Tree Planter's Notes Volume 44, No. 1 (1993)

Scarifiers for Shelterwoods

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Three scarifiers have been modified to provide natural regeneration in shelterwoods. The Salmon blade, an anchor chain, and a three-point hitch-mounted disk were made lighter, smaller, more compact, and more manuverable. They can achieve 50 to 60% scarification and can mix the top 2 inches (5 cm) of soil with duff while avoiding damage to residual root systems. The scarifiers performed well in field tests in the Great Lakes States and are available commercially. Tree Planters' Notes 44(1):13–15; 1993.

A Salmon blade, an anchor chain, and a three-point hitch-mounted disk have been modified to scarify the soil for optimum natural regeneration in shelterwoods. The equipment was designed to benefit hardwood regeneration in the Great Lakes States, but the scarifiers have potential for other site preparation work. The scarifiers are capable of achieving 50 to 60% scarification and can mix the top 2 inches (5 cm) of soil with duff while avoiding damage to residual root systems. The scarifiers are light, compact enough for use in partially cut stands, and offer good maneuverability.

The Missoula Technology and Development Center (MTDC) worked with representatives from the Chequamegon and Nicolet National Forests in Wisconsin (Eastern Region), as well as the North Central Forest Experiment Station's Grand Rapids Science Laboratory, and members of the Lake States Silvicultural Cooperative to provide adequate seedbed preparation for paper birch (table 1), which thrives in the moist, cool conditions of New England but requires help to regenerate in the drier, warmer edges of its range in the Great Lakes region. To ensure seed germination and seedling survival under these marginal conditions, downed seeds and surface litter must be mixed with the decaying organic matter and underlying mineral soil. MTDC engineers modified three scarifiers used in Northwest regeneration projects. The scarifiers were made smaller, lighter, more compact, and more maneuverable.

Table 1—*Shelterwood species used in scarifier trials in the Great Lakes area*

Common name	Scientific name
yellow birch	*Betula alleghaniensis* Britton
paper birch	*Betula papyrifera* Marsh.
eastern hemlock	*Tsuga canadensis* (L.) Carr.
northern red oak	*Quercus rubra* L.
eastern white pine	*Pinus strobus* L.
northern whitecedar	*Juniperus virginiana* L.

The modified scarifiers were evaluated during the 1991 field season. Shelterwoods of paper birch and white pine on the Chequamegon and Nicolet National Forest test sites were 5 to 40 acres (2 to 16 hectares) and had slopes of up to 20%. Preliminary data show good results for the modified scarifiers. The scarifiers should be effective tools for reestablishing yellow and paper birch, northern red oak, eastern white pine, eastern hemlock, and northern whitecedar (table 1).

Modified Salmon Blade

The modified Salmon blade (figure 1) is designed for use with a John Deere Model 450/550, 60- to 80-horsepower crawler-tractor. It holds excellent promise for shelterwood scarification on small, partially cut sites. Preliminary reports indicate good scarification and soil mixture during field tests.

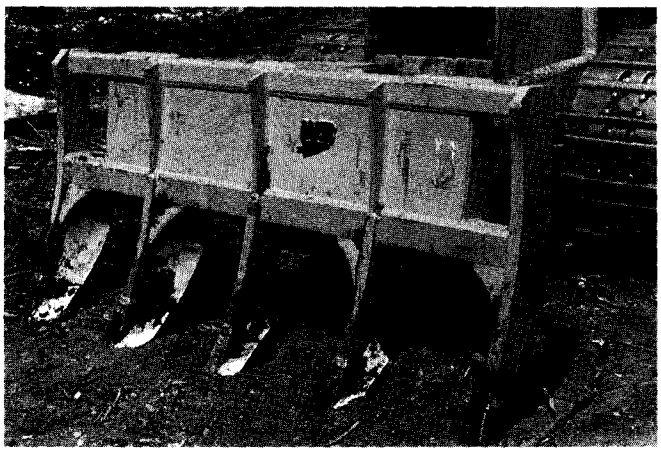

Figure 1—*Front-mounted Salmon blade for small crawler-tractors, including cultivator inserts on each prong.*

The modified blade is 30 to 40% smaller than the original machine built by the Salmon National Forest in Idaho. This smaller blade increases maneuverability in small spaces. The smaller blade is easy to mount and fits the smaller crawler-tractors used in this work. It can effectively undercut competing vegetation, which results in less grass invasion and increased regeneration. Both the original and the modified Salmon blades are capable of piling or scattering slash. The cultivator inserts provide good soil mixture. The cultivator inserts create furrows to catch seed and hold water that provides a microsite for regeneration. Penetration level can be controlled by varying the blade depth. One trip over an area can produce adequate soil disturbances for seedbeds. The modified Salmon blade is not recommended for slopes exceeding 35%.

The 6.5-foot-wide (2-m-wide) modified blade costs about $7,000. It weighs 1,400 pounds (636 kg) and is available from the manufacturer at the following address:

Weldco-Beales
2328 Roosevelt Avenue
PO Box 8
Enemclaw, WA
(206) 825-3581

Modified Drag-Chain Scarifier

The modified drag-chain scarifier (figure 2) is smaller than the original anchor-chain scarifier that was developed in British Columbia, Canada, for post-logging operations. The modified drag-chain is designed to be pulled by crawler-tractors in the 30- to 50-horsepower class. The modified drag-chain scarifier was designed to expose mineral soil in spot areas under standing trees. Preliminary tests indicate that the modified chain may distribute seed better than rakes or disks, although rakes and disks may provide better soil disturbance.

The modified drag-chain employs two lengths of lightweight drag-chain instead of the three heavy strands in the original. Two-inch-square bar stock, 24 inches (61 cm) long, welded to each length of chain, increases scarification. Swivels divide the strands to provide a rolling action. Cross bars are 2 x 2 inches (5 x 5 cm) square x 20 inches (50 cm) long. During field tests, 10 links made up a strand that scarified a 6-foot-wide (2-m-wide) swath with about 50% scarification. Links weigh approximately 25 pounds (11 kg) each. The anchor chain scarifier weighs approximately 1,200 pounds (545 kg). The scarifier incorporates a unique spread bar for use with a three-point hitch, which increases maneuverability. Hoist lines suspended from a pair of rigid arms raise and lower the unit.

Crews elected to use a skidder to pull the chain instead of a crawler-tractor during tests. The results were satisfactory. The chain is self-cleaning and rolls over slash downfall better than other implements. Roots of competing grasses are pulled out by the chain. The modified drag-chain scarifier is not recommended for slopes exceeding 30%.

The small drag-chain scarifier costs about $4,000. For additional information on the system, contact:

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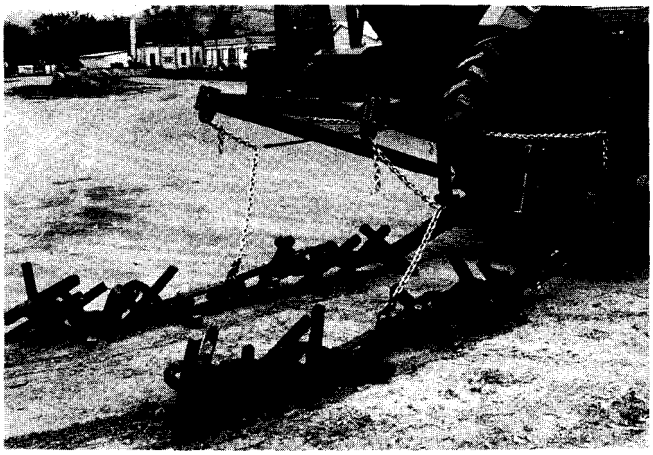

Figure 2—*Modified anchor chain scarifier shown with three-point hitch drawbar and lift attachment.*

Three-Point Hitch-Mounted Disk

Traditionally, standard trailer-mounted towed disks have been used to prepare soil in paper birch stands, but they were prone to overturn on moderate slopes. To ensure stability on slopes up to 35%, a commercially-available three-point hitchmounted disk was attached to a 30- to 50-horsepower crawler-tractor to scarify steep slopes (figure 3). The three-point mount can be used with a variety of commercially available light to heavyduty disks. With the capacity to lift the disk out of the ground in wet spots and other problem areas,

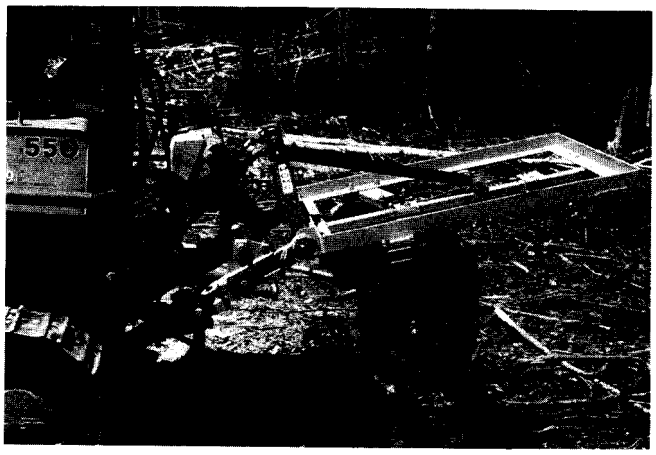

Figure 3—*Three-point hitch and three-point hitch-mounted disk.*

the three-point hitch affords greater tractor maneuverability than the trailer-towed version. Additionally, the hitch-mounted disk can be used with good results in conjunction with a front-mounted Salmon blade.

The disk provides good soil mixing. However, in tests, the three-point hitch-mounted disk, which was a 24-inch (61 cm) lightweight agricultural disk weighing about 700 pounds (318 kg), was not heavy enough to achieve desired soil coverage. A heavy-duty disk weighing 1,500 to 2,000 pounds (680 to 910 kg), with 26-inch (66-cm) disks should be adequate for forest site preparation. The three-point hitch-mounted disk appears to be less effective than the Salmon blade at reducing the invasion of competitive grasses. Use of a three-point hitch attachment on crawlers used for fire plows requires installation and removal of the attachments to vary operations. The three-point hitch-mounted disk can be used successfully when the crawler-tractor is dedicated exclusively to site preparation.

The three-point hitch-mount is available commercially for about $5,000. Standard towed disks range in price between $1,500 and $6,000, depending on the type of application intended. Approximate weight of the mounted disk is 750 to 3,000 pounds (340 to 1,360 kg). For additional information, contact:

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