

HARVESTING

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Harvesting is the removal of produce from the forest for utilization. It includes cutting, any further initial processing, such as topping and trimming, and extraction (Ford-Robertson 1971). Commercial intermediate cutting, such as commercial thinning, as well as regeneration cutting are included. Harvesting and the income that it produces sometimes is regarded as an end in itself. However, it also may be used as a means of renewing or improving a forest. Harvesting is a viable method of retaining aspen forest on many sites where it would otherwise disappear because of natural succession.

In the West, aspen traditionally has been harvested for sawtimber, with excelsior and other markets sometimes taking smaller material. Aspen fuelwood harvests, which utilize considerably smaller and more crooked material, also have become significant near metropolitan areas. However, harvesting aspen for flakeboard may soon account for most of the aspen volume cut in the West.

Logging Considerations

Aspen in the West generally has been logged using systems designed to harvest conifers (fig. 1). This often is inefficient, compared to systems that could be designed



Figure 1.—Until recently, most aspen in the West has been harvested as sawlogs.

specifically for harvesting aspen (Groff 1976). Sawtimber diameters in aspen are small compared to those of most associated conifers (Groff 1976). Unlike forests of coniferous sawtimber, aspen seldom grows in large blocks, but commonly are small and somewhat scattered, on gentle to moderate slopes. Consequently, harvesting equipment should be easy to move from stand to stand and ordinarily does not require a high production capacity. Groff (1976) suggested self-loading trucks and small tractors.

Logging these scattered, small stands may require construction of a substantial length of access roads for the relatively small timber volumes to be harvested. If harvesting is desirable for values other than timber products, then other functions might be expected to contribute to the cost of road construction. This seems especially desirable if high road construction standards are required.

If aspen harvest alone is to pay for the cost of building roads to access merchantable aspen stands, a comprehensive harvest schedule and transportation system plan should be developed. This enables a series of timber sales to share road building costs and to utilize a common transportation system. Control and timing of vehicles on such a system will allow roads of minimum design standards and construction costs. (See the WOOD UTILIZATION chapter for a discussion of utilization opportunities and feasibility.)

Time of Logging

Season of logging is influenced by many factors, including mill capacity, markets, inventory, ease of veneer peeling, weather, fire-hazard, and aspen regenerative capacity.

Spring or early summer logging offers the advantage of easy peeling for those milling processes requiring bark removal. Logs are lighter in the summer because of reduced water content (Yerkes 1967). This allows more efficient skidding, loading, and hauling. Sawlog utilization also may be better with logs cut in summer. However, spring logging may affect the quantity and quality of subsequent suckers (see the REGENERATION chapter).

In contrast, soil compaction and erosion hazard are greatest if logging is done with heavy equipment when soils are saturated in the spring. Logging at this time is most damaging to aspen roots, also, which can reduce suckering. Also, because root carbohydrate reserves are lowest in spring (see the VEGETATIVE REGENERATION chapter), harvesting at that time can further reduce sprouting.

Commercial thinning when the cambium is active and the bark is easily peeled from the trees (from budburst in spring until midsummer) can result in more and larger wounds on residual trees, and serious disease problems (fig. 2).

The potentially detrimental effects of spring harvesting may outweigh any logging and processing benefits, making harvesting during the dormant season, when soils are dry, frozen, or snow-covered, most desirable. However, in much of the West, heavy winter snowpacks and late spring melt probably will limit the harvesting season to between mid-summer and late autumn—a realistic compromise.

Cutting

Trees may be felled, and then skidded whole with no further cutting at the felling site. They also may be felled, limbed to the upper limit of merchantability, and topped out for skidding as a full merchantable tree length. Or, they may be felled, limbed, and cut (bucked) into logs prior to skidding.

Lamb (1967) criticized bucking aspen to a single standard length in the Lake States. It was more profitable to maximize grade by bucking into variable lengths while taking into account stem form, defects, and the end product. Whether aspen is bucked at the stump or at a gathering place is likely to be determined in part by skidding considerations.



Figure 2.—Bark can be peeled from aspen easily in the spring, causing extensive damage to residual stems if any form of partial cutting is used.



Figure 3.—Care must be taken in skidding to avoid damaging the clonal root system.

Slash disposal practices used in conifer harvesting are not applicable for aspen in the West. Logging aspen produces less slash than conifers; aspen slash also decomposes rapidly. Slash can be left where it falls. Lopping may be desirable to increase forage use by ungulates. If overbrowsing of the new sucker stand is feared, tops can be left unlopped. If regeneration of even-aged aspen is wanted, any advanced aspen regeneration should be cut at the time of harvest (see the REGENERATION chapter).

Skidding

Choice of skidding methods most often is affected by economics, utilization standards, and available equipment. Multiple-use benefits, such as esthetics and wild-life values, also help determine the method chosen. In Minnesota pulpwood operations, Zasada (1972) stated that skidding of entire trees (full-tree skidding), of full merchantable lengths (tree-length skidding), or of 100-inch (2.5-m) lengths all were equally acceptable for aspen regeneration.

Skidding operations that cause deep cutting or compaction of the soil result in fewer suckers and reduced sucker growth. Therefore, repeat skidding traffic should be kept to main trails as much as feasible (see the REGENERATION chapter) (fig. 3).

Full-tree Skidding

The available information on full-tree skidding of aspen comes from pulpwood operations in northern Minnesota (Zasada 1972; Zasada and Tappeiner 1969a, 1969b). Full-tree skidding does not seem widely suited to sawtimber logging of aspen in the West. Minimum merchantable top diameters for sawlogs are usually 6 inches (15 cm). Thus, a rather large part of each skidder load would be unusable, and daily volume production of merchantable material would be substantially reduced. If, however, the smaller material has utility as chips, it could be feasible to use full-tree skidding to a chipper located adjacent to the landing.

On-site slash is minimized with full-tree skidding (fig. 4). This results in favorable conditions for subsequent use by livestock and big game. Also, the logged site is easier to plant if conversion to light-tolerant conifers is desired. However, at least in the central and southern Rocky Mountains, seedlings of Engelmann spruce, Douglas-fir, and the true firs survive much better in the shade of downed timber or slash (see the NURSE CROP chapter).

With full-tree skidding, one or more limbing-topping sites are needed near the landing. The skidder stops at these sites long enough for limbs and tops to be cut from the trees before proceeding to the landing. This creates concentrations of limbs and tops, which should be piled and burned, or utilized. Otherwise, the piled slash could occupy 5-10% of the total area harvested, based upon



Figure 4.—Full-tree skidding was used in this clearcut. Soil disturbance and slash are minimized using this technique.

aspen stocking and utilization standards in the West and upon Zasada and Tappeiner (1969a).

Because of potential damage to residual trees on the site, full-tree skidding is inappropriate for commercial thinning and entirely unacceptable where a coniferous understory is to be spared. Also, long-term site quality may be adversely affected by concentrating the nutrient-rich tops and limbs on a small portion of the area. Full-tree skidding is advantageous where advanced regeneration or understory shrubs are to be destroyed.

Tree-length Skidding

Usually, skidding full merchantable lengths of trees, without branches or tops, is more economical than skidding entire trees. Smaller skidders also may be used.

Premarked, main skid trails leading to the haul road or landings should be used for the bulk of repeat skidding traffic. Felling should begin halfway between these skid trails and proceed toward them. Trees should be felled in the direction away from the trail to which they will be dragged. When cutting has reached a main trail, skidding then begins with the trees closest to the trail. Skidding should be directly to the main trails, and then down them to the road or landing. It should not be cross-country from the felling site to the landing or haul road, except for trees lying close to them.

Skidding Shorter Lengths

The full merchantable tree length may be bucked into logs where it is felled, then skidded as individual logs to the landing. Bucking trees where they fall often is less efficient than bucking at a central point, and considerably more hooking is necessary to skid a given volume in shorter logs.

Skidding short lengths may be desirable if the stand being logged has a coniferous understory that needs protection from logging damage. Also, in commercial thinning operations, skidding should be in short lengths, unless it is done with extreme care. Skidding short lengths will considerably reduce damage to regeneration, or to the butts of aspen left after thinning.

Releasing a Coniferous Understory

Aspen harvesting may be used to immediately convert aspen stands with coniferous understories to conifer dominance (fig. 5). In those cases, great care should be taken to protect the conifers from damage during logging. Special logging methods, such as the use of herringbone skidding, may be appropriate. Other management actions to discourage aspen sprouting also may be necessary (fig. 6).

Herringbone logging is a system that may be used to release conifers. This method was observed in 1955 on a



Figure 5.—Conifer understories can be released by removing an aspen overstory, but extreme care is required.

large sustained yield unit in the Midwest.¹ It probably is more applicable in the West than dray skidding. A large acreage of undulating terrain had a heavily stocked overstory of mixed jack pine (*Pinus banksiana*) and aspen about 85 feet (25 m) tall. Life-long crowding had resulted in narrow crowns. There was a fully stocked understory of balsam fir (*Abies balsamea*) and black spruce (*Picea mariana*) that were 5 to 15 feet (1.5-5 m) tall. To begin logging, narrow branch trails were cleared at right angles to the main skid trails. Each branch trail was the centerline of a cutting strip about 65 feet (20 m) wide. Cutting began at the end of the strip away from the main skid trail. All trees possible were felled away from the main skid trail at an acute angle to the branch trail. This formed a herringbone pattern, with the branch trail as the backbone and the felled trees as backswept ribs. Trees were bucked where they fell. The logs then were pulled to the branch trail with minimum lateral movement. Tractors stayed on the trails and winched the logs to them. As a result, after the dense overstory of aspen and pine had been removed, the understory of sapling fir and spruce remained essentially undamaged and fully stocked.

Other Harvesting Techniques

Many aspen stands in the West should be well suited to mechanical harvesting using feller-bunchers with accumulating shear heads to prebunch logs for later

¹Personal observation by John R. Jones, formerly Principal Plant Ecologist with the Rocky Mountain Forest and Range Experiment Station's Research Work Unit at Flagstaff, Ariz.

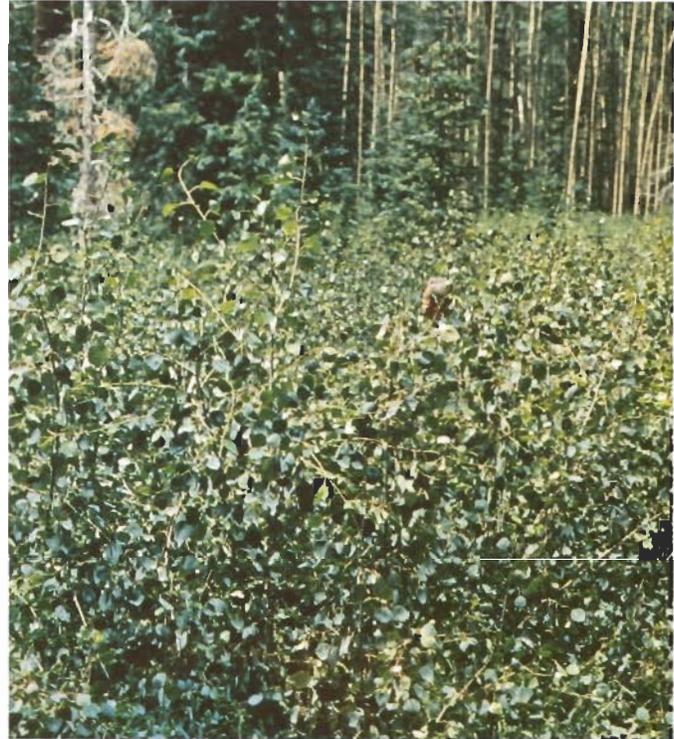


Figure 6.—Three years after harvest, the conifers in figure 5 are again overtopped by aspen.

pickup by grapple skidders, or forwarders. Such equipment works well on moderate terrain and efficiently handles stem sizes commonly found in aspen stands in the West. Because most live branches are near the tops of aspen stems, delimiting attachments would not be needed.

Smaller diameter stands might be harvested effectively using small, radio controlled skidding winches similar to those developed in Europe. These devices allow one person to skid, buck, and deck several cords of wood per day. Damage to the residual stand and understory vegetation can be minimized by using skidding cones and snatch-blocks (attached to residual trees with nylon straps) to direct the movement of logs.

Small skyline logging systems (currently under development) also could be used to log aspen stands. They perform very well on steep ground, but they would not be appropriate in a thinning operation or where residual conifers are to be saved.

Walking harvesters also allow logging of aspen stands on terrain too steep for other equipment. These devices pull themselves across steep slopes on hydraulic legs and are equipped with accumulating shear heads to prebunch stems for later removal by crawler-skidders or cable systems.

Lynch (1983) described these devices in a publication on timber harvesting in the central Rocky Mountains. The increased demand for small and efficient equipment may provide new machines and techniques to harvest not only aspen, but the many acres of other small-diameter species, such as lodgepole pine, that grow in the West.