
TECHNICAL NOTES

Nail-Board Method of Root Sampling¹

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A method of exposing root systems of individual plants or plant communities has been developed and used successfully at the Manitou Experimental For-

est in Colorado. Called the nail-board method, it incorporates techniques used by Pavlychenko (1937), Weaver and Darland (1949), and especially adapts those of de Roo (1957). Soil monoliths containing root samples are excavated in a nail-studded frame. The nails retain the roots in their natural positions while the soil is washed away. The

method proved effective in sampling root systems of native ranges and should be adaptable to crop plants.

Materials

Materials needed are inexpensive and readily obtainable. Only the nail-board and cutting blade require special construction.

The nail-board (Figure 1) consisted of two 24- by 36-inch sheets of ½-inch plywood, 178 16-penny nails, and eight feet of 3½-inch angle iron made of 14-gauge steel. The angle iron was cut and welded to fit around three edges of one plywood board to form an open-faced frame with three steel sides and one open end at the top. Inside

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dimensions were 24 inches wide, 36 inches high, and three inches deep. The 16-penny nails were inserted through the back at two-inch intervals and protruded into the frame $2\frac{3}{4}$ inches. The second plywood board was bolted to the back, and held the nails and steel sides in place. A $\frac{1}{2}$ -inch-mesh hardware cloth 24 inches wide and 38 inches high was inserted among the nails. It lay flat in the frame with a two-inch portion extending out of the top. The entire frame was painted black, and white lines

were drawn to mark soil depth levels.

The cutting blade consisted of a 28- by 40-inch sheet of 12-gauge steel reinforced along the 40-inch edges with split pipe and on the top or pounding edge with angle irons and reinforcing rods.

Excavation

Root samples were excavated from the sides of trenches dug by tractor-powered back-hoes. We found that excavation should be done when soil moisture was high enough to give the soil some plasticity, and that samples

should be excavated shortly after trenching. When trenches were left open, the soil and roots dried, which made excavation difficult and root breakage a problem during washing.

Root samples were excavated by pressing the nail-board, nails and cutting edge first, into a trench wall and slicing the enclosed soil monolith from the wall with the cutting blade. The trench was dug with one wall as near the plants to be sampled as possible. The wall directly beneath the plants was made smooth and vertical. The nail-board was positioned on the wall so that once inserted it enclosed a three- by 24-inch sample plot at the edge of the trench and the soil and roots beneath this area to a depth of 36 inches. It was forced into the trench wall by pressure from two jacks based on the opposite wall. Wooden T-shaped extensions were used to connect the jacks to the frame and to apply pressure evenly.

The enclosed soil monolith was sliced from the trench wall with the cutting blade. The blade was forced down in front of the nail-board with a sledge hammer. After the blade was inserted, pressure from the jacks was released to free the nail-board and monolith from the trench wall. The soil block was trimmed to exact size of the frame by sliding the cutting blade along the cutting edges of the frame.

To take deeper samples, two nail-boards were used and the sample was removed in two sections. The bottom frame was inserted first to prevent caving in the bottom section while inserting the upper. Removal from the wall was the reverse.

Washing

Samples were soaked in water in a trough for at least two hours. Overnight soaking was allowed when possible, but it did not appreciably enhance washing. The longer soaking periods

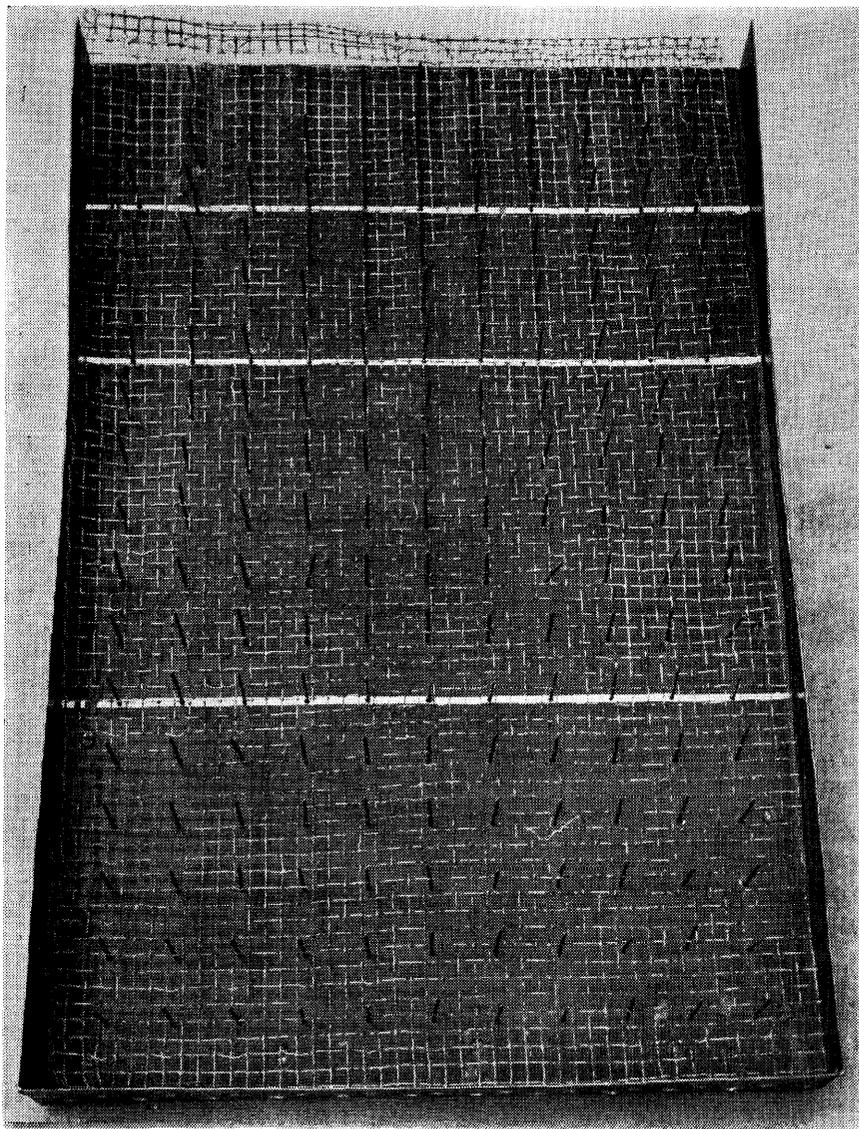


FIGURE 1. The nail-board is three inches deep, 24 inches wide, and 36 inches high. A $\frac{1}{2}$ -inch-mesh hardware cloth is inserted among the nails; white lines denote soil depth levels of six, 12, and 24 inches.

may be needed for more compact soils. Frebourg (1953) used a wetting agent to facilitate the washing process.

Soaked samples were removed from the water and tilted slightly to allow soil and water to drain through one-inch holes bored in the angle-iron at the bottom. Roots were washed with a fine, low-pressure spray of water from the bottom of the nail-board upward toward the plant root crowns. Gravel and stones were removed by hand. Soil blocks and stones were prevented from slumping and tearing any entangled roots. As the roots were exposed, the hardware cloth was lifted to allow water and soil to pass underneath. The roots being held up by the hardware cloth were thus not moved again by water or soil particles after they were exposed. Washing continued until all soil was removed and any water passed through the root systems came out clear. The roots thus exposed were ready for quantitative or qualitative study (Figure 2).

Limitations and Adaptations

The nail-board worked well with moderately and well developed alluvial soils. The soils where it was used were sandy loams or loams with sandy loam or sandy clay subsoils. It could be used in any soil that can be dispersed with water, the coarser the soil texture the easier the operation. Large stones or rock layers would pose a problem, as would loose sands, especially when dry.

The size of the nail-board can be adapted to fit the needs of the study. Any combination of sample thickness, depth, and width can be used. If, for example, the desired depth of sampling is 48 inches, the board can be built 48 inches deep. Upper size limits most likely will be

governed by the equipment and manpower available to handle large samples.

The nail-board can be used to extract root samples of individual plants or root systems of plant communities as found on native ranges.

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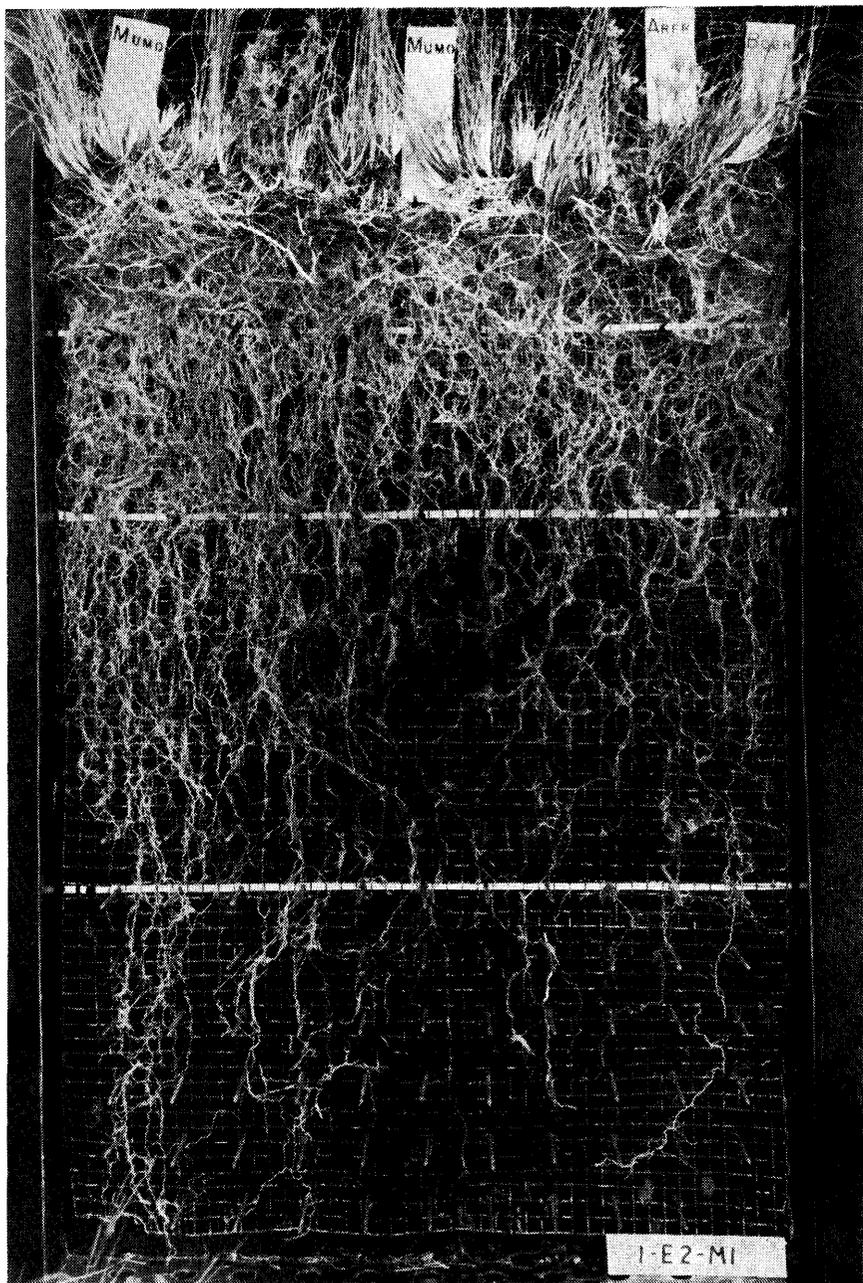


FIGURE 2. Nail-board containing exposed root sample.