



Small-Area Forestry Equipment: Island Park Demonstration

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On July 27, 1999, the Island Park Ranger District (Targhee National Forest) and the Missoula Technology and Development Center (MTDC) hosted an equipment demonstration featuring several small machines. The demonstration focused on some of the machinery identified in MTDC's Small-Area Forestry Equipment project. MTDC was directed to identify and set priorities for forestry-related tasks needed for forested areas smaller than 10 acres, typically with small-diameter vegetation. The most common tasks identified were brush and slash reduction and thinning small-diameter trees. Small machines offer a way to reduce capital investment and the costs of moving equipment in and out. Small machines can also work in stands with tight tree spacing and often cause less ground disturbance than their larger counterparts. In other words, they're generally light on the land. The Forest Service's Washington Office Timber Regeneration Steering Committee directed MTDC to provide information on these machines for the field. Live demonstrations were thought to be an effective way to acquaint field personnel with the advantages of some of these machines and with their limitations.

The objectives of the demonstration at Island Park were to:

- Demonstrate the capability of several small machines to perform fuels reduction and to thin small-diameter stems.
- Provide an informal setting to discuss the usefulness and practicality of small machines.
- Introduce persons attending the demonstration to two contractors who currently own and operate small, mechanized equipment.
- Discuss the special niches such machines might fill and what contractors need to maintain a viable operation.

Tasks Demonstrated

Precommercial Thinning and Shredding

A Ford Model 276 Versatile tractor (articulated) with a Royer Woodsman 5-foot-wide horizontal drum shredder (Figure 1) was demonstrated. The tractor had a 100-hp diesel engine with a hydrostatic transmission. A mechanical PTO (power take-off) powered the drum shredder. This head can be mounted on a farm tractor or on a tracked or wheeled front-end loader. The head can handle material up to 12 inches in



Figure 1—Ford Model 276 Versatile tractor with 5-foot-wide Royer Woodsman drum shredder.



diameter. The head costs about \$22,500 (factory quote). **Note: all prices are estimates and do not include shipping costs, which can be substantial.**

The owner/operator of the tractor and shredder was Bob Cook from Ovando, MT. He is a contractor who uses this head to thin stands of trees, clear land, grind stumps, and dispose of slash. Because of the size and power of his tractor, he does not like to cut down and shred single stems larger than 8 inches in diameter. When shredding several stems at a time, the material should be no more than 3 to 4 inches in diameter.

Bob estimates the cost of operating his machine to be about \$56 per hour (no profit included). This machine is most efficient when used on a site with small-diameter trees, even terrain with moderate slope, and no protruding rocks. The easiest treatment would be a precommercial thinning or land clearing. With ideal conditions, a production rate of 1.5 hours per acre at a cost of \$100 per acre would be possible. Bob recommends a maximum slope of 25% for safe equipment operation. On flat ground the equipment can achieve 10-foot spacing. At 25% slope, it can achieve 15-foot spacing. It takes about 1 month for a new operator to become proficient in operating the equipment. Since Cook began using the shredder, rocks have occasionally destroyed the shredding knives. In addition, the output shaft from the gear box has been broken.

During the demonstration, the shredder was first used for precommercial thinning in a young lodgepole pine stand (tree diameters up to 4 inches). Initial

stand stocking (Figure 2) was about 900 trees per acre (7- by 7-foot spacing). The District asked for the stand to be thinned to 11-foot spacing. The site was fairly flat but very uneven with some rutting. **Video footage of this machine (and others at the demonstration) in action is available on request from MTDC.** Observers stayed at least 70 feet from the machine because of flying debris. The danger was more acute directly in front of and behind the machine. The thinning strategy was to thin strips in a criss-cross fashion with as little backing up as possible.

An advantage to this approach was that the machine mulched the stems as it passed over them, substantially reducing the fire hazard. The machine speed and the height of the final fuel bed is a function of the height setting for the drum shredder. The head can be adjusted to within 2 inches of the ground (with skid shoes on). If desired, the machine can really grind things up by backing over

them (of course, this would increase treatment costs).

An advantage to mulching is that districts that would normally require the thinning slash to be piled and burned would be spared the extra cost. Smoke management problems would not be an issue.

There was some discussion about bark beetles (*Ips*). Some of those attending thought the shredder ground the top half of the stem enough to allow it to dry before populations could increase. Others were not so sure.

Once in a while the machine did not sever the base of the stem completely. Part of the problem was the uneven nature of the ground. After operating the machine for a while, Bob estimated the cost to treat the demonstration site would be about \$110 per acre (Figure 3). He estimated the machine's production rate would be 4 to 6 acres per day.



Figure 2—Precommercial thinning and shredding with the Woodsman drum shredder.



Figure 3—Site after drum shredder treatment.

Grinding Slash Piles

The Ford tractor with Woodsman head was also used to treat slash piles at a log landing. The drum shredder ground the slash piles (Figure 4) created by a small excavator with a processing head. Some of the participants thought grinding the slash piles might

offer an attractive alternative to burning them. Bob thought that mulching the piles with his machine would be a cost-competitive alternative to burning the piles. The additional labor costs of burning and holding crews would be avoided and the chance of a fire escape would be eliminated.



Figure 4—Slash pile after shredding.

Shearing and Skidding

An ASV HD-4520 Posi-Track with a Dymax forestry tree shear (Figure 5) was demonstrated. The ASV HD-4520 comes with a 115-hp diesel engine and a hydrostatic transmission. It has an auxiliary hydraulic circuit that can supply 30 gpm at 2,750 psi. The Dymax forestry tree shear (with accumulator) has a maximum 14-inch cutting capacity and can be mounted on the loader arms of a skid-steer machine. The Dymax requires a minimum 40-hp machine with an auxiliary hydraulic circuit of 13 gpm at 2,500 to 3,000 psi. The HD-4520 has recently been replaced by the 4810 (115 hp gross, 105 hp net). A new 4810 Posi-Track costs about \$55,000. A new Dymax 14-inch forestry tree shear (with accumulator) costs about \$8,000.

The owner/operator of the shearing, skidding, and processing equipment was Marc Houg from Philipsburg, MT. Mark uses this combination of machinery to thin lodgepole stands to supply material for a post and pole mill. Mark estimates that the ASV costs about \$30 per hour to operate (no profit included) when used for this operation and can produce \$65 per hour gross, depending on markets. He prefers to cut trees with the shear head (mounted on the ASV), skid with a small rubber-tired skidder, and process the trees at the landing with a processor head (mounted on his small excavator).

The optimum site for using this machinery is in clear-cuts. Mark works primarily in stands with leave-tree spacing of 10 to 15 feet. Production when leave trees are present is approximately 50 tons a day. Mark has operated the ASV with shear head only on



Figure 5—ASV HD-4520 Posi-Track with Dymax shear.

slopes of up to 20%. He feels these slopes are safe when using the shear head. The ASV with shear head can operate in 10- to 12-foot tree spacing. It takes a new operator 2 to 3 days (about 30 hours) to become proficient in the equipment's operation.

Mark also owns a custom ImpleMax grapple with winch (Figure 6). A Model 6042Rw

(grapple with winch), had to be modified to fit on the ASV's 3-point hitch. This custom grapple has an enclosure area of more than 9 square feet. The opening is 60 inches wide and 42 inches tall. This grapple requires a three-point hitch and a hydraulic circuit of 15 to 24 gpm at a maximum of 3,000 psi. It was equipped with the optional 12,000-pound capacity winch built into the boom (a 9,000-



Figure 6—ASV HD-4520 Posi-Track with ImpleMax grapple.

pound capacity winch is standard). ImpleMax now makes a grapple with a winch that mounts on the loader arms of skid-steer machines. The sales staff at ImpleMax advises against putting the customized 6042Rw grapple on the ASV. Instead, they would like their 4836-series grapple to be used. A new 4836Lw (the model designed for skid-steer machines with a minimum of 25 hp) costs about \$5,870. This model's enclosure area is 6.94 square feet. The opening is 48 inches wide and 36 inches tall.

During the morning of the demonstration, the ASV was used to shear lodgepole pines in a stand that averaged 6 inches d.b.h. Initial stand stocking was about 540 trees per acre (9- by 9-foot spacing). The ground was basically flat. The only obstacles were the leave trees. The District instructed the operator to thin trees to a 15-foot spacing. Trees were cut, bunched, and stacked in small piles with the Dymax shear head. Piles were oriented to expedite skidding.

In the afternoon, the ImpleMax grapple was mounted on the ASV and used for whole-tree skidding (Figure 7). The trees were skidded to a landing to be processed by a small excavator with processor head. On this site, Mark estimated that 50 to 75 tons of posts and poles could be loaded onto logging trucks per day.

The ASV comes with a skid-steer standard quick-attachment plate mounted on its loader arms, which reduces the time needed to change implements. This machine was very quick, both when it was used to create log piles in the morning and when it was used for skidding in the afternoon. The ASV has a zero turning radius. It should be noted that as the driver



Figure 7—Whole-tree skidding with the ImpleMax grapple mounted on an ASV Posi-Track.

mounted on a small excavator, it can also be mounted on a skid-steer machine (the factory suggests a minimum 55-hp skid-steer machine). The Kubota and Hahn heads owned by Mark were both built in 1994. The two units cost \$90,000 when purchased used. The cost of a new HSG-140 is about \$49,805. The KH-191 is no longer manufactured. Mark estimates that this Kubota/Hahn combination costs about \$60 per hour to operate and can make up to \$150 per hour, depending on the market. Production rate for the Kubota/Hahn combination is about 30 tons per day, according to Mark. He estimates it takes 500 to 1,500 hours (average about 1,000 hours) for an operator to become proficient in its use.

concentrated on speeding up skidding production of whole trees, the damage to residual trees increased. Participants at first were concerned that the ASV might cause excessive soil disturbance. As the machine worked, it was apparent that in most cases the ASV did not displace the roots of grasses it ran over. That is one of this rubber-tracked machine's pluses (the factory claims 3-psi ground pressure for the HD-4520 with bucket attachment). Some forests measure disturbance by total ground traversed, not by machine psi. This reasoning would favor a machine with a boom-mounted implement rather than a machine such as the ASV that has to be driven to each tree.

(Figure 8). Although the machine and head are capable of felling and processing trees in the woods, Mark said it would be more efficient to shear the trees in the woods with the Dymax shear. The suggested flow rate (from the factory) for the Hahn head is about 34 gpm with a pressure not to exceed 3,300 psi. Although the Hahn head was

During the demonstration, the Hahn head showed it has the potential to process stems quickly. Unfortunately, the pressure on the feed rollers was not properly adjusted—according to Mark. MTDC's video footage shows some stems slipping during the processing operation. This problem will go away with proper feed roller adjustment.

Processing at the Log Landing

A Kubota KH-191 excavator (13,500 pounds, 59 hp) with Hahn HSG-140 single-grip harvester (14-inch roller opening, 16.5-inch maximum cut) was used to process the stems at the landing



Figure 8—Processing at the landing with the Hahn HSG-140 head mounted on a Kubota KH-191 excavator.

Discussion

The equipment demonstrated at Island Park may be useful to many districts. Operators and equipment were chosen to participate because they met most of the criteria set forth in the Small-Area Forestry Equipment project and because they were available. Many other useful machines and implements exist. Specifications for the equipment identified in the Small-Area Forestry Equipment project are included in the MTDC publication, *Small-Area Forestry Equipment* (9924-2820-MTDC). Single copies of this publication and video footage from the Island Park demonstration day are available on request from MTDC.

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