

UNEVEN- versus EVEN-

Aged Management of Southern Pines

What do Landowners Give up? What Do They Gain?

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Landowners actively engaged in timber production of southern pines generally manage their forests using even-aged silvicultural techniques. Even-aged management of pine plantations is relatively simple: plant seedlings on a desired spacing or allow natural regeneration, conduct one or two thinning operations to favor growth of higher quality trees, conclude the rotation with a final harvest, and repeat the process. The less favorable aspects of pine plantation management include the lengthy period of time before any significant revenues are realized and the aesthetics of the final harvest method of clearcutting. Other management alternatives for southern pine timber production exist, such as uneven-aged management, that many landowners may not have considered or been aware of.

Uneven-aged management of southern pines is an alternative that allows landowners to manage for timber production, while not depending upon clearcutting to harvest timber, and can generate income periodically (every 5 to 10 years) rather than realizing the majority of timber income 30 years or so at final harvest. Many landowners engage in even-aged silviculture as a way to maximize revenue from timber production. Can uneven-aged management of southern pines be as profitable as even-aged management? For most situations, the answer to that question is no. Even-aged management of southern pines is generally considered to be the most effective way to maximize timber revenue. The higher return on investment is one of the rea-

sons why even-aged management is more common than uneven-aged management for managing southern pine forests. Yet, there are a number of other benefits that uneven-aged management can provide, such as improved aesthetics and wildlife habitat diversity.

When comparing the economics of even-aged and uneven-aged timber management, the following question should be considered: is the monetary loss of choosing uneven-aged management over even-aged management outweighed by the non-timber benefits gained? If your objectives are not limited to timber revenue maximization, then you might consider how much timber revenue a landowner would be willing to give up to manage on an uneven-aged basis rather than an even-aged basis. In other words, how much is it worth to be able to manage for timber production without having to clearcut? To help answer that question, we will consider the economic differences between even- and uneven-aged timber management. But first, let's consider the differences between even- and uneven-aged silviculture and examine how foresters establish and maintain a balanced uneven-aged southern pine forest.

In even-aged management of southern pine plantations, the period of time from stand establishment (e.g. planting) to final harvest (e.g., clearcut harvest) is called the rotation age. For most southern pine species, a rotation can range from 25 to over 50 years, depending on a number of factors, including management intensity and landowner objectives. One or more

thinnings may be conducted during the rotation to reduce stand density as trees grow in diameter and to improve growth of the remaining trees. Uneven-aged management, on the other hand, is based on a cutting cycle rather than a rotation. A cutting cycle is time between timber harvests in an uneven-aged stand. For example, a cutting cycle of 10 years means that a timber will be harvested every 10 years to remove the larger diameter or older trees in the stand. Ideally, an uneven-aged stand will consist of a range of age or size classes, having many smaller trees in the younger age classes, fewer medium-size trees in the middle-age classes, and even fewer larger trees in the older-age classes. Thus, there are more young trees and fewer older trees. The distribution of the number of trees by diameter at breast height (DBH) of a balanced uneven-aged stand when plotted on a graph results in a reverse "J" shaped distribution

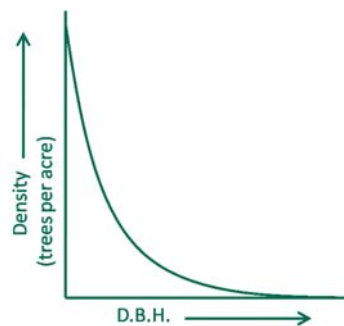


Figure 1 Number of trees per acre (density) and the size of trees or diameter at breast higher (dbh) relationship of a "balanced" uneven-aged stand resulting in the reverse "J" distribution.

(Figure 1). There are generally three or more age classes and the trees within each age class are positioned evenly throughout the stand. A fully balanced uneven-aged stand can take many years to develop.

Uneven-aged silviculture is more commonly used in hardwood management and the management of more shade tolerant species; however, this form of management can be successfully applied to shade-intolerant species such as southern pines. The uneven-aged silvicultural system depends on replicating natural disturbance and succession that occurs when a tree or small group of trees dies and is replaced by smaller trees from the mid- to lower-stories of the forest canopy. This natural occurrence can be simulated by selectively harvesting mature trees (i.e., replicating natural disturbance) and allowing the next age classes to utilize the open space (i.e., succession).

To implement this type of silvicultural system with shade intolerant tree species requires the help of a professional forester who understands how to regulate stand structure, maintain appropriate stocking, and control competing vegetation. But how does the forester know how many trees to remove and from what age classes? The process of determining the number and age class or size of trees to remove is referred to as regulation, and there are several methods for achieving regulation in uneven-aged forests. One of the most common is the BDQ method. The BDQ method allows for the control of the entire diameter distribution of the stand and determines the number of trees to leave in each diameter class based on the maximum diameter, basal area of the stand after the harvest, and the q-factor, which defines the number of trees in a diameter class relative to the number in the next larger class.

Aside from maintaining a regulated



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forest and determining the cutting cycle, another challenge with uneven-aged management is establishing a balanced uneven-aged forest by converting from either an even-aged forest or from an otherwise unmanaged or under-stocked forest. A study conducted by Cafferata and Kemperer (2000) compared the economics of uneven- and even-aged silviculture for loblolly pine based on timber production and found that uneven-aged management results in a lower net present value than even-aged management. That, of course, is not a surprising conclusion; however, the range of the value differences between the financially optimal management regimes for uneven- and even-aged silvicultural systems reported in that study can help a landowner decide if transitioning to uneven-aged management might be “worth it” when considering the other benefits of uneven-aged management.

Cafferata and Kemperer (2000) conducted an economic comparison of even-aged and uneven-aged management starting with bare land and from a mature even-aged stand. The base assumptions used in their comparison were a loblolly pine site index 90 (base age 50), 4 percent interest rate, 30 percent higher harvesting costs for uneven-aged stands, and stumpage prices of \$222 per Mbf for sawtimber, \$155.82 per Mbf for chip-n-saw, and \$22.26 per cord for pulpwood. Net

present values (NPVs) for financially optimal management regimes were calculated for uneven- and even-aged management starting from bare land and a mature even-aged stand, and NPVs were also expressed as equivalent annual income values to translate the financial returns into annual income values. When starting from bare ground, net present values were \$654 per acre for uneven-aged and \$877 per acre for even-aged management. In terms of equivalent annual income, uneven-aged management annually yielded \$9 per acre less than the even-aged silviculture. If the conversion to uneven-aged management is made from a mature even-aged stand, then net present values were \$2,569 per acre for uneven-aged and \$3,400 per acre for even-aged management. When considered as annual income, uneven-aged management annually yielded \$33 per acre less than the even-aged silviculture. They also used sensitivity analysis, allowing assumptions about timber prices, interest rates, site quality, and costs to fluctuate, and found that uneven-aged silviculture annually yields \$3 to \$22 per acre less than the even-aged silviculture when starting from bare ground. Net present values were as low as \$33 per acre for uneven-aged and \$110 per acre for even-aged to as high as \$1,017 per acre for uneven-aged to \$1,570 per acre for even-aged. When converting a mature

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even-aged stand to an uneven-aged stand, the values ranged from \$31 to \$42 per acre less each year if uneven-aged management is selected rather than maintaining even-aged management. When starting from a mature even-aged stand, net present values were as low as \$1,581 per acre for uneven-aged and \$2,633 per acre for even-aged to as high as \$2,994 per acre for uneven-aged to \$3,909 per acre for even-aged.

Cafferata and Kemperer (200) also compared the economics of uneven and even-aged management when starting with a fully balanced uneven-aged stand. Net present values were \$2,084 per acre for uneven-aged and \$2,152 per acre for even-aged management, which would be \$3 per acre annually less if uneven-aged management was continued rather than converting to even-aged management. Under some of the sensitivity analysis

scenarios, uneven-aged management actually resulted in slightly higher net present values than even-aged management. However, the comparison assumes a fully balanced uneven-aged stand. So if you already have an uneven-aged forest, converting to an even-aged stand likely would not produce substantially higher economic returns than maintaining an uneven-aged stand. When starting from bare ground, net present values were \$654 per acre for uneven-aged and \$877 per acre for even-aged management. In terms of equivalent annual income, uneven-aged management annually yielded \$9 per acre less than the even-aged silviculture.

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starting from a mature even-aged stand, net present values were as low as \$1,581 per acre for uneven-aged and \$2,633 per acre for even-aged to as high as \$2,994 per acre for uneven-aged to \$3,909 per acre for even-aged.

When deciding between even- or uneven-aged management for southern pines, from an economic perspective, you have to consider the costs and the benefits. Are the non-timber benefits of uneven-aged management greater to you than the income lost by not using even-aged management? If you are primarily interested in timber production, then even-aged silviculture may not be the best management approach for your forestland. However, if you want to manage for timber production without clearcutting, then uneven-aged management may allow you to meet your forest management objectives. Essentially, you have to ask yourself if you are willing to



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pay up to \$22 to \$42 per acre per year not to clearcut, since that is the amount of income you could potentially give up if you chose uneven-aged over even-aged management. Depending on the productive capacity of your land and market conditions, the values might not be that high, they could be lower; however, the point is you will most likely earn less per acre per year in terms of timber revenue by favoring uneven-aged management over even-aged management. However, there are non-timber benefits associated both uneven- and even-aged management that have value and should also be considered, such as aesthetics and wildlife habitat diversity.

Establishing a balanced uneven-aged southern pine forest is no easy task, and uneven-aged management can be

more challenging than even-aged management. Harvesting costs for an uneven-aged forest can easily be 30 percent higher than for an even-aged forest. This method of silviculture often depends heavily on chemical treatments to control hardwood competition. Finding a forestry consultant who is willing and capable of effectively managing southern pines using uneven-aged management may also be a challenge. The amount of acreage may also make uneven-aged silviculture difficult to implement, since harvest volumes from smaller stands may be too small to attract loggers. However, uneven-aged silviculture of southern pines may be a viable management alternative to meet the objectives of some forest landowners.

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