

# FAST, INEXPENSIVE FIRELINE CONSTRUCTION



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Anyone who has ever tried building fireline on rocky land knows there has been a need for an inexpensive, efficient piece of equipment to do this job. We've recently invented a simple fireline plow to build fireline in such terrain. Fireline construction with this plow makes less of an impact on the environment, and it may cost less than usual methods of building line (either by hand or by machine).

In March and April 1994, we conducted underburning on 35 acres (14 ha) in a private forest in western Montana, mainly consisting of ponderosa pine and Douglas fir. Our objectives were to reduce surface fuels, kill stagnated and rust-infected saplings, and remove dense undergrowth to allow healthy pine regeneration. We had only three workers available, we needed to burn in divisions on 3 or 4 days, and we had to provide our own equipment at low cost. The terrain is gently sloping but rocky and difficult for hand fireline construction. Our task was to construct 1.5 miles (2.4 km) of fireline through almost continuous boulders that support a dense mat of low, woody vegetation (largely kinnikinnick) and pinegrass.

We considered alternatives, then decided to construct a fireline plow

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A machine-pulled fireline plow for small operations proves to be efficient and adaptable to many situations.

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that could be pulled by a small farm tractor. From a scrap metal yard, we purchased some promising components for 10 cents a pound (454 g), then took them, along with our ideas, to a local blacksmith. After only a little experimentation and for only \$150, we had it—a plow that makes good fireline even in rocky glacial till (fig. 1).

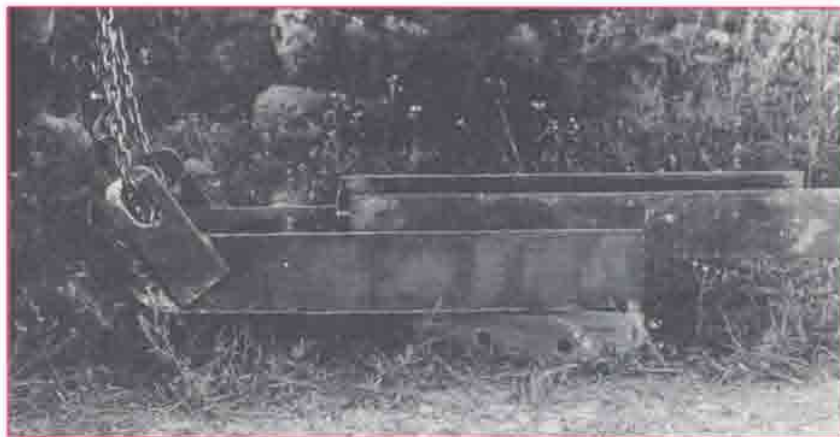
## Plow Construction

As shown in figure 2, the main support structure of the plow is a piece of 6- x 15-inch (15- x 38-cm) I beam, 36 inches (91 cm) long, weighing about 120 pounds (54 kg). The blade consists of two pieces of used road-grader blading

edge welded into a V, 20 inches (51 cm) wide, and mounted under the I beam. A steel plate that is 1/2 inch (1.3 cm) thick is welded onto the I beam in front of the V blade (fig. 3), allowing litter, duff, and soil to slide by the V and be cast aside.

We welded large loops onto the front of the I beam to allow pulling with a chain. Bolts with a 1-inch (2.5-cm) diameter are welded on top of the I beam to fasten down the portable weights—one bolt per weight. The 100-pound (45-kg) weights used are two 36-inch (91-cm) railroad rails. Several holes in the weights allow us to attach them to the bolt in various positions (forward or rear, fig. 4) for the most efficient plowing. This also allows us to transport each piece of the plow separately without strenuous lifting. Total weight of the plow is about 350 pounds (159 kg).

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**Figure 1**—Side view of the plow made from scrap metal that creates fireline quickly in rocky glacial till. Photo: Stephen Arno, Intermountain Research Station, Missoula, MT, 1994.

## Vehicles for Pulling the Plow

We have used four different vehicles for pulling this plow. One vehicle was a medium-sized, 52-horsepower (39-kw) farm tractor with a heavy rear dozer blade mounted on the three-point hitch. Setting the dozer blade down on the middle of the plow kept it from overturning and provided extra weight for cutting the fireline. Only one person was needed to operate this vehicle.

Another vehicle was a small, 24-horsepower (18-kw), three-wheeled farm tractor that served well in places where we needed great maneuverability. While being pulled at 1 mile per hour (1.6 km/hr), one person stood on the plow and held onto the back of the tractor to keep the plow from tipping over side-wise on boulders. At such a low speed, safety was not a problem.

In addition to these two vehicles, a friend borrowed the plow to use on his property and pulled it behind a four-wheel-drive pickup truck. Most recently, we have been using the plow behind a four-wheel-drive, all-terrain-vehicle (ATV) with a 350-cc engine (fig. 5). The ATV was able to pull the plow up a 25-percent slope and down steeper slopes. Generally speaking, fire-management crews will find that pulling the plow with the ATV would make it most useful for their work.

## Plow Performance

On the glacial till site, consisting of mostly 10- to 20-inch (25- to 50-cm) boulders, the plow performed well. On one pass, most surface rocks were loosened and rolled out. If necessary, we could easily roll rocks aside by hand. After a

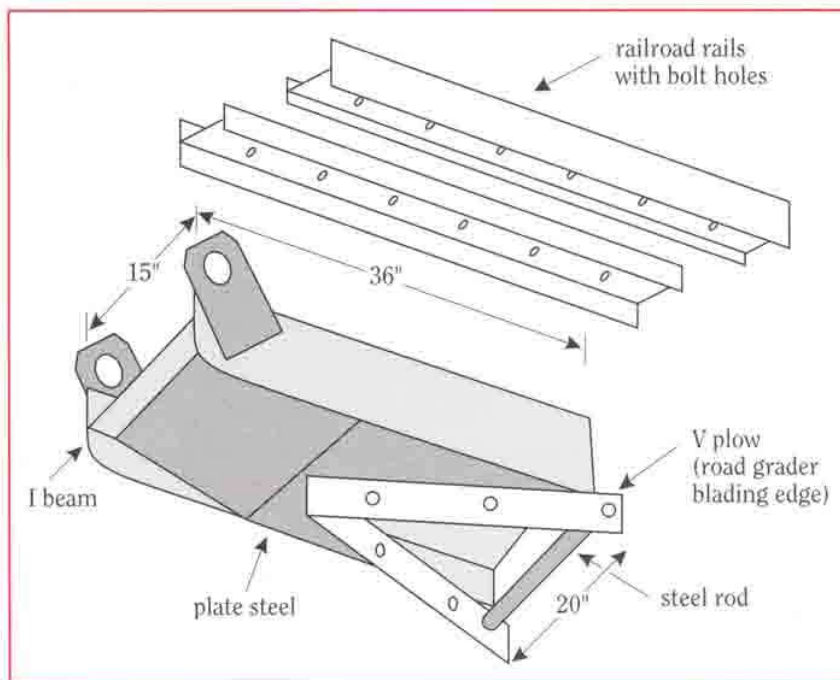


Figure 2—Sketch of the fireline plow—thickness of the metal components is not shown to scale. Illustration: Dennis Simmerman, Intermountain Research Station.

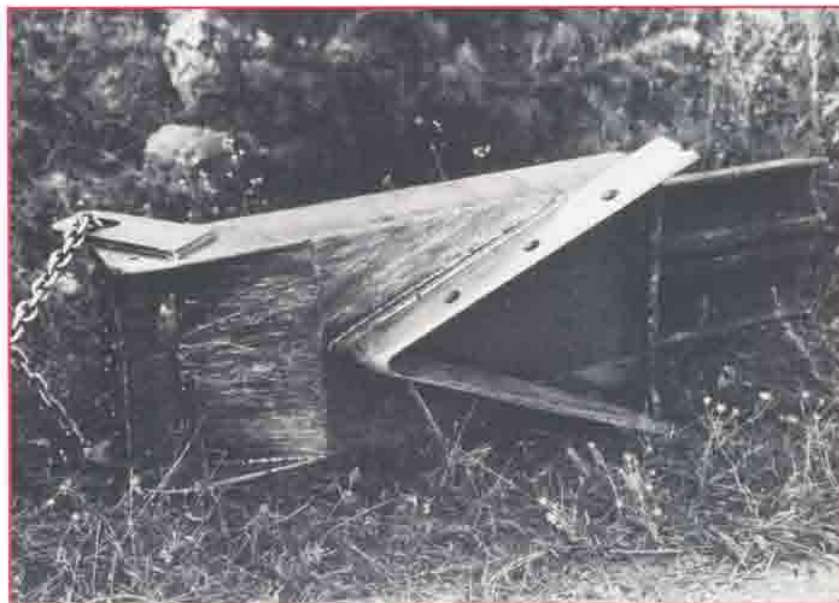


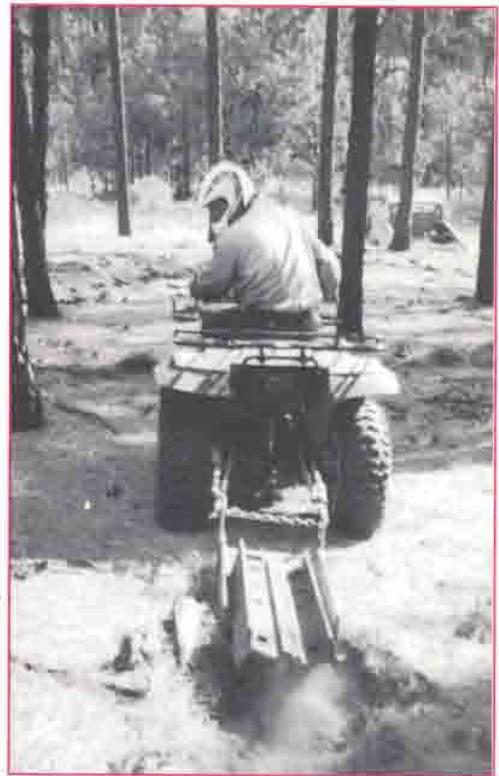
Figure 3—Bottom view of the plow showing the steel plate welded onto the I beam in front of the V blade. Photo: Stephen Arno, Intermountain Research Station, Missoula, MT, 1994.

few repetitions, the fireline was finished. In places that had soil, the plow completed a 20-inch (50-cm) wide, 2- to 4-inch (5- to 10-cm) deep fireline down to mineral soil. Low shrubs, roots, and litter did not impede performance.

As the point of the V became rounded slightly from grinding through the rocks, it was not as effective at cutting roots. However, the cutting edge can be restored inexpensively by welding a hardened steel rod onto it.



◀ **Figure 4**—Top view of the plow showing how two 36-inch (91-cm) railroad rails can be bolted for the most efficient plowing. Photo: Stephen Arno, Intermountain Research Station, Missoula, MT, 1994.



▶ **Figure 5**—Fire crews will find that pulling the fireline plow with an ATV such as this one will be most useful for their work. Photo: Nathan Arno, Missoula, MT, 1994.

We completed the 1.5 miles (2.4 km) of fireline for the 35-acre (14-ha) burn in 16 person hours and lined another 10-acre (4-ha) unit of rocky forest ground in 4 person hours. According to production rates published in the "Fireline Handbook" (NWCG 1989), a 20-person Type II crew in these conditions could produce 264 feet (80 m) of line per hour. This compares to about 495 feet (151 m) per hour using two people and the plow.

### Environmental Impacts

The environmental impacts of the plow varied with the type of pulling device. Due to dry conditions, the farm tractors neither turned up the soil nor compacted it. How-

ever, in order to drive through the forest, tractors and pickup trucks required a route cleared of vertical fuels. The ATV made virtually no impact on the environment. It is capable of maneuvering through trees and shrubs, therefore reducing the need for a fuel break. With tractors and pickup trucks, use of the plow would be limited to slopes of less than 25 percent. ATVs, on the other hand, could pull the plow down steeper slopes. However, side-slope plowing would be limited by vehicle capability.

Because this plow has met our needs quite well, we have not experimented with design changes that might improve its efficiency or adaptability to other situations.

We encourage others to try this or a modified design for their own line building and to let us know the results. Anyone who wishes to discuss the plow should contact either Nathan Arno, Wildland/Residential Fire Management, 106 Helena Ct., Missoula, MT 59801, tel. 406-542-1497; or Steve Arno, USDA Forest Service, Intermountain Fire Sciences Laboratory, P.O. Box 8089, Missoula, MT 59807, tel. 406-329-4813.

### Literature Cited

National Wildfire Coordinating Group. 1989. Fireline handbook. NWCG Handbook 3. Boise ID: National Interagency Fire Center. 146 p. ■