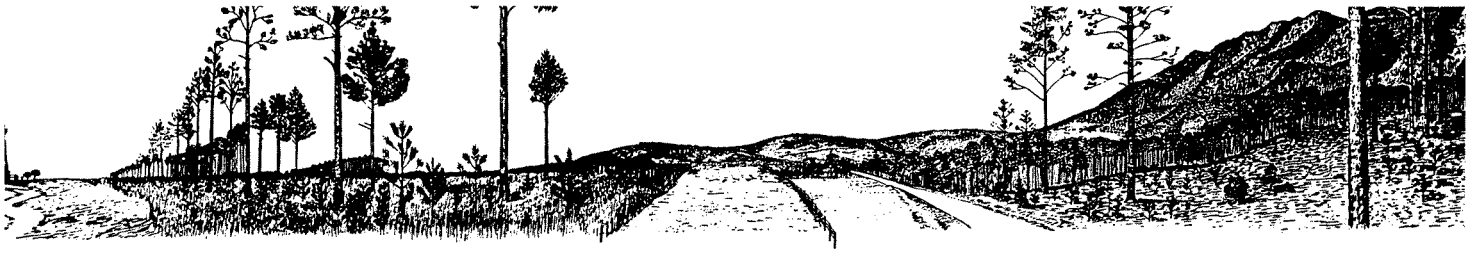

USDA Forest Service Research Note SE-169 November 1971

A CIRCULAR-IMPACT SAMPLER FOR FOREST LITTER

Abstract.--Sampling the forest floor to determine litter weight is a tedious, time-consuming job. A new device has been designed and tested at the Southern Forest Fire Laboratory that eliminates many of the past sampling problems. The sampler has been fabricated in two sizes (6- and 12-inch diameters), and these are comparable in accuracy and sampling intensity. This Note describes the characteristics, use, and construction dimensions of the new sampler.

Anyone who attempts to study the forest floor usually deals with the problem of sampling litter weight. The most commonly used tool is the 1-sq.-ft. frame with a separate device for cutting around the frame and extracting the sample. Removing fuel samples with this device is time-consuming and inaccurate because of the handwork involved and the fact that a clean cut is not made, further complicating removal of the litter sample.

A new device has been designed and tested at the Southern Forest Fire Laboratory that eliminates many of the past problems of litter sampling. The circular-impact sampler for forest litter consists of two basic parts (fig. 1): the litter-cutting assembly, which includes the serrated cutting cylinder, aligning shaft housing, and handles; and the litter-compression assembly, which includes the compression plate, aligning shaft, stop mechanism, and compression spring for returning the compression plate to its original position. Height of the sampler is 60 inches overall, and its weight is 30 pounds. If necessary, the sampler can be constructed to conform to the height of the individual using it. The cutter was turned from a 12-inch water pipe with an inside diameter of 12 inches and a thickness of 0.125 inch. Holes are drilled in the top of the cutting assembly to eliminate air compression between it and the close-fitting litter-compression plate.

The compression plate has a very close tolerance (0.030 inch) with the side walls of the cutter to ensure a clean cut and retain an accurate sample. Tolerance between the aligning shaft and housing is not close, and no lubrication is applied. The stop attached to the top of the aligning shaft should be set to allow the compression plate to stop just short (0.5 inch) of the points of the cutting cylinder. Also, it is removable for disassembly and cleaning. The return spring for the compression plate should be carefully selected--stiff enough to force the plate back to its

Southeastern Forest Experiment Station - Asheville - North Carolina
U.S. Department of Agriculture - Forest Service

Figure 1.--The circular-impact sampler for forest litter consists of two basic parts: the litter-cutting assembly (left) and the litter-compression assembly (right).

neutral position and short enough to allow for a deep sample cut. The cutting edges must be sharpened periodically to ensure a well-defined, accurate cut. An accessory unit is used in conjunction with the cutter to make the pickup more convenient and accurate. This unit, composed of a sheet-metal cylinder with handles and a sharp, serrated edge (fig. 2), is used by the pickup crew after a sample has been cut. The cylindrical template is placed in the cut and twisted to ensure that the sample is cut all the way. The litter within the template can then be collected without fear of including more than intended.

Figure 2.--Serrated sheet-metal unit used by pickup crew as a template for the sample cut.

A smaller model of the circular-impact sampler has been fabricated to reduce the weight and make it more convenient for some users. The design is exactly the same except that it is made from pipe with an inside diameter of 6 inches and a wall thickness of 0.125 inch. The entire unit weighs only 20 pounds.

The circular-impact sampler is operated from a standing position by using a downward thrusting motion. Litter within the bounds of the cutting edge is held in place by a spring-loaded compression plate as the sample is cut. The compression plate also keeps the sample from moving as the sampler is withdrawn.

Figure 3 shows a cutaway view of the sampler in its normal configuration. The dimensions of the two models are as follows:

	6-inch model	12-inch model
Handles	0.656 inch (inside diameter)	1.00 inch (outside diameter)
Shaft	0.625 inch (round stock)	1.50 inches (outside diameter)
Housing	0.656 inch (inside diameter)	1.75 inches (inside diameter)
Plate	0.250 by 5.94 inches (diameter)	0.250 by 11.94 inches (diameter)
Cylinder	6.00 inches (inside diameter) (0.125-inch wall)	12.00 inches (inside diameter) (0.125-inch wall)
Serrations		
Number	6	8
Depth	1.00 inch	1.00 inch

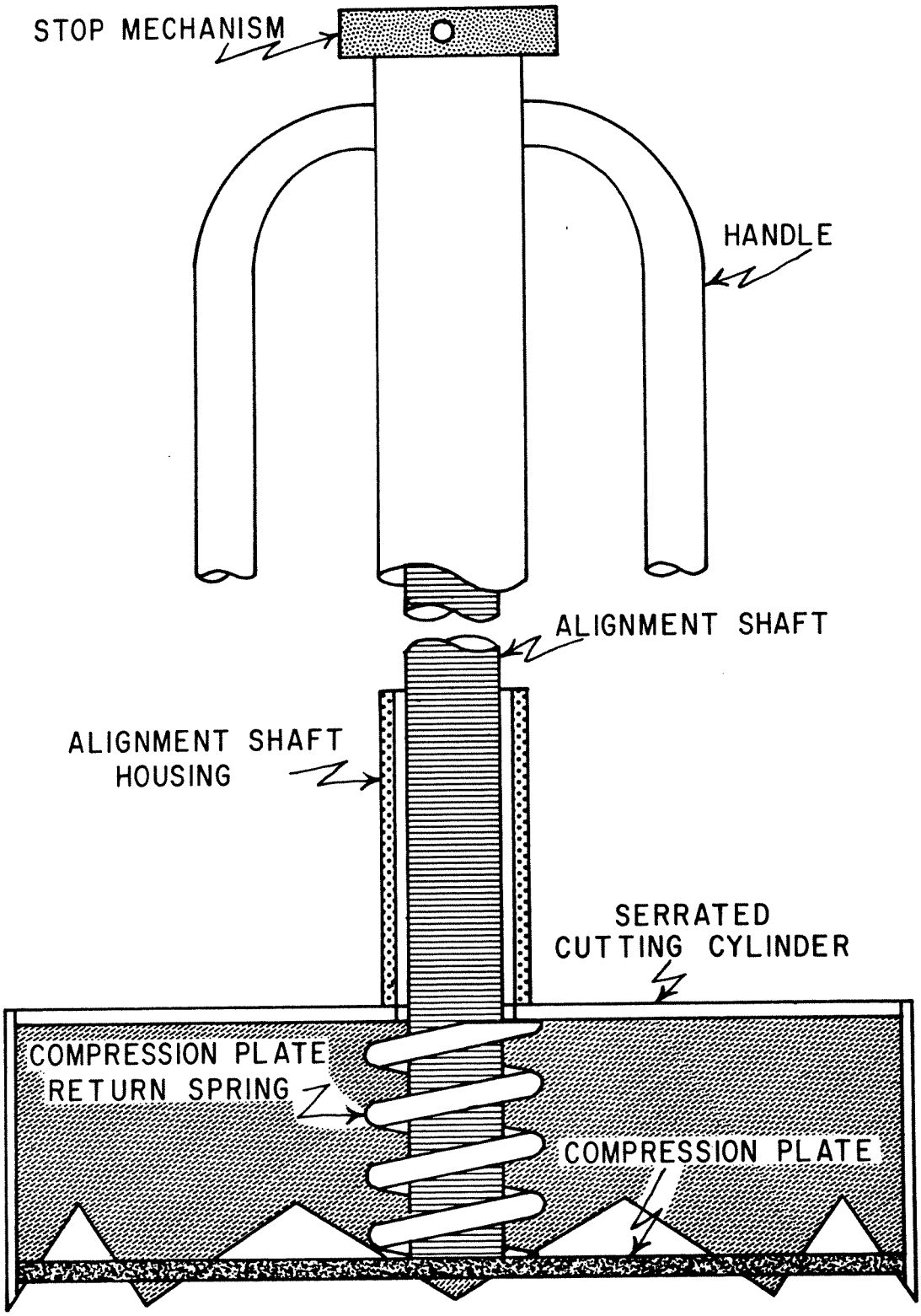

Figure 3.--Cutaway view of sampler in normal configuration.

SAMPLING PROCEDURE

Three individuals make a good sampling team. One additional crew member can aid considerably in the collecting and tallying of the bagged samples. In actual field operations, the crew member operating the sample cutter proceeds from one predesignated sampling point to the next at his own pace. Two crew members follow, using templates to help extract the sample. They bag, mark, and staple the samples to be collected and tallied by the fourth crew member, if available.

There are no mechanical problems when the sampler is used in stands with little or no undergrowth. However, when stands with heavy undergrowth are sampled, some problems are evident. Because of its weight, the cutter will penetrate both living and dead fuel near the surface of the ground. But when the cutter strikes large, solid objects--such as a palmetto tuber or large, dead branch--the cutting cylinder may not make complete contact with the litter bed. It may be necessary under these conditions to use the template or a pair of clippers to complete the cut. Sampling in rocky soil would also reduce the effectiveness of the cutter, but so far the speed and convenience of using this new tool has far outweighed the disadvantages.

COMPARISON OF 6- AND 12-INCH MODELS

Comparison of the two models indicates that the smaller can be used almost as effectively as the larger. The following is a résumé of 400 individual samples taken with each model in the Coastal Plain; all samples were collected on level ground in slash pine plantations void of standing vegetation:

Function	6-inch model	12-inch model
Cutting time	9.6 sec./sample	9.9 sec./sample
Sample collection time	26.8 sec./sample	32.1 sec./sample
Sampling intensity[1]		
10 percent ± sample mean	48 samples	36 samples
5 percent ± sample mean	192 samples	146 samples
2 percent ± sample mean	1,200 samples	910 samples

[1] Freese, Frank. Elementary statistical methods for foresters. USDA Forest Serv. Agric. Handb. 317, 87 pp. 1967. (Desired limit of error ± 10, 5, and 2 percent of the mean, with a probability of 95 percent.)

The 12-inch model does have a slight advantage even though it takes longer per sample, both to cut and pick up. If we were looking for an accuracy of ± 5 percent of the sample mean (95-percent confidence level), it would take us 116.5 minutes to take 192 6-inch samples and 102.2 minutes to take 146 12-inch samples.[2] The final decision as to which model to use will probably be determined by the weight of the model and the physical stamina of the user.

[2] To obtain these figures, 192 samples are multiplied by 9.6 seconds and 26.8 seconds, and the two products are added. In the same manner, 146 is multiplied by 9.9 seconds and 32.1 seconds, and their products are added.

Stephen S. Sackett, Associate Fire Behavior Scientist
Southern Forest Fire Laboratory
Macon, Georgia

☆ U. S. G.P.O.: 1971 – 745-560/5021, REGION NO. 4