INTRODUCTION

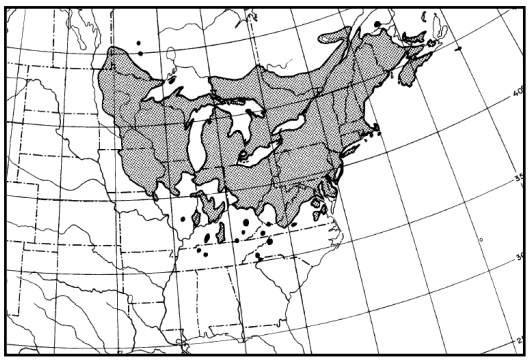
Bigtooth aspen (*Populus grandidentata*) and trembling aspen (*Populus tremuloides*) are valuable wildlife habitat components in Pennsylvania. With light colored wood and telltale leaves, aspen literally catches the eye of wildlife managers. Aspen (often called popple or poplar) is best known for its connection with ruffed grouse; However, it also provides habitat for white-tailed deer, American woodcock, eastern and Appalachian cottontail, snowshoe hare, golden winged warbler, and numerous other songbirds. Habitat components vary with stand age. Because of aspen's open canopy structure, older stands (20–50 years) often have a well developed herbaceous understory that lends nesting and brood rearing cover for species like wild turkey. This same canopy structure can also lead to invasion by non-native shrubs, a management topic covered later. Mature male aspen in older stands also provide buds, a high-protein winter food source for ruffed grouse.

Young aspen stands (1–20 years) can produce excellent wildlife cover. Following timber harvest, aspen stem density may approach 30,000 stems per acre. No other forest type in Pennsylvania is capable of achieving this cover quality. In addition, aspen is a preferred browse that provides a high density food source for deer, elk, cottontail, and snowshoe. Aspen stands like this are not difficult to produce when prescriptions are planned to take advantage of the species' distribution and life history traits.

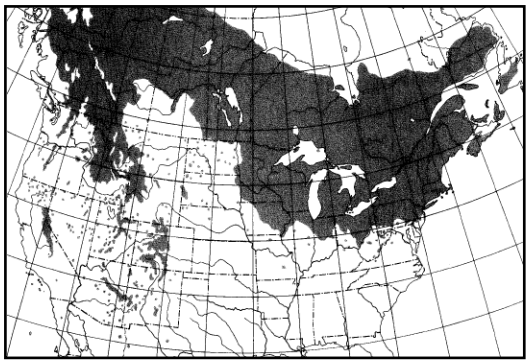
Aspen Distribution in Pennsylvania

Although bigtooth and trembling aspen are found throughout Pennsylvania, the state is not at the core of aspen range. In the upper Great Lakes States (i.e., Wisconsin, Minnesota, Michigan) thousands of acres may be occupied by nearly pure stands. In Pennsylvania, 50 acres constitutes a large stand with 1-5 acres more the norm. Moreover, most of these areas occur in

the northern half of the state above Interstate 80. Most aspen management guidelines were developed for the core of its range. Given its limited distribution and value to wildlife in the Keystone State, aspen can be considered a critical and unique habitat, with adjustments to Midwestern strategies necessary to guide management.



The native range of bigtooth aspen (The Silvics of North America, Volume 2 Hardwoods)



The native range of trembling aspen (The Silvics of North America, Volume 2 Hardwoods)

Aspen life history and growth traits

Aspen growth depends on soil water availability. Soil factors that affect water include soil texture (% silt, sand, clay), slope, aspect, and water table depth. The best aspen growing sites coincide with high silt content, or where the water table begins at 3–8 feet depth. Water tables less than 2 feet limit oxygen supply to roots. Conversely, droughty sites like those encountered on stony, steep, or south and west aspects limit growth due to lack of water. In short, aspen grows best on rich sites or where water is available in the lower rooting zone.

Aspen reproduces most readily via root suckering. Although seed production is high, seedlings rarely survive due to competition from other vegetation. Stump sprouts occur but are uncommon, especially for trembling aspen. Considering these reproductive traits, the best way to regenerate aspen is to promote clonal root suckering.

Aspen root suckers provide many regenerating stems after harvesting the parent tree; however they are shallow rooted so care must be taken not to damage them.

Roots that produce suckers lie about 3–7 inches below the ground surface. These roots are lined with dormant buds stimulated to develop shoots by soil temperature increase and release of apical dominance (i.e., the parent tree is felled). Shoots may develop following removal of ground vegetation by mechanical means or prescribed fire, but these seldom survive if the parent tree remains standing. Following harvest, root suckering can produce 3,000 –30,000 stems per acre, depending on stand age, season of harvest, number of residual trees standing, and amount of slash left on the site. Because they grow from an established root system, suckers are capable of rapid growth.

Clonal root sprouting can expand aspen 20–40 feet from each parent tree. This growth pattern presents an excellent opportunity to expand aspen into adjacent areas.

These traits reveal the first principles to maximize aspen stem density:

- Prioritize aspen management on the best growing sites.
- Cut and remove parent trees.
- Maximize sunlight at ground level.
- Avoid soil disturbance that could damage shallow roots.
- Promote clonal expansion to increase aspen cover.

Aspen Management in Pennsylvania

In the upper Midwest, checkerboard patterns with 1–5-acre, various aged blocks are recommended. This approach isn't feasible in Pennsylvania because entire stands are generally less than 10 acres. Further, topography, soils, and timber markets often preclude regularly shaped, small harvest units. Instead of trying to dissect small aspen stands into checkerboards, managers should concentrate on expanding clones and regenerating aspen where trees are nearing 30 years of age. Where enough aspen is available across the landscape, age classes can be interspersed in units of various sizes and shapes dictated by tree composition, topography, and adjacent habitat types.

Beyond age thirty, Pennsylvania aspen patches are often outcompeted and replaced by other hardwoods if a harvest doesn't occur to rejuvenate them. This was observed in many Pennsylvania "grouse blocks" where return intervals necessary for interspersed hardwood growth were too long to perpetuate aspen. A thirty-year rotation is appropriate to maintain aspen and meet wildlife needs. Years 1—15 offer early successional habitat while the later third of the rotation provides mature aspen buds used by grouse. If enough aspen stands are available to provide both stages in close proximity, that's great! If not, focus should be on the regeneration process, as grouse will consume alternate foods (black cherry, birch, and blueberry buds) where mature aspen is scarce. Remember, if aspen is left untreated beyond thirty years it will be lost completely in most cases.

Aspen clone in a moist soil shrubland surrounded by hemlock-northern hardwoods. An excellent opportunity for clonal expansion and improved habitat.

Aspen's primary commercial use is pulpwood; therefore, management won't result in notable financial returns. Pulp markets

have a narrow profit margin meaning large stands (at least 50 acres) are necessary for viability as stand alone projects. As discussed, such aspen stands are rare in Pennsylvania and managers must be creative to get the work done. Several approaches in order of preference and increasing cost to the landowner include:

1.) incorporate aspen cuttings into larger hardwood timber sales as additional pulpwood,
2.) propose aspen as "penalty blocks" in timber sales, where the cost of aspen cutting and removal is deducted from the total timber value,
3.) Pay a per acre rate for a timber contractor to cut and remove aspen (price can be offset by value of the aspen pulpwood),
4.) "Cut and dump" whereby aspen trees are felled and left on site (cutting done by the landowner or via contract).

Aspen trees (40-years old) that are too far gone to regenerate. Note the thin tops and scraggly appearance. These trees will not produce many suckers, if cut.

Site selection

Because aspen management may be costly priority should be given to areas that maximize habitat value (i.e., maximum regenerating stem density). Basic requirements are:

<u>Aspen site index of 60 or greater.</u>

Site index greater than 60 ensures managers are working in the healthiest, most vigorous stands. Good sites are often on moist soils , along stream and wetland margins, and on north and east aspects. Perhaps surprisingly, good sites can also occur on strip-mined land and old spoils.

<u>Aspen greater than 20 ft^2 basal area or 50 trees per acre.</u>

Aspen often occurs as scattered trees among northern hardwoods. These low density aspen can't compete among black cherry, maple and other northern hardwoods. Areas with less than 20ft^2 aspen basal area are better left to standard northern hardwood rotations.

<u>Stand age 20–30 years (mean dbh greater than 8 inches).</u>

Although young aspen will produce root suckers, they do so at a lower density than 20 –50 -year old trees with larger root systems. Conversely, stands >30-years old begin to decline in vigor, reducing their ability to regenerate. The key is to harvest the healthiest aspen stands.

Management techniques

Aspen should be managed via even-aged silviculture using total overstory removal. For each 15ft^2 of residual overstory, sucker growth is reduced by 35–40%. Although reserve trees are important in other forest types, their shading effect inhibits aspen regeneration and the maximum stem density objective.

Shrub competition can have the same effect. All shrubs should be cut, burned and/or sprayed prior to overstory harvest. This "evens the playing field" and allows aspen root sprouts to outcompete other vegetation. In this way, aspen sprouts can be used to shade invasive shrubs such as honeysuckle, autumn olive and multiflora rose without major herbicide application. When herbicides are used for invasive shrub control, timing and type of chemical are critical. Most objectives can be met using glyphosate (Roundup®, Aquaneat®), during the fall while invasives are still green, but aspen is beginning to lose its leaves.

Residual overstory trees and slash (especially conifers) can severely limit aspen regeneration. Note the lack of aspen stems in the foreground.

Cutting in winter and removal of slash promote optimal aspen regeneration.

Felled trees can also smother aspen regeneration, especially conifers. Therefore, as much wood as possible should be removed from the site. This often requires a commercial operation using whole tree harvest. If commercial cutting is not viable, trunks up to a 3 inch top should be pulled aside and piled (or built into brush pile bases outside the aspen regeneration area). Tree tops left on site do not produce as great a shading effect compared to tree boles, but they can affect sucker stem density.

Season of harvest is important in successful aspen regeneration. Aspen regenerates best when cut in winter for several reasons. First, carbohydrate levels in the roots are greatest. These energy reserves are utilized to develop vigorous root suckers. Second, frozen ground protects roots from damage by equipment. In general, late November to mid-March are best. As long

Invasive shrubs should be treated by mowing, burning, or spraying prior to overstory harvest.

The above photos from Centre County (SGL 176) show invasive shrub density before (left) and after fire (right). The area was burned with a low intensity fire in early April 2012. Most of the top-killed shrubs (honeysuckle and autumn olive) did not re-sprout, likely due to shading from overstory aspen. Scorching on aspen trees was minimal. The stand could now be harvested and excellent aspen regeneration would be expected.

as the ground is solid and buds have not begun to swell harvest conditions are good. Some guidelines suggest summer harvesting because competing vegetation is damaged by equipment. However, there are other ways to remove competing vegetation without sacrificing sucker production.

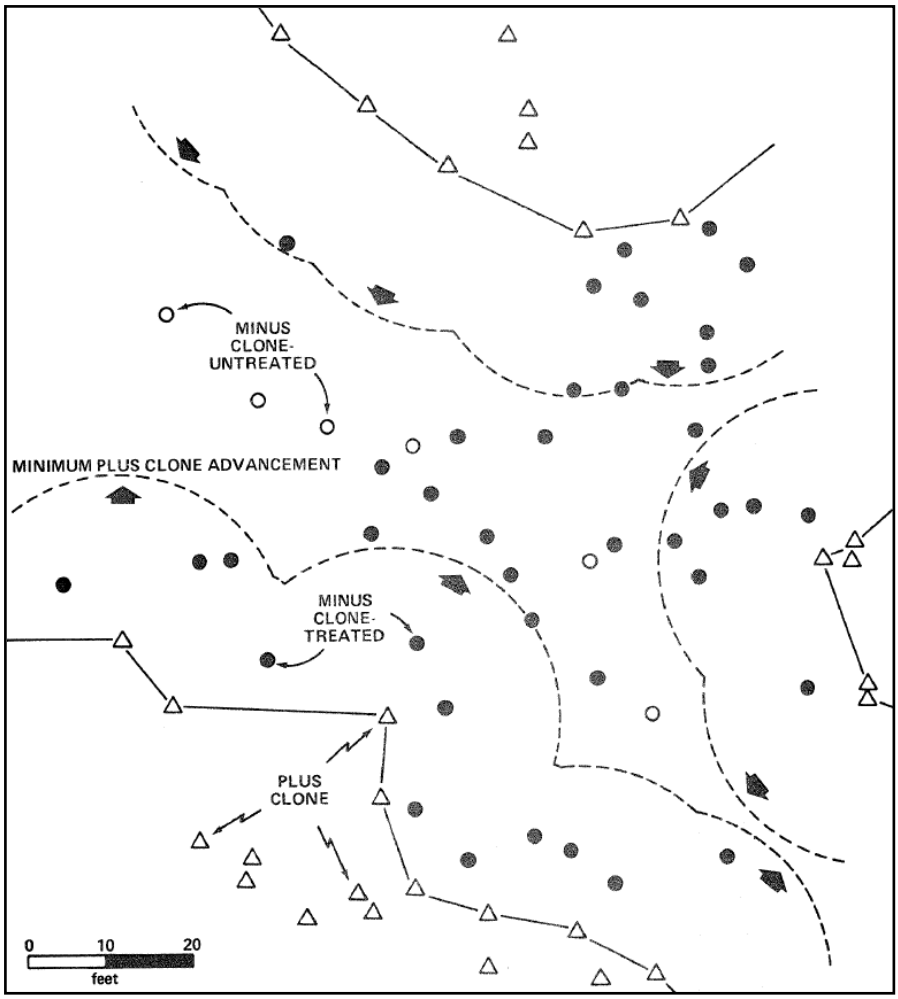
Prescribed fire can be used in conjunction with harvest for site preparation. Fire helps remove slash and set back competing vegetation. Blackened areas also warm quickly stimulating sucker development. Site prep fire can be conducted before harvest, or after harvest, but before root suckers develop. Therefore, the burning window is early spring. On an aspen study in Clinton County (SGL 89), blocks that were burned following clearcut (removal of tree boles with tops left on site) produced 14 times more aspen stems than stands that were clearcut without burning.

On strip-mined sites, aspen often grows among planted pines that are beyond optimal habitat value. Pines like those in the foreground should be removed to expand aspen clones.

Aspen sprouts expanding into an herbaceous area after mowing ceased. This represents an excellent

Prescribed fires intended to restore barrens and oak communities can affect aspen to varying degrees. Regular fire return intervals provide the frequent disturbance aspen needs, but these same fires can draw on reserves over time and reduce density . It all depends on the amount of time between fires and growing site quality. In general, where aspen exists in barrens communities, it can be expected to persist in patches over time. For the most part, barrens communities have low aspen site index.

Managers should take advantage of opportunities to expand aspen on good growing sites. Vegetation treatments that extend 20–40 feet outside the current stand will promote outward clone expansion. In some cases, this can be as simple as ceasing mowing in adjacent herbaceous areas. In other areas it may require removing adjacent shrubs and other tree species. On older strip-mined areas, aspen often occurs in a mix with conifers and larch that have grown beyond optimal habitat height. Removing these conifers can allow clonal expansion and creation of larger, more wildlife-valuable aspen stands.



Management scheme to increase aspen clones. Felling the minus trees allows the plus clones to sucker after being cut and extend in the direction of the arrows. Untreated minus trees are needed to provide full sucker stocking outside of the minimum effective suckering range (20 feet) of the plus clones. (from Managers Handbook for Aspen in the north central states, NC-36, GTRC2).

Special provisions-browse pressure

One benefit of regenerating aspen is that it provides a preferred browse for white-tailed deer and elk; however, excessively high browsing can limit clonal expansion, or even wipe out a growing stand. Under moderate browsing pressure aspen's growth rate can quickly put saplings above ungulate height. Problems occur when stems are repeatedly nipped within the same growing season. Although removing all slash from a harvest maximizes stem density, some tree tops can be retained to protect young shoots. A good standard is to retain well dispersed, four inch tops from the harvest. By the time these fine-stemmed tops break down (one or two growing seasons) the young aspen has a jump start to withstand browsing.

Managers are advised against implementing small, stand alone aspen harvests in areas of high deer density. A fifteen-acre sprouting aspen stand among thousands of acres of 40 — 80 year-old hardwoods will be decimated by hungry deer or elk.

Aspen stems under protection of a cut tree top.

Larger tops (>4 inches) in dense piles can prohibit aspen regeneration all together. Tops left to shield overbrowsing should be less than 4 inches and well dispersed.

Grouse drumming logs

Male grouse have been observed drumming on just about any pedestal that affords visibility, both for themselves and the hens they're courting. But drumming *logs* are by far their favorite . Where aspen is being regenerated by whole tree harvest, scattered trees can be reserved as drumming logs for later felling. Five to ten well-spaced trees per every 10 acres should be plenty. If available, trees in the 14 — 20 inch dbh size class will make the best drumming logs. Residual trees can be cut during or after the main harvest, as dictated by logistics and safety. Felling parallel with the topographic contour will promote the highest use by grouse.

Trees reserved as drumming logs to be felled after the harvest. Note the dispersed tree tops left on site and additional cut stands on the adjacent hillside. This cut was part of a 100-acre aspen regeneration project on previously strip-mined ground.

Aspen harvests interspersed across the landscape. This area in the northern tier (Lycoming County, SGL 75) has several relatively large aspen stands. Rotational cutting will diversify age classes and keep this habitat component viable into the future.

Landscape considerations

Aspen's patchy distribution and wildlife value make it a unique habitat feature. With a few specific techniques, it can be maintained and even expanded. But aspen management can't be considered in a vacuum; instead, it's part of the overall context of a management area. Thinking through several questions will ensure that aspen is part of the bigger picture: What's the overall forest age class distribution? What other early successional habitats exist? Where does aspen occur in relation to other forest types? Are there opportunities to include aspen in other forest habitat projects? Is there enough aspen for a rotation that will intersperse age classes? Are aspen stands accessible for management? How will they contribute to wildlife priorities on the area? Of course, there are as many potential answers as there are regenerating stems in an 8-year old aspen cut! But using these guidelines, there are no wrong answers and habitat managers can be creative in perpetuating this unique habitat type.

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