

Constructing an Inexpensive Weather Station Pole

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Abstract

Weather stations are commonly employed in outdoor research programs, but they can be very expensive. A weather station pole is presented here that accomplishes the same function as one sold commercially, yet is half as expensive. Step-by-step instructions, pictures, a schematic, and parts and tools lists are included.

Introduction

Today's electronic sensing equipment makes it relatively simple to establish onsite weather stations. Researchers often use these sensors to collect detailed site-specific environmental information, but the sensors and the structural equipment necessary to position them can be very expensive. Small savings are often required throughout the research process in order to balance the rigors of science with budgetary constraints. Although the environmental sensors themselves have unavoidable associated costs, money can be saved on the structure used to hold these sensors.

This paper describes a simple weather station pole (figure 1) that was developed to allow the secure attachment of environmental sensors, utilizing the mounting hardware provided by the company while reducing the overall price tag. All of the necessary equipment for the pole was purchased at local hardware stores. This pole can be adapted to a variety of situations, sensor types, and configurations for use with environmental sensing equipment from different manufacturers.

As an example of the potential savings, the Vegetation Management Research Cooperative (VMRC) initiated five new study sites in 2006 and 2007. Each site had a centrally located weather station that included a rain gauge, an air temperature/relative humidity sensor, a wind speed indicator, and a light meter. Some manufacturers charge as much as \$165 for a 6-ft (1.8-m) weather station tripod system. The weather station pole presented here cost less than half that amount, saving the VMRC over \$445 during those 2 yr.

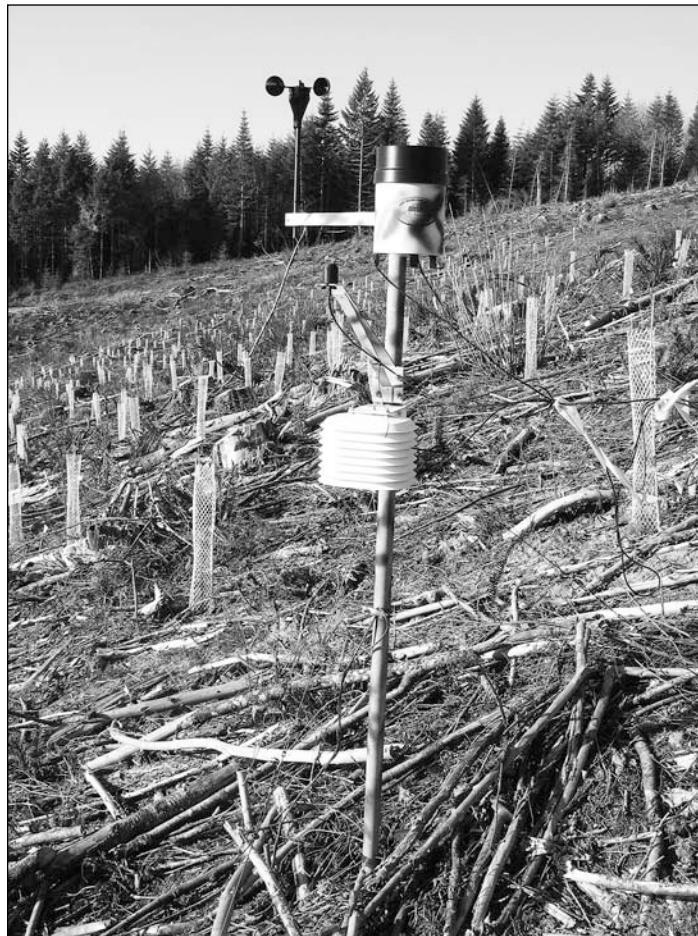


Figure 1. A weather station in the field.

Instructions

The schematic of the weather pole (figure 2) can be used for reference during assembly.

Before heading into the field:

1. Order the environmental sensing equipment and the necessary mounting hardware for each sensor.
2. Obtain other supplies and equipment locally (tables 1 and 2). (Adjustments to the fence-pipe diameter may be needed if the attachment hardware is a different size.)

3. If the weather station will be installed on a particularly rocky site, use a heavier gauge pipe (galvanized steel). Note: this will increase the cost of the pole.
4. Drill three ¼-in (7-mm) holes through the fence pipe (A, figure 2) 120° apart and approximately 3 ft (1 m) from the top of the pole (guy wire detail, figure 2). Make sure the holes are 1 in (2.54 cm) apart *vertically* so that the 4-in (10-cm)-long eyebolts (E) do not interfere with each other as they pass through the fence pipe (figure 3).
5. If a wind speed arm will be attached, drill the necessary holes 2 in (5 cm) from the top of the fence pipe (figure 4). Leaving 2 in (5 cm) at the top of the pipe will allow the rain gage to be mounted so that it is above the height of the fence pole. The pipe clamps for the rain gage will be positioned above and below where the wind speed arm attaches (figure 4).

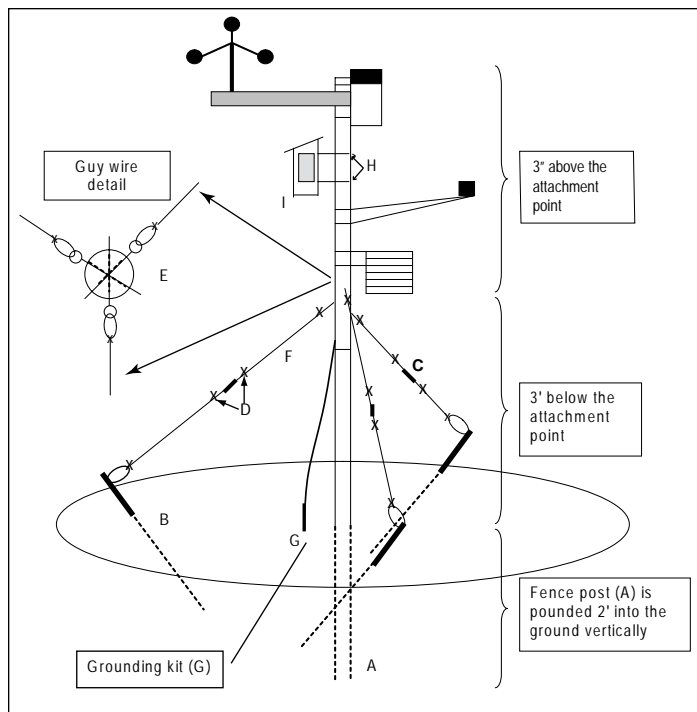


Figure 2. Weather station schematic.

Table 1. Equipment list.

Symbol ¹	Equipment	Size	Number needed	Cost (US\$)	Total cost (US\$)
A	Line post (fence)	8 ft long, 1½-in diameter	1	9.00	9.00
B	Galvanized pipe	3 ft long, ¾-in diameter	3	3.69	11.07
C	Turnbuckle	5½ in long, ¼ diameter	3	1.10	3.30
D	U-bolt cable connector	in	12	0.50	6.00
E	Eyebolt	4 in long, ¼-in diameter	3	0.50	1.50
F	Cable	3-ft length, -in diameter	6	0.57	3.42
G	Ground wire kit ²		1	35.00	35.00
H	U-bolt connector	¼ by 1 in	2	1.50	3.00
I	Scrap plywood	12 by 16 in, ½-in thick	1	3.00	3.00
				Total	75.29

¹ Refers to symbols on figure 1.

² A ground wire kit normally consists of a copper stake that is driven in the ground near the fence post pipe (A). A length of copper wire is then attached with one end to the fence post pipe (A) and the other to the copper stake.



Figure 3. Guy wire attachment.

Table 2. Tools required.

Electric drill with ¼-in (7 mm) drill bit
Fence post pounder or sledge hammer
Ratchet set
Adjustable wrench
Screw driver
2-ft (60 cm) carpenter level

6. Drill $\frac{1}{4}$ -in (7-mm) holes 2 in (5 cm) from the top of each piece of $\frac{3}{4}$ -in (1.9-cm) diameter pipe (B).

Once in the field, finish the assembly.

1. Pound the fence pipe (A) into the ground in the desired location. Use the 2-ft (60-cm) carpenter's level periodically to ensure that the pole stays relatively vertical. Small adjustments will be accomplished with the turnbuckles (C) later.
2. Install the three eyebolts (E) into the fence pipe as shown in figures 2 and 3.
3. Pound the 3-ft (91-cm) lengths of pipe (B) with the $\frac{1}{4}$ -in (7-mm) holes on top into the ground approximately 3 ft (1 m) from the base of the fence pipe. Make sure that they are in line with the eyebolts on the fence pipe, canted at a 20–30° angle; leave the upper 6 in (15 cm) exposed. Canting the pipes will allow them to maximize their holding power as stakes when tension is applied with the turnbuckles (figure 5).
4. Attach one length of $\frac{1}{8}$ -in (3-mm) cable (F) to each eyebolt (E), using $\frac{1}{8}$ -in (3-mm) cable connectors (D).

5. Attach a turnbuckle (C) to the other end of these pieces of $\frac{1}{8}$ -in (3-mm) cable with a second cable connector (D) (figure 6).
6. Insert lengths of $\frac{1}{8}$ -in (3-mm) cable (F) into the holes drilled on the top of each of the 3-ft (91-cm) stakes (B) and attach them with cable connectors (D) close to the stakes (figure 5).



Figure 5. Stake attachment.



Figure 6. Turnbuckle attachment.



Figure 4. Wind speed arm attachment point.

7. Attach the other end of these cables to the turnbuckles with another cable connector (D), completing the guy wire assemblies. Carefully take out the slack of each guy wire as you tighten these last cable connectors. Be sure to check that the pole is still vertical during this process.
 8. Lastly, tighten the turnbuckles on each guy wire frequently checking the fence pipe for a vertical orientation with the level in at least two directions. This is a trial-and-error process, but the guy wires, once tight, will provide stability and allow small adjustments when necessary.
2. Drill two ¼-in (7-mm) holes 1 in (2.54 cm) from the top and bottom of the scrap of plywood (I) to allow the U-bolt connectors (H) to pass through. Then use the two 1⁵/₈-in (4 cm) U-bolt connectors (H) to attach the plywood (I) to the pole (figure 2).
 3. Mount the data recording device to the plywood (I), following all instructions.
 4. If extra weatherproofing for the data-recording device is needed, consider making a small awning with scrap plywood and covering it with plastic wrap or roofing material (figure 1). Hinged plastic boxes or ammunition cans mounted to the plywood backing (I) also work very well.

Attaching the equipment:

1. Attach the weather station equipment following the directions provided by the manufacturer. It is important to electrically ground this pole, so use an appropriate grounding wire kit (G).

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