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INTERMEDIATE TREATMENTS

John R. Jones and Wayne D. Shepperd

Intermediate treatments are those applied after a new stand is successfully established and before the final harvest. These include not only intermediate cuttings—primarily thinning—but also fertilization, irrigation, and protection of the stand from damaging agents.

THINNING

By definition, thinning is felling trees in an immature stand primarily to accelerate growth of the remaining trees (Ford-Robertson 1971). The term "thinning" should not be applied to salvage, sanitation, or shelterwood cuttings. Thinning an aspen stand may have any of several objectives (Perala 1978b): (1) to increase yield of large-diameter products, (2) to increase total fiber yield by cutting the trees expected to die because of competition, (3) to bring early financial return from commercial thinnings, (4) to reduce logging costs during the regeneration cut, (5) to improve conditions for regenerating aspen suckers by reducing competition, (6) to favor desirable clones in stands of small adjacent or intermixed clones, (7) to improve access and forage for livestock and wildlife, or possibly (8) to increase visibility for esthetic reasons.

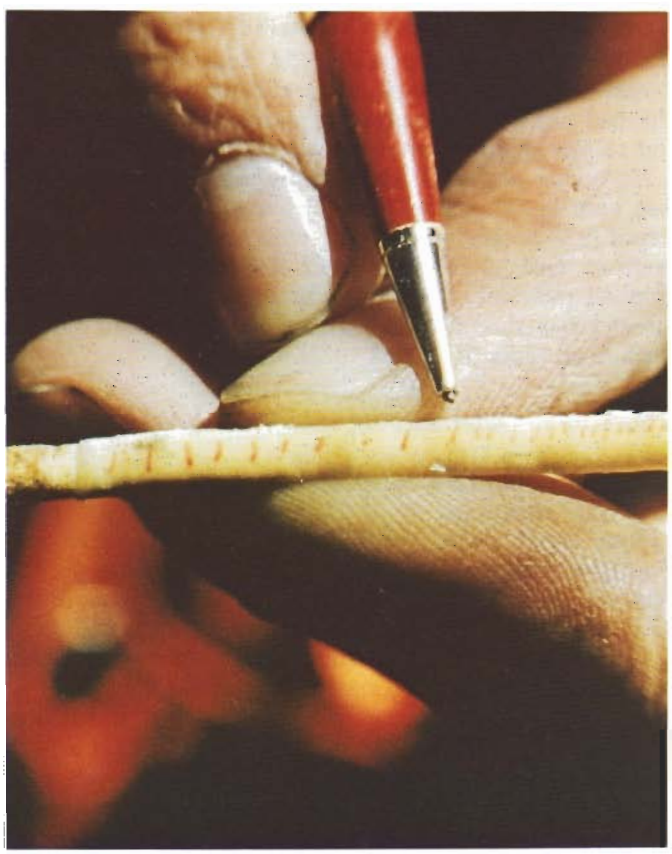

Figure 1.—The annual growth rate of this young aspen stem increased dramatically after thinning.

Small tree diameter has hampered logging, marketing, and utilization of aspen (see the WOOD UTILIZATION chapter). Accelerated decay in stands beyond about age 100 limits the time an aspen stand can be left unharvested to obtain additional growth. Even on good sites, many trees are too slender to log or to mill efficiently for lumber at 100 years of age (Groff 1976, Hittenrauch 1976, Wengert 1976). Recent development of waferboard technology to utilize aspen is changing this.

Most of the available information about thinning aspen comes from the Lake States and Canada, where growing conditions and rotation ages are different than those in the Rocky Mountain West. The degree of applicability of this information to aspen in the West is unknown. Because aspen is self-thinning, decisions about thinning it usually are based on economics, not on any silvicultural necessity.

Kinds of Thinning

Thinnings are classified as commercial or precommercial. In commercial thinning, some or all of the trees cut can be sold to help pay thinning costs. In the West, opportunities for commercial thinning of aspen have been very infrequent.

Thinnings also are classified by the criteria used to determine what trees to cut and what to leave. (1) In thinning from above, mostly the larger trees are cut, and the smaller ones are left. This process, for example, may be applied in early commercial thinnings. (2) Thinning from below removes the smaller trees, leaving the larger trees with greatest vigor and best and earliest potential for high value products. (3) Crop-tree thinning is a refinement of thinning from below, in which the most promising trees are selected for careful tending throughout the life of the stand. Thinning removes only those trees that compete with the best ones. In dense stands with many good trees, there may be little difference between crop-tree thinning and thinning from below. (4) In mechanical thinning, a predetermined spacing is the primary criterion. Most young sucker stands are so dense that mechanical thinning permits leaving the best of several stems at most spacing points. In this case, mechanical thinning becomes essentially a thinning from below.

Growth Effects

Thinning affects diameter growth but not height growth. Height growth, instead, largely depends on site quality. In aspen stands in the West, it appears that thinning will release the diameter growth of aspen of most ages and sizes (fig. 1). Generally, thinning increases diameter growth more on trees that previously had not grown well; but the trees that had grown fastest also respond to thinning, and they maintain their dominant position in the stand (Baker 1925, Bella 1975, Bickerstaff 1946, Sorensen 1968, Steneker 1964, Steneker and Jarvis 1966).

Thinning Very Young Stands

Thinning a new sucker stand does not appear to increase diameter growth. For 3 years after a dense 1-year-old sucker stand in Minnesota was thinned, it was necessary to cut the dense resprouting to retain the thinning (Strothmann and Heinselman 1957). After 15 years, average diameters of the best 400 trees per acre (988 trees per ha) were only slightly larger than those on unthinned plots; and the best 200 trees had virtually the same diameters on thinned and unthinned plots (Sorensen 1968). Schlaegel (1972) reported that, after 20 years, the unthinned plots had the best quality trees. Trees on the most heavily thinned plots were extremely limby and had poor bole form. He concluded that 1-year-old stands were too young to thin.

However, others have had positive results where young stands have been thinned (fig. 2). In central Canada, 2 years after very dense sucker stands 3, 5, and 6 years old were thinned (Bella 1975), there was heavy resprouting; but the new sprouts were overtopped and seemed destined to decline and die. Diameter growth of the best 400 trees per acre (988 trees per ha) in the 5- and 6-year-old stands was substantially better on thinned plots. In northern Minnesota, plots in a 7-year-old sucker stand on an excellent site were thinned from 3,750 stems per acre (9,266 stems per ha) to 695 stems per acre (1,717 stems per ha) (equivalent of an 8- × 8-foot (2.5- × 2.5-m) spacing), when the dominant trees were at least 20 feet (6 m) tall. Twelve years later, the thinned plots had about nine times as much volume in stems larger than 5 inches (13 cm) diameter than did the unthinned plots (Hubbard 1972).

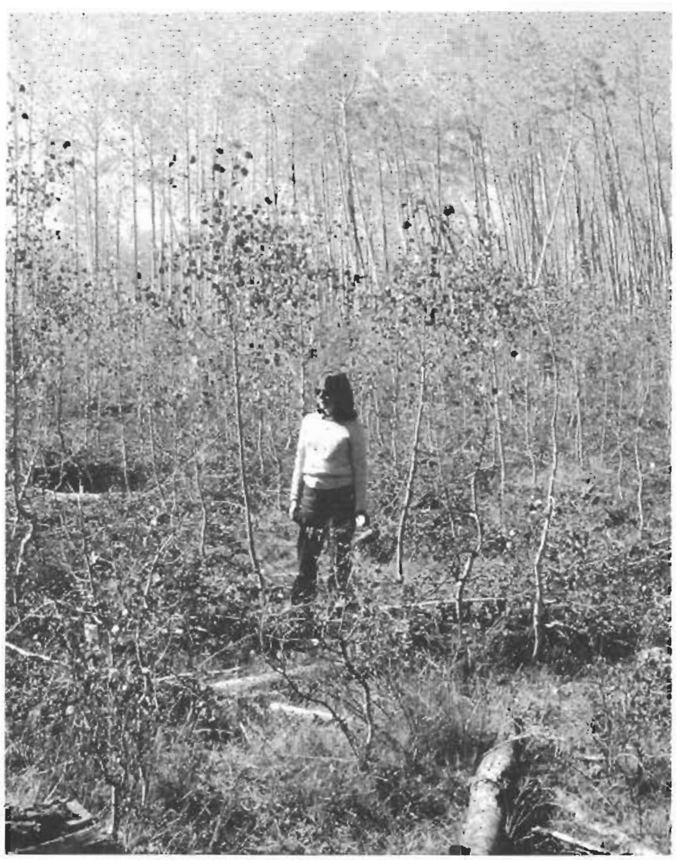

Figure 2.—A thinned 8-year-old sprout stand on the San Juan National Forest, in Colorado.

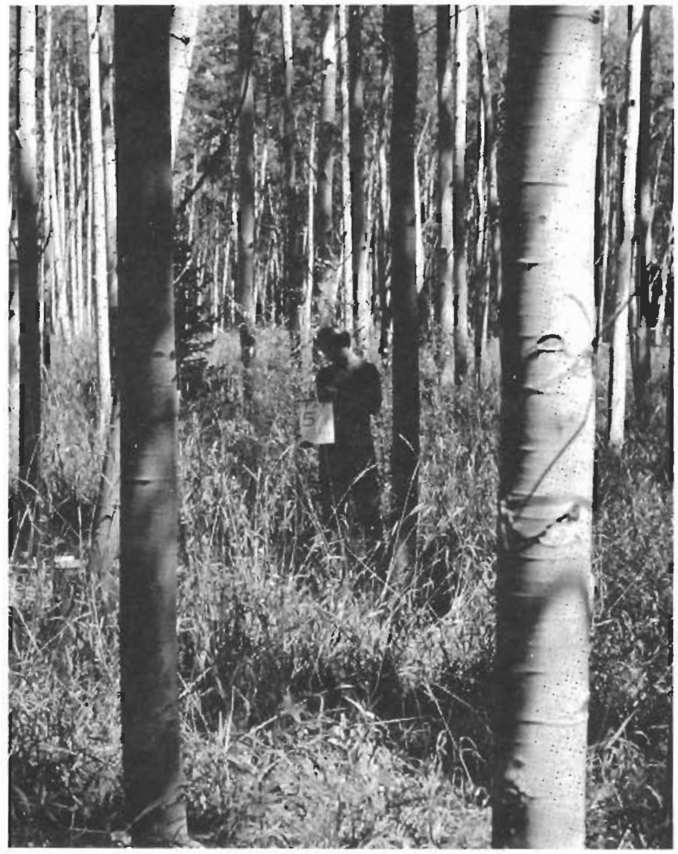

Figure 3.—Thinning pole-sized aspen stands has produced varied growth results in other areas and may not be justified in longer lived aspen stands in the West (see the ROTATIONS chapter).

Thinning in Older Sapling Stands

Zasada (1952) concluded that the sawtimber rotation had been shortened 10 or 15 years by thinning a Minnesota stand on a good site, at age 20, when the dominants were about 37 feet (11 m) tall. At age 40, the plot with a 15-foot (4.6-m) spacing had 2.5 times as much sawtimber volume as the unthinned plot.

In Manitoba, 14-, 19-, and 23-year-old stands were mechanically thinned to spacings of about 8 × 8, 10 × 10, and 12 × 12 feet (2.5 × 2.5, 3.1 × 3.1, and 3.7 × 3.7 m). Ten years later, most of the thinned plots had substantially more trees in large diameter classes, and it appeared that they would produce a veneer-log harvest about 10 years earlier than the unthinned plots; but no strong recommendations could be made about best spacings (Steneker 1964).

In a detailed analysis of thinning studies in central Canada, Steneker and Jarvis (1966) suggested thinning to 60 square feet basal area per acre (13.8 m^2 per ha) in sapling stands. However, Perala[1] suggested that the basal area for best growth may change with age.

Thinning in Pole Stands

The results of thinning from below in pole-sized aspen stands are mixed and inconclusive (fig. 3). Thinning an aspen stand in Ontario at age 40 resulted in a marked release. Ten years later, at age 50, even the largest trees on the unthinned plots had not kept pace with those on the thinned plots (Bickerstaff 1946). In contrast, in Minnesota, a 37-year-old stand on a good site was thinned from 113 to 58 square feet basal area per acre (26 m^2 to 13.3 m^2 per ha). Ten years later, the 150 largest trees per acre were the same size on the thinned and unthinned plots (Schlaegel and Ringold 1971). When harvested at age 52, however, the thinned plots yielded somewhat more veneer logs than the unthinned plots.[1] Thinning in two other Minnesota stands at ages 31 and 34, on good sites, also resulted in somewhat greater veneer volume 15 years later (Hubbard 1972). Five years after 40- to 70-year-old aspen stands in Utah were thinned, the larger trees showed little or no improvement in diameter growth; but growth had been stimulated in smaller trees (Baker 1925).

On excellent sites in the West (80 feet (25 m) or taller at age 80), some trees may reach merchantable size several years before rotation age, allowing a commercial thinning from above (Curtis 1948). In such an operation in Minnesota, the thinned plots produced no more volume of total products—thinning and final harvest combined—than the unthinned plots (Heinselman 1954). The trees left in the thinning from above did not grow as well as dominants on the unthinned plots, and the best trees, with the greatest potential for high value products, had been harvested for low value products during thinning.

Again, the applicability of these results to aspen in the West is unknown. Martin (1965) described a 70-year-old stand in Arizona that had been thinned from above at age 50. The stand remained healthy; growth on the residual trees had improved, and some were approaching sawtimber size. Shepperd[2] observed several aspen stands in Colorado in which residual stems showed release after a partial cut or commercial clearcut. However, many of these stems were damaged during logging, and were no longer desirable growing stock. Research in progress may help resolve uncertainties about thinning pole-sized aspen in the West.[2]

[1]*Personal communication with Donald A. Perala, North Central Forest Experiment Station, USDA Forest Service, Grand Rapids, Minn.*

[2]*Data and/or detailed information on file at the Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.*

Other Thinning Effects

Thinning may affect wood quality, incidence of disease and insect attacks, esthetics, use of the stand by livestock and wildlife, regeneration costs, and, in some cases, genetic character.

Wood Quality

Heavy thinning in a 1-year-old sucker stand resulted in excessive limbiness and poor bole form (Schlaegel 1972). Heavy thinnings in a 20-year-old stand and a 13-year-old stand also were followed by poor pruning and reduced log quality (Brinkman and Roe 1975, Zehngraff 1949). Thinning that results in greater persistence of live branches in aspen, will cause larger knots and more product degrade attributable to discoloration, because stain spreads through the wood from the bases of these live branches (Hook and Sucoff 1966). Specific gravity and strength of wood laid down after thinning is likely to be slightly lower; but this usually will not appreciably reduce the value of aspen for lumber or veneer (Kennedy 1968, Paul 1963) (see the WOOD UTILIZATION chapter).

Diseases and Insects

Ewan (1960) suggested that opening a stand by thinnings or partial cuttings may increase attacks by the poplar borer. Such attacks directly affect the tree's health, cause product degrade because of the discoloration that spreads from attack sites and galleries (Graham et al. 1963, Hook and Sucoff 1966), and could introduce disease (Graham and Harrison 1954) (see the INSECTS AND OTHER INVERTEBRATES, and DISEASES chapters). However, careful thinning to not too large a spacing ordinarily does not increase borer attacks much, especially in sapling stands whose canopies tend to close again quickly.

Sunscald can damage pole stands opened too strongly by thinning or other events (Bickerstaff 1946, Hinds 1976, Hubbard 1972). It has not been reported after even heavy thinning in saplings.

Thinning may increase fungal diseases in aspen (Jones 1976) (fig. 4). In the Lake States and Canada, a larger percentage of trees were infected and killed by hypoxylon canker on thinned than on unthinned plots (Anderson 1964, Bickerstaff 1946), even where all visibly infected trees had been removed during thinning (Anderson and Anderson 1968). Preliminary data from a pole stand thinning study in Colorado showed an increase in cankers and subsequent mortality on the treatment with the most trees removed.[2]

In stands with abundant bark wounds (usually caused by logging, sunscald, or vandalism), sooty-bark canker is a major element in a complex of factors that often causes heavy mortality. However, sooty-bark outbreaks have not been found in thinned stands of saplings.

Careful thinning of saplings causes few bark wounds, and this size of stem may not be susceptible to sooty-bark infection. The risk of sooty-bark infection after thinning or partial cutting in pole-sized stands is greater. Bark wounding of the residual trees is much more likely, especially if the thinned stems are removed from the stand.

Esthetics

The esthetics of a thinned stand involves more than the appearance of the stand itself (see the ESTHETICS AND LANDSCAPING chapter). A person can see farther into, or through, a thinned stand (figs. 5 and 6). Where forest lies between the road and a lake or other vista, thinning may be desirable to provide a better view (Esping 1963). For maximum wood production, thinning probably would be done to a semiregular spacing—a uniform spacing that is limited by the occurrence of satisfactory trees. This would make most efficient use of growing space. But, if visual diversity is desirable, then thinning in a deliberately irregular pattern may be preferable along roads, streams, and other esthetically strategic foreground views. More closely spaced groups may be left and small gaps may be created (see the MANAGEMENT FOR ESTHETICS AND RECREATION, FORAGE, WATER, AND WILDLIFE chapter). Such thinning patterns also can take advantage of the irregular or clumped stem distribution found in some clones.

Figure 4.—This stem was damaged during a commercial thinning from above. Although diameter growth increased, the stem subsequently became infected with decay.

Figure 5.—An unthinned, 65-year-old stand.

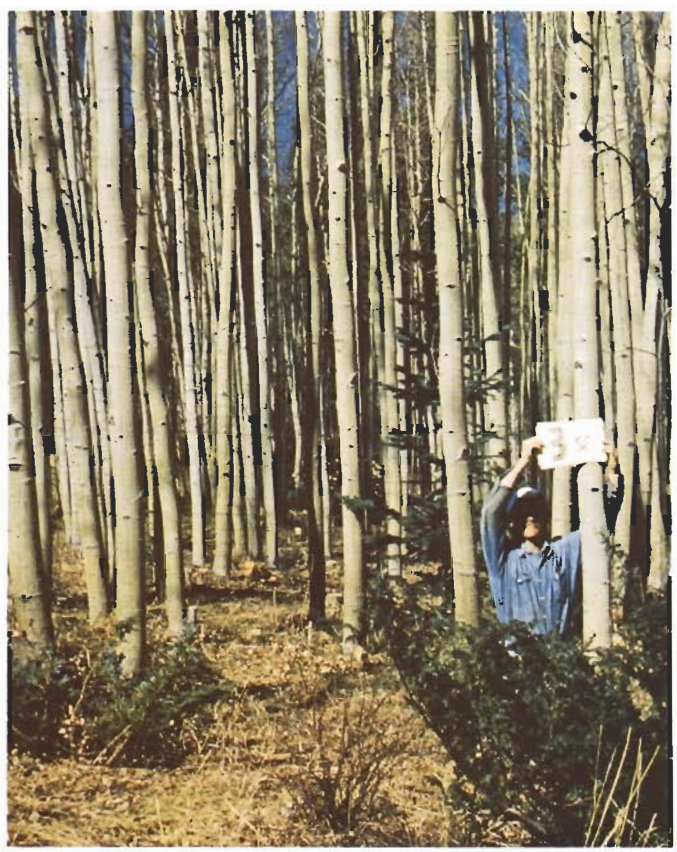

Figure 6.—The same stand after a thinning which removed all dead stems and 25% of the live basal area.

Use by Livestock and Wildlife

Very dense stands of aspen through the sapling stage are used lightly by cattle. Access would be improved by thinning, thereby permitting increased use of understory forage.

The effect of thinning on the quantity or quality of forage is not clear. Harper,[3] and Severson and Kranz (1976) found herbaceous understories were similar beneath open stands of aspen and beneath dense stands. But, these were all unthinned stands on assorted sites, rather than thinned and unthinned plots on the same or similar sites. At least on one Utah site, partial cutting (removal of 50% of the larger trees) increased understory production 36% for 3 years (Smith et al. 1972). The grass-forb ratio is commonly lower in dense young stands than in open stands. If the grass-forb ratio is increased by thinning, and if thinning increases production, then thinning makes the forage more attractive to cattle, and more abundant as well as more available to all ungulates. Also, thinning may cause a brief surge of suckering (Bella 1975), which can provide temporary browse for both livestock and wildlife (see the FORAGE chapter).

Thinning may have adverse impacts on the use of an area by animals. Poles or large saplings that are felled and left create obstacles that inhibit use of the stand by large animals. In Arizona, Reynolds (1969) found thinned stands that were used less than unthinned stands by elk, deer, and livestock. This makes early thinning more attractive for wildlife habitat, because the felled material is small, decays rapidly, and would be a lesser and more temporary hindrance.

Dense aspen stands through the smaller sapling size class provide good habitat for ruffed grouse, snowshoe hares, and several other species of wildlife (see the WILDLIFE chapter). They also provide abundant browse for wild ungulates. Thinning markedly reduces the value of young aspen stands as habitat and as a food source for these species. Thinning sapling aspen stands gives them a structure somewhat similar to a typical pole-sized or mature aspen stand. For wildlife, the value of the dense young stand is lost (fig. 7). In the West, the prevalent naturally thinned stands of pole-sized aspen currently provide adequate wildlife habitat with that structure.

Regeneration Costs

Unthinned stands carried to a sawtimber rotation have many stems too small to use as sawlogs (fig. 8). If these smaller stems are unmerchantable, then cutting or killing them during clearcutting adds to harvesting costs. If they are felled during harvesting, they also contribute to logging slash, and thereby limit animal access and movement, add to fuels, and possibly retard sucker regeneration by excessive shading. Yet, they must be cut or killed to promote a top-quality stand of new suckers. Thinning such stands from below while they are in the sapling stage would remove most of these subdominant trees (Zasada 1952). But, the question remains, would thinning many small saplings at age 15 be less costly than treating the unmerchantable small trees that remain at the harvest cut at age 90? Also, bole sizes that currently are not merchantable may be in demand when the stand is clearcut 75 years later, as technology and the economic situation changes. Therefore, thinning to reduce regeneration costs many years later is a very uncertain practice.

[3]*Harper, K. T. 1973. The influence of tree overstory on understory production and composition in aspen forests of central Utah. Society of Range Management [Boise, Idaho, February 1973]. Abstract of paper 26:22.*

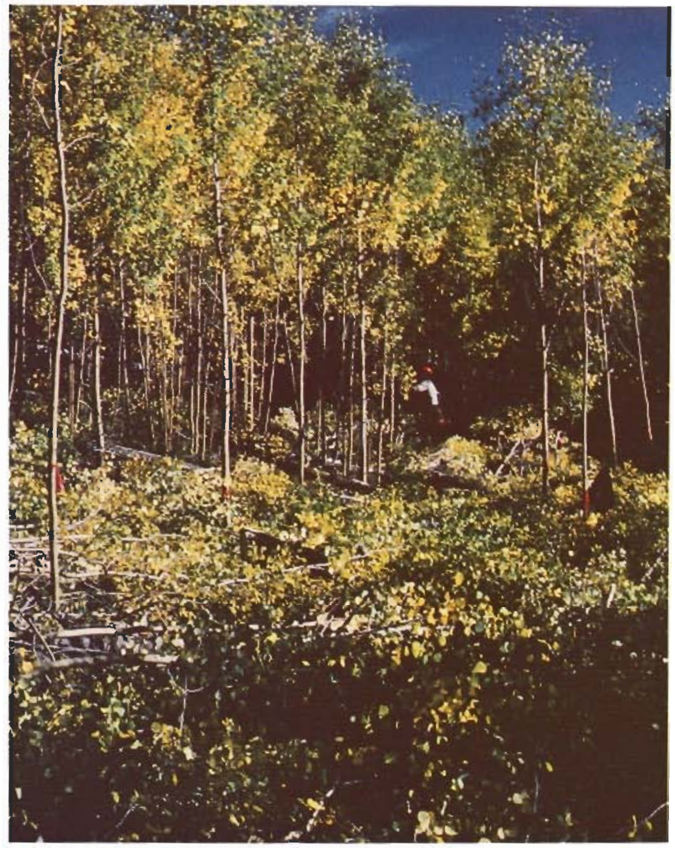

Figure 7.—Hiding cover is lost when young aspen stands are thinned.

Genetic Effects

In the Great Lakes region and central Canada, clones usually are small and often intermingled (Barnes 1966, Kemperman and Barnes 1976, Steneker 1973). Thinning can be used to improve the genetic makeup of such stands by discriminating against inferior clones (Perala 1977, 1978b; Steneker 1974; Wall 1971). Aspen stands in the West commonly consist of large, discrete clones. Genetic improvement of such stands by thinning is possible only along the clonal boundaries; good clones may be expanded and poor ones reduced in area. To do this, poor clones should be removed while keeping a sufficient overstory from good clones and other trees to suppress and ultimately kill regeneration from poor clones.

Other Effects

In sapling or pole-sized mixed stands of aspen and conifers, thinning the aspen from above will increase conifer growth rates, especially conifer understories (Jarvis et al. 1966) (fig. 9).

Thinning a dense aspen stand by basal spraying or injection of individual trees with herbicides may have unwanted results. Many herbicides can be translocated through the interconnected root system to untreated leave trees, killing much more of the stand than desired (Brinkman and Roe 1975, Hubbard 1972).

Thinning Recommendations

Felling residual trees and thinning new stands may contribute to better growth and stand structure. Ordinarily, only stands on sawtimber sites should be thinned. However, precommercial thinning may be uneconomical, especially if there is a potential market later, at the time of harvesting, for the smaller boles that cannot be used for sawlogs. Clones that are distinctly poor should not be thinned, except to discourage them where they contact better clones.

If a stand will be thinned only once, it seems best to wait until the dominants are about 25 feet (8 m) tall and 2 to 3 inches (5-8 cm) in diameter. On good sites in the West, this is at about age 15. Thin to a spacing of roughly 8 × 8 feet (2.5 × 2.5 m), which leaves about 700 trees per acre (1,730 trees per ha) and usually removes between 3,000 and 15,000 per acre (7,400 to 37,000 per ha). Retain only dominants and very good codominants. With spacing closer than 8 × 8 feet (2.5 × 2.5 m), the trees become crowded again in a few years. Wider spacings, or even 8- × 8-foot (2.5- × 2.5-m) spacing among somewhat smaller trees, may lead to bushy crowns that tend to persist and cause poor quality trees.

Figure 8.—Some mature aspen stands contain many unmerchantable stems.

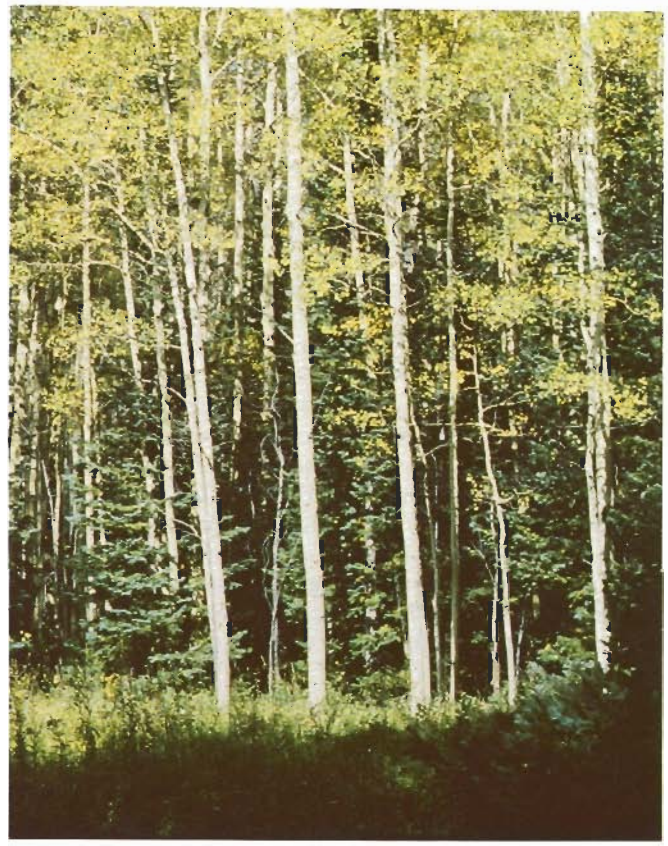

Figure 9.—Thinning or removing the aspen overstory in this mixed stand would improve conifer growth and allow quick conversion to conifer management.

To thin a stand twice may be more expensive than thinning once; but it may produce better results.[4] The first thinning could be made when dominant trees are about 15 feet (4.6 m) tall (age 5 to 10), to a spacing of roughly 5 × 5 feet (1.5 × 1.5 m), or a density of approximately 1,500 trees per acre (3,700 trees per ha). In a typical aspen stand in the West, this will require cutting 5,000 to 20,000 stems per acre (12,000 to 50,000 stems per ha); but, at this age, most of them will be 1 inch (2.5 cm) or less in diameter—easy and inexpensive to cut. When the dominant and codominant trees that were left have reached about 35 feet (11 m) tall, they will be somewhat crowded again. Many will be about 4 inches (10 cm) d.b.h. Then, the stand should be thinned to an irregular spacing of about 15 × 15 feet (4.6 × 4.6 m), with deviations to keep only the best 200 trees per acre (494 trees per ha). Thinning at this stage of stand development requires cutting about 1,200 trees per acre (3,000 trees per ha). Trees of the sizes considered are easy to control in felling; with proper care during cutting, the remaining trees will not be damaged.

[4]*Personal observations and conclusions by John R. Jones.*

Among trees 35 feet (11 m) tall, spacing wider than 15 × 15 feet (4.6 × 4.6 m) is undesirable. In Minnesota, thinning aspen to a 20-foot (6-m) spacing, when dominants stood between 35 and 40 feet (11-12 m) tall, resulted in large persistent limbs and impaired quality at final harvest 20 years later. A 15-foot (4.6-m) spacing did not (Zehngraff 1949). A 15- × 15-foot (4.6- × 4.6-m) spacing at this stage will temporarily underutilize the site, but delays later crowding.[1] A 10-foot (3-m) spacing resulted in somewhat poorer growth than a 15-foot (4.6-m) spacing, presumably because the trees became crowded again too soon.

It may be tempting for the manager, to satisfy some markets, to permit commercial thinning from above in previously unthinned stands of pole-sized aspen. Thinning such stands is particularly risky, however. Ordinarily, it will be better to supply the market by clearcutting stands of rotation age or older.

If pole-sized stands are thinned from above, retain at least 60 square feet per acre (13.8 m^2 per ha), and remove no more than 30–40% of the basal area.[1] Otherwise sunscald may result. Extreme care should be used in felling and removing trees in these stands. No logging should be done during the spring and early summer, when the bark is easily peeled from the trees. Trunk wounds then are more easily made, are often much larger, and take longer to heal. Wounding is likely to result in disease, or at least will severely reduce ultimate product value. Wounding of the ultimate crop trees, regardless of how slight, cannot be tolerated in a thinning operation.

Directional felling, and felling and skidding in two or more stages may be necessary to prevent damage to crop trees. Skidding should be done with small machines equipped with winches to reach into tight places. High stumps should be left at key turning points during skidding operations to protect residual trees, and then removed later. Full-tree skidding and tree-length skidding should not be used. Lengths skidded should be short enough to be removed without scraping or wounding the bases of remaining trees.

OTHER INTERMEDIATE TREATMENTS

Irrigation and Fertilization

Aspen will respond to both irrigation and to fertilization on sites where water or nutrients are not in optimum supply. For example, Van Cleve (1973) demonstrated large but irregular growth increases following fertilization of poor quality, 15-year-old aspen growing on an impoverished site in Alaska. Einspahr et al. (1972) found that irrigation alone, on a sandy loam in Wisconsin, increased the 3-year volume growth of a sapling stand 60% over that on untreated plots. The effect was primarily on height growth. Fertilization without watering improved volume growth 16%, mainly by increased diameter growth. On plots which were both watered and fertilized, volume growth was 140% greater than on untreated plots.

Although many of the aspen sites in the West are quite fertile, for maximum growth on high-value sites, the addition of some major nutrient, frequently nitrogen, and sometimes of trace elements such as iron or zinc, may be helpful. During times of high moisture stress, irrigation alone may markedly increase aspen growth and understory forage production.

However, it is impractical to irrigate or fertilize aspen on most sites in the West for the usual objectives of forest or range management. Irrigation and perhaps fertilization may be applied when planting aspen on new sites where it is needed to successfully establish the trees. In unique circumstances, these treatments also may be applied to small key locations to improve esthetics by speeding the growth of planted or natural aspen. If aspen management in the West progresses to the point of using selected hybrids in plantations for rapid production of high-value products, then fertilization or irrigation may become worthwhile.

Protection from Disease

There are no proven forest stand treatments that successfully prevent or control disease in aspen. Maintenance of a well-stocked stand, minimizing wounding of stems and control of damaging agents (e.g., fire, ungulates, and humans), and harvesting at the proper rotation age are the best management recommendations that can be made today. However, there have been some suggestions worth noting.

To limit heartrot by *Phellinus tremulae*, Meinecke (1929) recommended sanitation cutting and removal of culls, blowdowns, and high risk trees. However, control of heartrot is desirable only in lightly infected or uninfected stands which are to be harvested for sawtimber or veneer. In those stands, protection from wounding and proper rotation lengths should provide adequate control. Once stands are heavily infected, clearcutting is the only control.

To control sooty-bark or black canker, Baker (1925) recommended clearcutting infected stands and burning the slash. But, infected leaves are sources of inoculum (Zalasky 1965), and flying insects are both reservoirs and vectors of the disease (Hinds 1972b). It is doubtful, therefore, that Baker's suggestions would provide significant protection to nearby healthy stands.

Protection from Insects

Direct control of insects in the aspen forest usually has not been practical, because the value of aspen has not warranted expensive controls, and because the impact of most insects has not been critical. Also, the environmental side-effects from chemical pesticide spraying usually has not been acceptable in the aspen ecosystem. As with diseases, maintenance of a well-stocked stand and protection from wounding perhaps is the most practical method of coping with insects in the aspen forest. Direct insect control may be appropriate in high-value, special interest stands; where aspen is planted, especially as an ornamental; or during prolonged outbreaks of tent caterpillars.

In British Columbia, an outbreak of the aspen leaf miner was effectively controlled by spraying in the spring with Thiodan and Rogor[5] (Condrashoff 1962). Page and Lyon (1973) reviewed eight chemical insecticides effective on the western tent caterpillar. The western tent caterpillar also has been controlled by spraying with a water suspension of a nuclear polyhedrosis virus mixed with *Bacillus thuringiensis*. This has been very effective in field trials, and has the advantages of being host specific, persistent overwinter in the environment, and contagious within the host species (Clark 1955, 1958; Stelzer 1965, 1967, 1968).

Protection from Mammals

Domestic livestock, wild ungulates, rodents, and hares utilize aspen as food and can have a measurable impact on some stands (see the ANIMAL IMPACTS chapter). Most animal damage can be prevented by careful husbandry of domestic livestock and by population control of wild game species. Because most aspen ranges in the West are grazed by cattle or sheep and have a significant population of wild ungulates, grazing management and game management are important to these forests. Other animals seldom need to be controlled; even when they do, economically practical control measures often are unacceptable.

Deferral of grazing, or fencing clearcuts or burns will control livestock damage during the critical regeneration years. Control of damage by big game during this stage of stand development requires game population control.

Although sapling- and pole-sized aspen stands are susceptible to damage resulting from bark removal by elk, perhaps moose, and porcupines, and from cutting by beaver, control is seldom necessary. However, where elk are concentrated in winter, especially because of artificial feeding, extensive browsing and bark damage may become common, and can contribute to stand deterioration (Hinds and Krebill 1975, Krebill 1972) (fig. 10). Under these circumstances, control is needed to retain the aspen.

Where beavers are considered a serious problem, the only currently acceptable control is removal by trapping. Usually, however, after beavers harvest a particular aspen stand, they exhaust their food supply and are forced to move on. The aspen then sucker in abundance, and a new stand develops.

Miscellaneous Treatments

Some young stands have several older aspen scattered through them. The new stand would benefit from

Figure 10.—Repeated bark stripping by elk has heavily damaged this stand.

the removal of the older trees; but if cut, their crowns could do considerable damage in falling. It usually is best to girdle the old trees instead of felling them. However, care must be taken to remove a band of bark large enough to prevent regrafting. Stems girdled with a single chainsaw cut have been observed to recover.[6] Girdled, they ordinarily will remain standing until most of their branches have fallen. When a snag goes down, it normally does much less damage than if it had been felled alive. Old, girdled culls may temporarily serve as nesting trees for cavity-nesting birds. It may be desirable to leave culls ungirdled if they already have nesting holes.

Salvage logging in aspen stands is seldom economical or advisable. An exception would be if the entire stand has been killed by fire, and if it can be logged during the first few months afterwards. Otherwise, to enter an aspen stand to salvage some trees creates too much risk of damage to the remaining stand.

Shearing might be considered an intermediate treatment to regenerate understocked or derelict stands, although it really is a form of non-commercial clearcutting. Perala (1983) successfully used this technique in Wisconsin to bring grossly understocked stands up to potential stocking and growth. He recommended shearing during the dormant season to avoid excessive scarification and disturbance of aspen roots.

[5]The use of trade and company names is for the benefit of the reader; such use does not constitute an official endorsement or approval of any service or product by the U.S. Department of Agriculture to the exclusion of others that may be suitable.

[6]Personal observations by Wayne D. Shepperd.