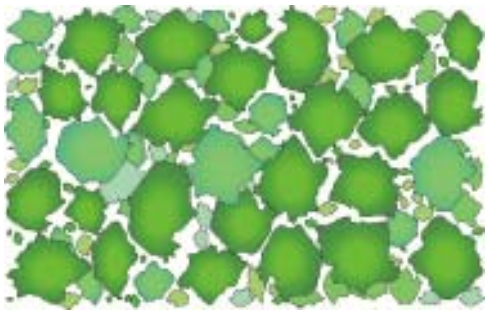
**Forest Preserve/Unmanaged Forest.** Forest preserves are not dioramas. Change happens. Where the vegetation remains unmanaged by any human intervention, slow changes accumulate gradually through the natural mortality of individual trees, or suddenly and catastrophically through the action of weather, fire, insect infestation or rampant disease. In the absence of natural catastrophic disturbances, these forest tracts progress in succession toward a more shade-tolerant and longer-life-span species mix that tends to perpetuate itself.



Unmanaged forest

Responsible stewardship requires that all forests, including unharvested forest preserves, have a management plan with a detailed map. At a minimum, management plans for forest preserves include provisions for determining and permanently marking the preserve boundaries to prevent damage to the preserve by accidental encroachment of human activities in adjacent parcels. Where the property abuts a public road, or if hiking trails are present, provisions for hazard tree management should be included. The property map should indicate the location of other potential hazards (e.g., abandoned wells).

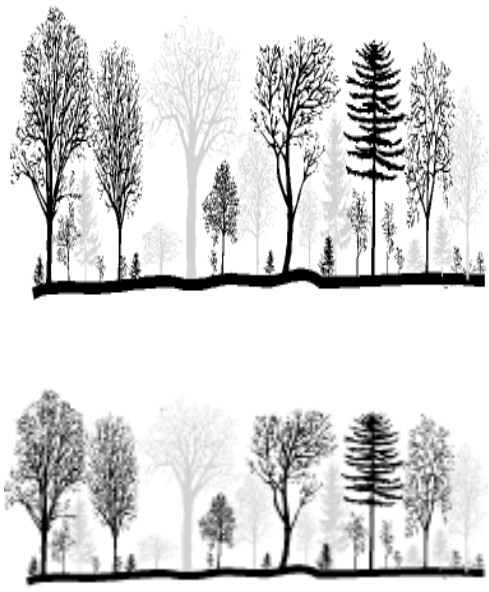
Prioritizing the relative importance of natural features will facilitate objective management decisions and allocation of limited resources. This is especially crucial when there is a potential conflict between priorities (protection of deer herd vs. maintenance of viable wildflower communities). The plan should also include strategies for monitoring and controlling invasive alien species, such as barberry and Norway maple, that could threaten the integrity of native populations.

**Advantages**

Easy to implement; Maintains continuous forest cover; Higher number of cavity and den trees; Favors shade tolerant species (hemlock, beech, maple); Increase in coarse woody debris (snags, dead logs); High watershed protection value

**Disadvantages**

No income for landowner; Change happens, unplanned and uncontrolled; More prone to some insect and disease infestations; Lower diversity over time; Shade intolerant species will disappear without severe natural disturbance



Single tree selection

**Single-Tree Selection.** Single-tree selection (or simply the Selection Method) is used by foresters to create or maintain multiple aged or uneven age conditions in a forest stand. Individual trees that are mature or declining in health are harvested from the stand in a manner that minimizes disturbance to the residual stand. This regeneration method most closely mimics the processes found in unmanaged forests, albeit at an accelerated pace, where trees die and drop out of the stand gradually. Removals are done on a periodic basis, so that trees of a variety of age classes are established and growing in the stand. The openings created for regeneration, however, tend to provide conditions most favorable for slower-growing shade tolerant species.

Landowners who consciously practice uneven aged management by the selection method are generally most interested in maintaining a continuous forest cover with trees of differing ages. High-value growing stock can be identified and their growth enhanced through the gradual removal of poorer competing trees. Fast growing trees and high-income yields are generally a lower priority for these landowners. This method is commonly applied in settings where multiple objectives, such as habitat, aesthetics, recreation, and income all must interact. *This method should not be confused with the commonly used and abused phrase, "selective cutting," which has no basis in scientific forestry practice or terminology. See "Diameter limit/High grading."*

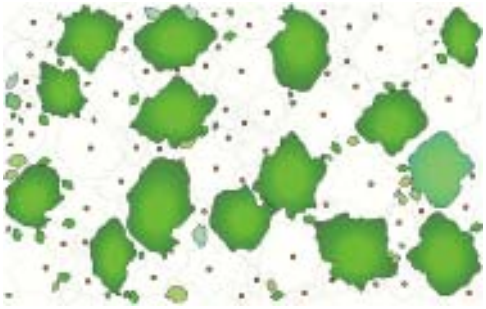
**Advantages**

Maintains continuous forest cover with low visual impact; Periodic income for forest owner, albeit low; Favors shade tolerant species (where desired); Ability to remove declining trees; Harvest schedules can be adjusted for market conditions

**Disadvantages**

High skill required for successful implementation; Higher costs for inventory, marking, and harvesting; May result in lower fiber productivity/yield in subsequent harvests; Will lead to long-term loss of diversity; Increased potential of damage to residual trees

**Shelterwood.** As its name implies, this method regenerates a new forest under the shelter of older trees. Mimicking disturbances in which only the healthiest dominant trees survive, the best growing, most desirable trees in the stand are left during the initial harvests. The residual overstory provides the seed source and cover for the regenerating forest, which becomes established over a number of years and will essentially be another even-aged forest. Simultaneously extra growth will be gained on the best stems, increasing stand value. The landowner would derive relatively substantial income from each of the harvests. However, following the final overstory removal a period of no income will occur until the new forest is old enough for commercial thinning.



Shelterwood

The Shelterwood regeneration method can be applied over two, three, or more stages, depending on physical, biological and economic factors. This method dovetails well with recreational and habitat objectives. The initial harvests create a park-like tableau of majestic trees canopied over a carpet of new regeneration and wildflowers.

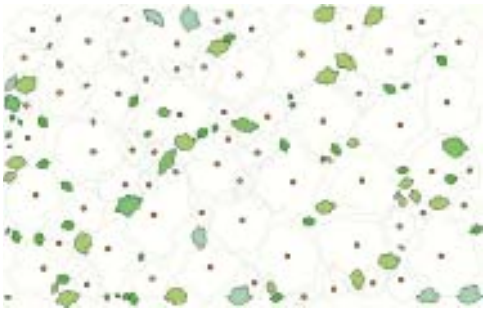
The overstory is harvested in two or three clearly defined stages scheduled several years apart. The number of overstory removal stages, and the interval between them, are scheduled according to the desired regeneration species mix. If, for example, a three-stage shelterwood system is applied in a stand at 15-year intervals, then the overstory trees will be harvested over a 30-year time frame, and the new forest will be almost 30 years old by the time the final cut is made.

**Advantages**

Can increase midtolerant (e.g., oak) regeneration; Increased volume growth of residual trees can maintain stand volume growth; Possible genetic improvement in regeneration; Damage to residual sawtimber usually minimal; Increased vertical structure heterogeneity; Regular periodic income to the landowner during harvest stages

**Disadvantages**

High skill required for successful implementation; Requires market for smaller trees; Residual volume may be lost to storm damage or epicormic branches (water sprouts); Delay in removing residual trees can lead to loss of midtolerant species and damage to new regeneration



Silvicultural clearcut

**Silvicultural Clearcutting.** It comes as a surprise to some people that clearcutting, when properly planned and executed, is a legitimate and indispensable regeneration method. There are certain species of trees that fully develop only under the full sunlight conditions found after clearing all competing vegetation. This group of species includes tulip poplar, aspen, paper birch, most oaks, eastern red cedar, butternut, and others. Without clearcutting or final overstory removal during a shelterwood these species will gradually decline and become rare in most of our forests.

There are other situations when clearcutting is appropriate. Sometimes a forest stand is in such terrible condition as a result of insect damage or other past abuse, that it does not fit with the long range objectives of the landowner. Faced with this situation, a landowner may be better off to remove the existing stand and start over. There may also be times when a landowner wishes to convert an area from one type of species to another (e.g., diversifying habitat by converting a stand of red maple to eastern white pine).

Regardless of the reason, a clearcut, while perhaps producing a one-time substantial income for the landowner, sets the forest back to its earliest successional stage. A clearcut mimics the conditions found following a catastrophic windstorm or fire and provides the best competitive advantage to the species that require full sunlight to survive. Regeneration must come as seedlings from a seed source nearby or from root or stump sprouts. It is important to understand that for regeneration to be successful *complete removal of all competing vegetation is required.* Just removing trees that are most valuable or larger than a certain size and leaving the others behind does not constitute a silviculturally correct clearcut system. Rather, this is a commercial clearcut with all of its potentially negative impacts. *See: "Diameter Limit/High Grading."*

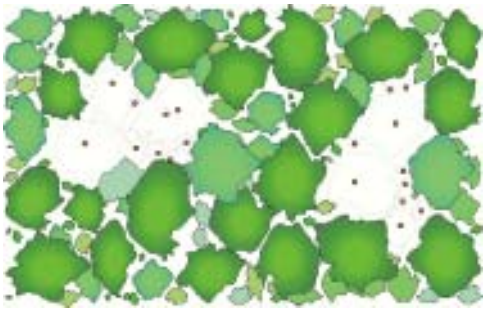
**Advantages**

Easiest method to mark and harvest; Necessary to regenerate shade intolerant species; High diversity of grasses and herbs until crown closure; Provides early succession habitat; Potentially substantial one-time income for landowner

**Disadvantages**

Aesthetically less desirable for general public; Unacceptable for many small forest owners; It costs money to remove residual poles and large saplings; No income from forest for at least 30-40 years; Susceptible to soil erosion if poorly implemented

**Group Selection/ Patch Cutting.** Group selection is a hybrid incorporating some of features of both the selection and silvicultural clearcutting methods. This approach does not select individual trees, or distribute the intensity of the harvest evenly throughout the stand, but rather removes groups of trees within pre-defined areas scattered through the stand. It leaves undisturbed forest in between, much like the conditions one would find following a severe "microburst" wind event. This method is very suitable for certain habitat enhancement, and can also be used to create a multiple aged condition within a forested parcel. Note that proper management dictates that poorly formed and less valuable trees be cut or removed along with the commercially marketable ones.



Group selection

A greater diversity of regeneration species can result if the patches created are large enough to permit full sunlight to reach the forest floor in part of the patch, so as to create conditions in which shade-intolerant species can compete. A good rule of thumb for shade-intolerant species is to make the minimum opening twice as wide as the surrounding trees are tall. This will result in openings that are at least half an acre in size. Smaller openings (1/4 acre) may be sufficient for midtolerant species or to release white pine saplings.

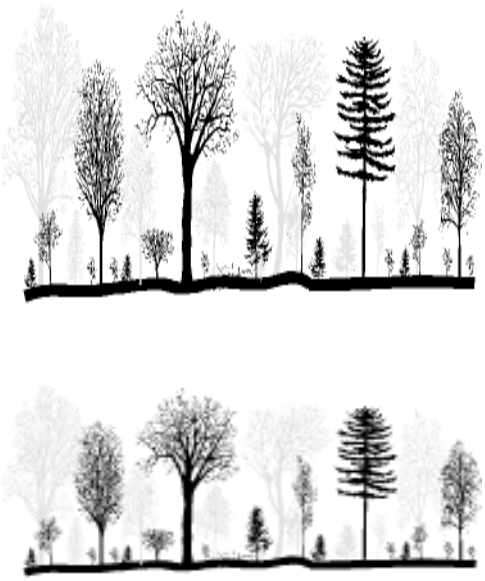
A forest managed using the group selection method will soon resemble a quilt of multi-aged and multi-sized trees. The example shows a forest after three cutting cycles. Note the three distinctive patches of different ages and sufficient uncut forest available for future harvests. Crucial to the long-term success of group selection is careful placement of the skid trails and roads. A well-designed road system will not only lower harvesting costs, but provides the landowner with a trail system for recreational use.

### Advantages

Allows regeneration of shade intolerant species without clearcutting; Provides landowner with periodic income; Provides a variety of habitats from early to late successional; Harvest schedules can be adjusted for market conditions

### Disadvantages

Resulting patchwork forest increases management costs; Patches may be too small for midtolerant/intolerant species; Deer may concentrate feeding in recent patches; Residual trees near patch edges may be susceptible to damage



Coppice with standards

**Coppice with Standards.** The coppice with standards method, originally developed in Europe to provide fuel and wattle for tenant farmers and timber for estate owners, may be useful for small accessible tracts where a market for fuelwood exists. This system favors selected crop trees (i.e., standards) for the production of high value timber or veneer logs while periodically removing all other merchantable trees. Harvests at 10-20 year intervals provide the landowner with flexibility to accommodate market conditions and growth. Reserve trees are kept free-to-grow to obtain maximum size, provide mast for wildlife purposes, and aesthetic reasons. The regenerating forest is primarily of sprout origin, even aged and dense, ideal habitat for game birds and other species. Landowners such as game clubs and wildlife preserves can use this method effectively to achieve a mix of objectives in which income from forest products is helpful, but other objectives are more important. This method can also be applied effectively in a forest managed for fuelwood. The pleasing visual mix of mature trees, small sawtimber, and poles with a scattering of shrub patches may make this the ideal method for landowners desiring both continual forest cover and periodic income. Initiating this treatment requires selection of approximately 55 standards (potential crop trees) per acre from existing pole and sawtimber. The goal is to have an even distribution of diameters over all classes. At each harvest, eight to ten new standards per acre are chosen in the pole size class. Concurrently, one fifth of the largest crop trees are harvested along with all other stems larger than 5 inches dbh.

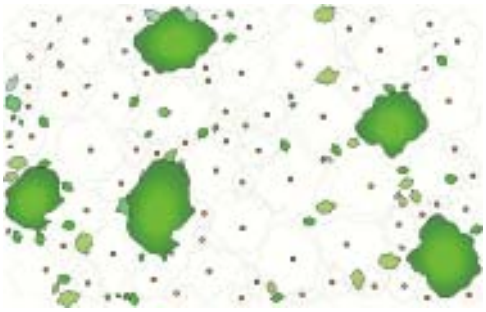
**Advantages**

Maintains continuous forest cover with low visual impact; Periodic income for forest owner; Harvest schedules can be adjusted for market conditions; Provides regeneration conditions favoring midtolerant species; Reserve trees will be very large at end of next rotation

**Disadvantages**

High skill required for successful implementation; Higher costs for inventory, marking, and harvesting; Lower yield at each harvest entry; Increased taper of main bole may decrease grader volume; Large crowns may damage other trees when harvested

**Reserve Tree/Seed Tree.** The reserve, or seed-tree method is like a clearcut, although more aesthetically pleasing, in that not all the overstory vegetation is removed. Borrowing an idea from the shelterwood method, a few trees are left scattered in the stand to provide a source of seed. The residual trees should be chosen from the healthiest and best seed producers in the stand. The main difference between this and a shelterwood system is that this method is a very high-intensity, but one–time (low frequency) disturbance event. All of the remaining vegetation is removed at once, and the new forest will be even aged. The reserve, or seed, trees are retained because other sources for new seedlings may not be reliable, and generally they are kept in the new stand until the time of the first commercial harvest. The new forest will be composed mainly of offspring from the reserve trees, and some habitat enhancement value from retaining these large scattered trees can be realized as well.



Reserve tree method

**Advantages**

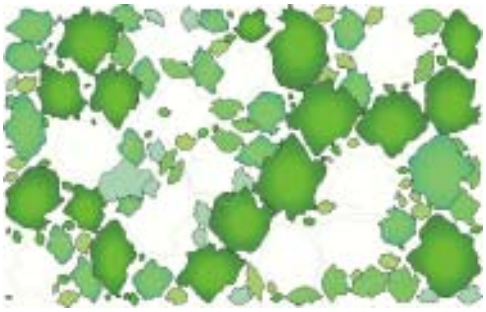
Aesthetically more pleasing than a clearcut; Provides regeneration conditions similar to a clearcut (i.e., beneficial for mid- and intolerants); Reserve trees will be very large at end of next rotation; Provides roost trees for raptors and other birds; Reserve trees serve as a supplemental seed source, especially for pine and tulip-poplar

**Disadvantages**

Reserve trees susceptible to windthrow and lightning damage (and lost volume); Crown breakage of reserve trees (see above) can damage smaller regeneration; Large crowns of reserve trees may damage other trees during next harvest operation; No income for 30-40 years

Beware!

**Diameter Limit/High Grading.** All too often a high-grade is disguised as a "selection" harvest where the most profitable trees are removed with little, or no, consideration given for future conditions. High-grade cutting, regardless of how "light" the cut is, has a negative long-term impact on both economic value and on forest health. Diameter limit cutting may appear to be a sensitive method, cutting the largest trees to release smaller, younger trees. Landowners are mistakenly persuaded that the largest trees are overmature and should be harvested before they die. However, most large trees with deep, healthy crowns will not only survive for decades, but, if the stand is thinned, will grow faster and increase in multiple values. In even-aged stands it is the poorly-growing trees that should be removed until the stand can be properly regenerated.



Diameter limit harvest

Where economic necessity dictates a diameter limit cut to generate sufficient income for a financial emergency (e.g., inheritance taxes, medical expenses, etc.) the negative impacts can be minimized. Cut or girdle all trees with poor form and low vigor. Trees with poor form will develop into wolf trees that prevent the development of more valuable regeneration. Trees with poor form are also more susceptible to damage from wind, ice, and snowstorms. Trees with low vigor grow slowly and are susceptible to insect and disease infestations.

Marking a diameter limit cut is simple. All merchantable trees larger than a certain diameter are harvested. Refer to the graph on the left for the following example. The landowner would have to wait decades before another commercially viable harvest would be possible if all trees with diameters larger than 11 inches were harvested (a commercial clearcut). Typically, many of the smaller residual trees (5-10 inches diameter) are slower growing, less valuable maple and birch.

Beware!

**Advantages**

Harvesting method generates highest short-term income; Minimal skill and cost required; Increased proportion of cavity and den trees; Increased vertical structure heterogeneity

**Disadvantages**

Long-term loss of fiber productivity and increased harvest intervals; Increased proportion of cull and slow growing trees in stand; Increased potential of damage to residual trees; Loss of valuable midtolerant species (e.g., oaks); Detrimental to wildlife species requiring early successional habitat