, all of which periodically affect the forests of southern Arkansas. Glaze damage during ice storms is particularly troublesome in recently thinned pine stands (Bragg et al. 2003). A number of ice storms and wind events have struck the CEF since 1970, contributing to the apparent structural deficiencies. However, though natural catastrophes have added to the decline of CEF single tree selection stands, our concern lies in the implementation of silvicultural prescriptions associated with cutting cycle harvests.

Historically, single tree selection stands were logged with chainsaws and rubber-tired skidders or small tractors. Logs were usually limbed, cut to a predetermined length in the woods, and hauled to landings to be loaded onto trucks for transport to mills. Additionally, since UEA practices were the dominant form of silviculture in the region, logging crews knew how to harvest stands to protect the residual overstory and advanced pine regeneration.



Figure 3 (above). Example of a cutting head from a feller-buncher.



Figure 4 (right). Advanced pine regeneration severed by a passing feller-buncher.

Much of this changed in recent decades with the growing dominance of even-aged (EA) practices, especially short rotation loblolly pine plantations. EA silviculture does not depend on the long-term maintenance of advanced pine regeneration, and plantations emphasize high volume production to offset the increased costs of stand establishment and maintenance. As a result, loggers have switched to larger and more expensive pieces of equipment like feller-bunchers, grapple skidders, and loader/delimbbers. This machinery has improved productivity by increasing the amount of wood that can be produced per worker and reducing the number of people needed to log a stand. Additionally, such equipment provides a safer, more comfortable working environment. Safety concerns, workman's compensation issues, and the need to maintain their insurance coverage have also steered loggers towards mechanized harvesting. The impacts wrought by these changes have not been all positive, especially for UEA systems. For example, the use of tree-length systems with mechanized harvesters (as opposed to log-

length operations using chainsaws and cable skidders) can greatly increase the loss of advanced regeneration. Following standard harvest techniques, a feller-buncher enters the stand to cut marked trees. When the operator drives through the forest looking for marked trees, many pine seedlings and saplings are run over and destroyed. Besides the large footprint this piece of equipment has, its cutting head (Figure 3) is usually spinning, so any accidental brushing of advanced regeneration generally ends poorly (Figure 4). The felled pines are then dragged (often with tops intact) to a landing by a grapple skidder. Given that a mature loblolly pine crown can reach 30 or more feet in diameter, the skidding of unlimbed trees sweeps a wide swath clear of advanced regeneration. Though this disturbance is generally considered favorable for EA stands, it makes it difficult to maintain the reverse J-shaped distribution that exemplifies UEA stands.

Selective herbicides to control non-pine competitors are another feature that makes UEA silviculture feasible in southern pines (Murphy et al. 1993, Baker et al. 1996). Recent advances allowing the safe and accurate aerial dispersal of herbicides are an improvement over ground-based applications. However, regulations associated with herbicide usage prevent some landowners, especially in the public sector, from taking full advantage of this improved technology. The CEF, which is part of the Ouachita National Forest, is prohibited from using helicopters or airplanes to dispense herbicides. Hence, the CEF applies herbicides using rubber-tired skidders. Once again, many pine saplings and small poles are damaged or killed after being run over by the skidders spraying the herbicide.

Another factor impacting the viability of UEA silviculture is the gradual loss of the extra value of high grade sawlogs. Changes in utilization standards and sawmill capabilities make it harder for mills to deal with big logs (those > 25 inches diameter). The premium traditionally paid for large, quality sawlogs helps to offset greater harvest and management costs per unit volume delivered, so its diminishment further hinders UEA treatments. Additionally, the increasing use of engineered wood also means that even poor quality materials can be manufactured into acceptable products, further favoring shorter EA rotations.

Recommendations

A simple but impractical solution would be to return to the logging techniques of years past because they had a lower impact on submerchantable pines. Smaller equipment hauling logs cut-to-length by chainsaw crews coupled with stem-injected or backpack-based herbicide applications would noticeably reduce the damage to advanced regeneration.

Unfortunately, market conditions will almost certainly prevent this from happening. Given that logging is one of the most dangerous professions in the United States, insurance companies are directing their clients to use certain types of harvest systems. Since chainsaw use is particularly dangerous, few companies are willing to insure loggers in southern Arkansas who extensively use chainsaw felling. If they can get insurance, these loggers are often classified as risky operations, and even a single accident could cause the loss of coverage. No insurance means that most landowners will not contract with them, effectively putting them out of business. High risk insurance would also add perhaps \$1/ton or \$10/MBF (Doyle) (roughly \$30 per load, given current markets), costing a typical operation in southern Arkansas an extra \$150 to \$200 per day in insurance premiums. Given already tight profit margins and the expense of running a mechanized operation, fewer and fewer loggers are able to use chainsaw felling.

Perhaps the most practical recommendation given the structural decline in the Farm Forestry Forties is to minimize equipment travel. The sheer size and power of modern logging equipment, coupled with the ability to skid full-sized trees long distances, makes the advanced regeneration and pulpwood-sized pines vulnerable to harvest-related damage. Several options exist for minimizing the impact of equipment travel, including using smaller pieces of machinery (unlikely given current market conditions), better marking of cut trees (and perhaps via mapping with global positioning technology), and adjusting stand structure so fewer, bigger trees per acre are removed. Equipment operators can also help by being more careful with submerchantable size classes, being judicious about where they fell trees and where they drive, and if possible, delimbing large trees before skidding. Planning haul roads and landings, scheduling harvests in the dry season to minimize the use of large flotation tires, and using lower impact methods to spray herbicides (e.g., helicopters as opposed to skidders) should also reduce losses.

Forest managers may also consider converting their stands to group selection systems if they continue to experience problems maintaining the desired reverse J-shape size class structure. Group selection may prove more conducive because patches are harvested to reinitiate the stand as small, EA groups, thus addressing many concerns with advanced regeneration (Murphy et al. 1993). Travel within a stand can also be better regulated since the more readily identifiable groups localize traffic and minimize between-group disturbance (unless the stand is also extensively thinned).

Above all, clear lines of communications between the landowner and the loggers are vital. Many loggers are not as aware as they should be about submerchantable classes in UEA stands, and may have to be contractually obligated to protect small diameter trees. This could include penalties for damage resulting from unnecessary traffic, specifying how and where skid roads are to be laid out, mandating the skidding of shorter logs, or perhaps even requiring the topping of trees before skidding. Given these restrictions, however, the landowner may have to accept lower stumpage prices as an unavoidable cost of safeguarding the residual timber.

Conclusions

Our recent experiences with single tree selection on the CEF serve as a notice of potential difficulties for others interested in UEA management. A combination of harvest and regulatory issues has made the successful application of single tree UEA silviculture in loblolly and shortleaf pine-dominated ecosystems challenging, but not impossible. The adaptation of existing regimes, coupled with changes to mechanized harvest and site preparation techniques, should permit the successful application of UEA practices under most circumstances. It will prove more difficult, however, to alter utilization standards and insurance directives since these business decisions are independent of the silvicultural regime.

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