

Rehabilitating Cutover Stands: Some Ideas to Ponder

Ralph D. Nyland

Faculty of Forest and Natural Resources Management, State University of New York
College of Environmental Science and Forestry, Syracuse, NY.

Here's The Issue

Landowners who have cutover stands usually want to rehabilitate them at no out-of-pocket cost. That always proves challenging. In fact, rehabilitation must start with the investment of assessing conditions that diameter-limit and other exploitative cuttings created. Then managers must identify ways to improve the situation, and finally select an alternative that minimizes additional cash outlays in the process. At best, they often settle on a least-cost approach, hoping it will return a stand to profitability in a reasonable time.

Yet landowners and their managers face a harsh reality. Having allowed or encouraged diameter-limit cutting, they already incurred a heavy cost in:

- production opportunities lost due to poor stocking after the heavy cutting
- reduced quality and vigor of the residual trees
- lessened revenues due to prior cutting of the most desirable species

As a result, the rehabilitation commonly becomes a last resort for salvaging a hopeless situation, with little promise for turning an immediate profit. It often requires considerable investments under the worst of situations.

The Legacy

Diameter-limit cutting usually leaves stands with a patchy distribution of residual trees (Fig. 1), including crowded conditions in some areas and sizable openings or only widely spaced trees in others (Nyland 2002). In fact, assessments in New York indicated that the variability in basal area (reflected by the coefficient of variation) increased by at least 1.75 to 2.0 times due to diameter-limit cutting, but no more than 1.5 times under silviculture. As a consequence, diameter-limit cutting results in incomplete and ineffective site utilization, with the dispersion of under-stocked and

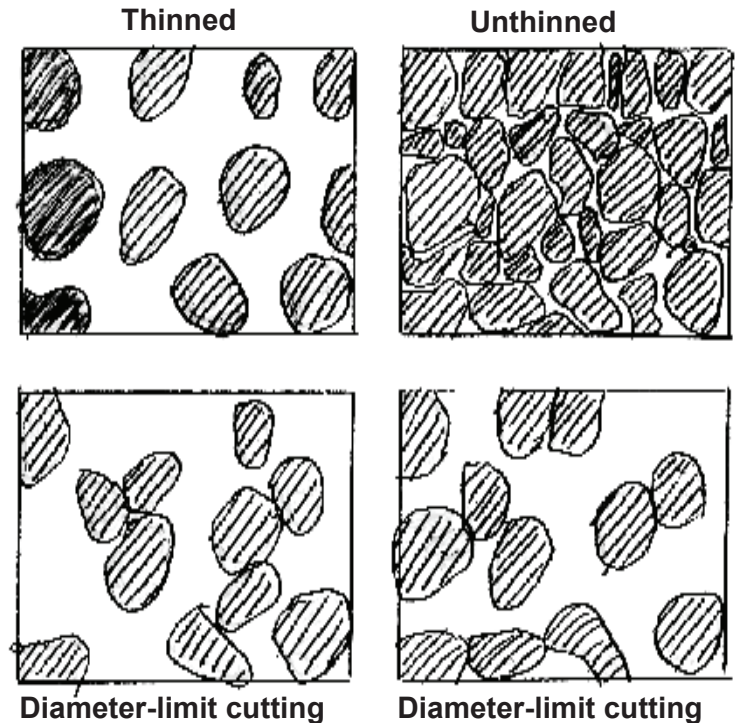


Figure 1.—Common difference in canopy cover between even-aged stands after thinning and a diameter-limit cutting (adapted from Smith 1986).

over-stocked places dependent upon the initial placement of trees larger than the threshold cutting diameter. Within uneven-aged communities, diameter-limit cutting often removes all or most the age classes that had grown to merchantable sizes, leaving the saplings and poles. Some cuttings may also leave the cull or low-value sawtimber stems. Further, it does no tending of the residual trees to enhance stand quality and vigor. Commonly, a residual uneven-aged stand has no more than 60-70 ft²/ac of basal area, distributed in a patchy fashion. For even-aged stands, diameter-limit cutting has an even more devastating effect. It removes all the marketable trees, leaving trees of poor crown position, vigor, and quality. In addition, diameter-limit cutting in even-aged stands often leaves no more than 50-60 ft²/ac of basal area after even a single entry. The stands also have a patchy distribution of residuals.

To make conditions worse, when landowners allow diameter-limit cutting they often signal a lack of interest in controlling the logging process as well, and many times the operation leaves large numbers of damaged or destroyed trees. Injuries to the main stem reduce the value, and particularly from wounds to the butt log. Loss of broken off or bent over trees creates additional places of low residual density, further reducing the production potential of the stand. Logging on saturated soil also causes deep rutting, severing the roots of trailside trees, opening entry courts for fungi, and reducing the carbohydrate storage capacity of the affected trees (Shigo 1985). These injuries often become manifest as crown dieback or decline during later periods of moisture stress. So managers must assess wounds to the bole and crown of residual trees, as well as damage to the root systems, when they search for the acceptable growing stock and make their judgment about continuing the management of a cutover stand.

Altogether then, landowners who want to rehabilitate cutover stands face some important challenges, particularly after two or more diameter-limit and other selective cuttings. These include (after Nyland 2003):

- few trees of good vigor and high quality remain, limiting the future potential for volume and value growth.
- the stand often has a patchy distribution of residual trees, resulting in incomplete site utilization and little control over understory development.
- limited usable volume remains, making a rehabilitation cutting commercially marginal or infeasible.
- a scarcity of large trees limits seed production, complicating attempts to establish a new cohort in stands lacking adequate advance regeneration.
- where past cutting proved dysgenic, the effect may carry over into new age classes that derive from the poor residual trees.
- interfering plants may dominate the understory, particularly in the more open areas, further challenging chances to regenerate new seedlings across the stand.

These aftermath conditions translate into production opportunities lost, and diminish the potential for profitable management in the years ahead. Under the worse of circumstances, they may require considerable investment to correct. Even in the least severe cases, a rehabilitation treatment will not necessarily restore a stand to its previous state. But it will set the stage for its gradual recovery to a more sustainable condition.

A Basic Strategy

Rehabilitation of cutover stands requires four basic measures:

1. even the spacing between residual trees by removing the poorest ones;
2. concentrate the growth potential onto trees of acceptable quality, or the potential to grow into ones of reasonable value;
3. regenerate a new cohort to fill the empty space; and
4. control interference to enhance regeneration success.

The need for each component differs between stands, forcing managers to carefully assess the situation before prescribing any rehabilitation treatment for a stand.

In making the appraisal, they must look at the distribution and abundance of acceptable growing stock trees, usually by watching for ones having these characteristics (after Smith 1995, Nyland 2003):

- at least a lower codominant within the original even-aged stand, or within a cohort of an uneven-aged community;
- at least 20-25% of the height with live branches;
- no epicormic branches on the lower bole;
- no holes or fruiting bodies on the main stem;
- less than 25% of the major branches dead or dying; and
- not leaning more than 10° off vertical, and no heavy forking.

In addition, preferable trees have live branches growing from all sides of the main stem (balanced crowns), and lack signs of structural weakness along the main stem or in the crown. The best ones also have few grading defects in the butt log, or a potential to heal over old branch

scars with sufficient wood to yield high quality boards from the outer faces. In the final analysis, the alternatives depend upon the number and distribution of these acceptable trees, and the degree that they will increase in volume and value in the foreseeable future.

Excluding stands suited to management with fairly traditional silviculture, the rehabilitation will likely deal with two basic conditions:

1. stands with some good residual trees, but at a low density; and
2. stands of limited promise

Rehabilitation for these will have some common elements, but the latter group will require more effort. Also, the financial requirements will differ appreciably.

Stands With Good Residuals

These stands lack sufficient acceptable trees for full site utilization, but have some worth growing to larger sizes as future sawtimber or pulpwood. The rehabilitation objectives include:

- retaining the best trees for future development; and
- creating a new age class beneath them.

Implementation would include reducing the residuals to extra wide spacing, concentrating the growth potential onto these few (the best) uniformly spaced trees, releasing any desirable advance regeneration, and establishing regeneration to fill the empty spaces.

Note that an even-aged northern hardwood stand at 40% residual relative density should develop sufficiently for full site utilization within a 15-year period (Leak et al. 1969, Roach and Gingrich 1968), given uniform spacing among the residuals. But some cutover stands have insufficient acceptable growing stock to make that option appropriate. The patchy distribution of residuals also precludes reasonable site occupancy if left alone. Instead, conversion to a two-aged arrangement might prove suitable for the long run. In that case, if the long-term plan calls for each age class to occupy one-half of the growing space, and for keeping the older ones until they reach 16 to 18 in. dbh (with a crown radius of about 15 ft), the ideal post-rehabilitation stand should

have residual trees at a 40-ft spacing (about 30 trees/ac). That might leave so little basal area that in some localities landowners must obtain a permit for the heavy cutting. Then they could increase residual stocking above the jurisdictional threshold by leaving some marginal trees. They would return to remove these poor ones when stocking of the acceptable ones (including the new cohort) passes the critical jurisdictional level.

For cutover uneven-aged stands having no or only a few acceptable sawtimber trees, the cut might leave 50-60 ft²/ac, with 2/3 of the basal area in poles (≥ 6 in. dbh) left at uniform spacing, and a disproportionate number of ones >8 in. dbh to promote their early movement into sawtimber. This strategy will brighten the ground and facilitate development of any advance regeneration. If stands still have a nominal component of acceptable sawtimber trees, then the treatment should make the spacing uniform among residuals and begin to balance the age classes by retaining trees of all sizes. An ideal stand with some acceptable sawtimber trees would have at least 55 ft²/ac of residual basal area, with:

- 20% in trees <6 in. dbh;
- 35% in trees 6-11 in. dbh; and
- 50% in trees of sawtimber size.

This low stocking would also brighten the understory considerably, and promote the rapid development of advance regeneration. Also, a stand at that stocking would support another entry in about 25 yrs, or 5 yrs sooner for each additional 10 ft² of residual growing stock in large poles and sawtimber (after Hansen and Nyland 1984).

Where a cutover even- or uneven-aged stand has appropriate advance seedlings, these cutting treatments will promote their growth. Further, seed from the residual sawtimber trees will help fortify the stocking of regeneration. Otherwise, landowners may need to add reinforcement planting to compensate for the shortage of regeneration, particularly in cases lacking a good in-stand seed source. In addition, they must control interfering understory vegetation where it occurs at a critical density (e.g., see Bohn and Nyland 2003). Yet if done by broadcast methods (e.g., mistblowing an appropriate herbicide) the site preparation will also eliminate the

advance regeneration. So managers must have a plan to reestablish the new age class by some deliberate means.

Stands of Little Promise

Some cutover stands (particularly after two diameter-limit cuts) have too few acceptable trees, and the residuals often have such low vigor that they also produce little seed. In other cases, landowners must remove all or most of the ones present to make the rehabilitation cutting commercially feasible. In both cases, the treatment should remove the low-grade remnants, and create a replacement age class. Stands in this condition often also lack advance regeneration and have important amounts of interfering understory plants. So the rehabilitation must:

1. clean off the cull and low-grade trees;
2. leave any suitable ones that might serve as a seed source, or provide some future revenues;
3. do site preparation to reduce the understory interference; and
4. plant the voids with new trees.

Mechanized harvesting and access to a biomass or pulpwood market may make the cutting cost-neutral: providing sufficient revenues to pay costs of other aspects of the rehabilitation. In stands with only a low volume to harvest, landowners may need to trade the stumpage in return for getting the cutting done. That would reduce their investments to the cost of site preparation and any planting. Where stands lack advance regeneration or have only scattered seedlings, conversion to conifers may seem best, but at a real cost. So recovering sufficient volume for a commercial sale may prove essential in making the entire rehabilitation cost-neutral.

The Importance of Action

In severe cases where landowners will not commit to investing in these operations, they could wait until a stand grows sufficient volume to pay costs of the treatments. In some cases, landowners have opted to dispose of the property instead. Yet the latter of these alternatives just abdicates responsibility for the past and passes the problem to someone else. Hopefully, landowners will prefer to do something to improve the situation, so they can return their cutover stands to a more desirable condition.

Altogether, rehabilitation requires a commitment to reverse the past and initiate a program of sustainable forestry. In the long run, landowners will find better opportunities by practicing silviculture in the first place. Yet where they must embark on a rehabilitation program, they might choose among these options (Nyland 2003):

1. Look for trees with reasonably well-developed and balanced crowns¹, good stem form, a marketable quality, and a potential to produce seed.
2. Keep sufficient numbers for future management, and cut the rest.
3. For uneven-aged stands, retain good trees of different sizes, interspersed throughout.
4. Remove just enough volume for a commercial harvesting operation, and to take out the unacceptable trees.
5. Leave uniform spacing, independent of the number kept for the future.
6. Deliberately establish a new age class, unless the overstory trees will fully occupy the site as they develop.
7. Reduce any interfering vegetation to insure regeneration success.

In essence, they should leave as many of the best trees as circumstances permit, keep them at uniform spacing, and regenerate a new age class to fill voids between and beneath the residuals. This means carefully evaluating the options, working out the costs with reference to the potential revenues, and guiding the decision-making to the best possible end result.

Literature Cited

Bohn, K.K.; Nyland, R.D. 2003. **Forecasting development of understory American beech after partial cutting in uneven-aged northern hardwood stands.** *Forest Ecology and Management*. 180: 453-461.

Leak, W.B.; Solomon, D.S.; Filip, S.M. 1969. **A silvicultural guide for northern hardwoods in**

¹A balanced crown has live branches growing from all sides of the tree. Reserve trees should also have at least 20-25% of the main stem with living branches.

- the Northeast.** Res. Pap. NE-143. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station.
- Nyland, R.D. 2002. **Silviculture: concepts and applications.** 2nd ed. New York: McGraw-Hill Book Co.
- Nyland, R.D. 2003. **Rehabilitating stands after diameter-limit cutting.** In: Beland, M., ed. Proceedings of the tolerant hardwoods management conference; 2003 8 May; Edmundston, NB: Universite de Moncton-Campus d'Edmundston. [CD rom].
- Roach, B.A.; Gingrich, S.F. 1968. **Even-aged silviculture for upland central hardwoods.** Agric. Handb. 355. Washington, DC: U.S. Department of Agriculture.
- Shigo, A.L. 1985. **Wounded forests, starving trees.** Journal of Forestry. 83(11): 668-673.
- Smith, D.M. 1986. **The practice of silviculture.** 8th ed. New York: Wiley.
- Smith, D.W. 1995. **The southern Appalachian hardwood region.** In: Barrett, J.W., ed. Regional silviculture of the United States. New York: Wiley: 173-225.

Citation

In: Kenefic, Laura S.; Nyland, Ralph D. eds. Proceedings of the conference on diameter-limit cutting in northeastern forests.; 2005 May 23-24; Amherst, MA. Gen. Tech. Rep. NE-341. Newtown Square, PA: U.S. Forest Service, Northeastern Research Station: