

Humane Soil Beastie Catcher: Its fabrication and use

Llewellyn L. Manske PhD and John A. Urban
Range Scientist and Range Research Technician
North Dakota State University
Dickinson Research Extension Center
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The soil beasties in grasslands make it possible for the aboveground plants and animals to be healthy and productive.

Most soil beasties in grassland ecosystems inhabit the narrow zone of soil around active roots of perennial grass plants known as the rhizosphere. The grass plants and rhizosphere beasties interact symbiotically in a mutually beneficial relationship that is essential for effective performance of the biogeochemical processes of the carbon (C), nitrogen (N), oxygen (O), phosphorus (P), and sulfur (S) cycles and for movement of soil water (H₂O) in grassland ecosystems. The rhizosphere beasties include endomycorrhizal fungi, ectomycorrhizal fungi, bacteria, protozoa, nematodes, springtails, and mites. These soil beasties do not travel very far or move very fast, nevertheless, the increases and decreases of their activity levels are related proportionally to the rhizosphere volume and biomass. To measure the rhizosphere beastie abundance, they must be captured and extracted from grassland soils. This report describes the fabrication and use of a humane soil beastie catcher.

The humane soil beastie catcher consists of three components: the capture cylinder with extractor chain, the striker plate, and the expulsion ram plunger (figure 1).

Capture Cylinder with Extractor Chain

The capture cylinder is machined from a single piece of steel pipe, 6.0 in. long with 0.25 in. thick walls. The outside diameter of the cylinder is 3.5 in. and the inside diameter is 3.0 in. The reinforcement collar at the top of the cylinder is 2.0 in. long and the capture chamber below is 4.0 in. long. The bevel that tapers the cylinder wall thickness to 0.03 in. at the bottom is 1.63 in. long.

The extractor chain is 28.0 in. long with links 1.25 X 0.88 in. The chain runs through a pipe handle that is 8.0 in. long with a 1.25 in. diameter. The two end links of the extractor chain are welded to opposite spots on the collar below the top rim of the cylinder.

Striker Plate

The striker plate is used to distribute the force of the hammer strikes evenly around the top rim of the cylinder. The strike pad is 4.5 in. long, 5.0 in. wide, and 0.50 in. thick. The tang is welded to the pad and is 6.13 in. long, 1.0 in. wide, and 0.50 in. thick. The pipe handle is welded to the tang and is 4.0 in. long with a 1.25 in. diameter.

Expulsion Ram Plunger

The expulsion ram plunger is used to remove the soil core with captured soil beasties from the capture chamber of the cylinder. The piston has a 2.88 in. diameter and is 0.50 in. thick. The shaft is welded to the center of the piston and is 8.0 in. long with a 0.75 in. diameter. The pipe handle is welded to the top of the shaft and is 4.0 in. long with a 1.25 in. diameter.

Use of the Humane Soil Beastie Catcher

Catching the inconspicuous soil beasties requires the capture cylinder to be placed over a grass plant (figure 2), then the striker plate is set on the top rim of the capture cylinder and it is firmly struck repeatedly with a sledgehammer (figure 3). Continue with the sledgehammer strikes until the bottom of the collar makes contact with mineral soil (figure 4), at that time, the capture chamber will be in 4 inches of soil (figure 5). Pick up the extractor chain by the handle with upward pressure (figure 6) and tap the collar a few times with the sledgehammer (figure 7), this will break contact between the ecosystem soil and the soil core with the captured beasties that is inside the capture chamber of the cylinder. Place two hands on the extractor chain handle and lift with your leg muscles using correct ergonomic motion (figure 8). This upward lifting action extracts the captured soil beasties from the grassland ecosystem (figure 9). Place the capture cylinder laden with soil beasties on the plywood work surface (12 X 20 X 0.5 in.) and place the piston of the expulsion ram plunger into the top of the capture cylinder (figure 10). Push with an even force on the handle of the expulsion ram plunger

until the soil core with the captured beasties is expelled out the bottom of the capture chamber (figure 11). Place the captured beasties in the soil core into a properly labeled capture bag (figure 12). Repeat this process until you have captured the beasties in three replicated soil cores from each sample site (figure 13). These humanely captured soil beasties are now ready to be transported to a research laboratory with personnel trained and equipped to handle wild rhizosphere beasties.

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Figure 1. Three components of the humane soil beastie catcher: the capture cylinder with extractor chain, the striker plate, and the expulsion ram plunger.



Figure 2. Capture cylinder is placed over a grass plant.



Figure 3. Striker plate set on top rim of capture cylinder is firmly struck with sledgehammer.



Figure 4. Repeated sledgehammer strikes drives capture chamber into the soil to the bottom of the cylinder collar.



Figure 5. Capture chamber in 4 inches of soil.



Figure 6. Extractor chain held by handle with upward pressure.



Figure 7. Cylinder collar tapped with sledgehammer.



Figure 8. Capture cylinder is lifted by leg muscles with two hands on extractor chain handle.



Figure 9. Capture cylinder with soil beasts extracted from grassland ecosystem.



Figure 10. Expulsion ram plunger placed into top of capture cylinder laden with soil beasts.



Figure 11. Soil core with captured beasts expelled from capture chamber.



Figure 12. Captured beasties in soil core have been placed in labeled capture bag.



Figure 13. Repeat humane soil beastie capture procedures.

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