

# Making and Using Measurement Tools—Slope

## Forest Management Practices Fact Sheet Managing Water Series #13

### Introduction

There are a variety of *measurement tools* that can assess a woodland. The tools can be sophisticated equipment items purchased from vendors or they can be homemade devices. This fact sheet will describe how to make and use a homemade tool for determining slope.

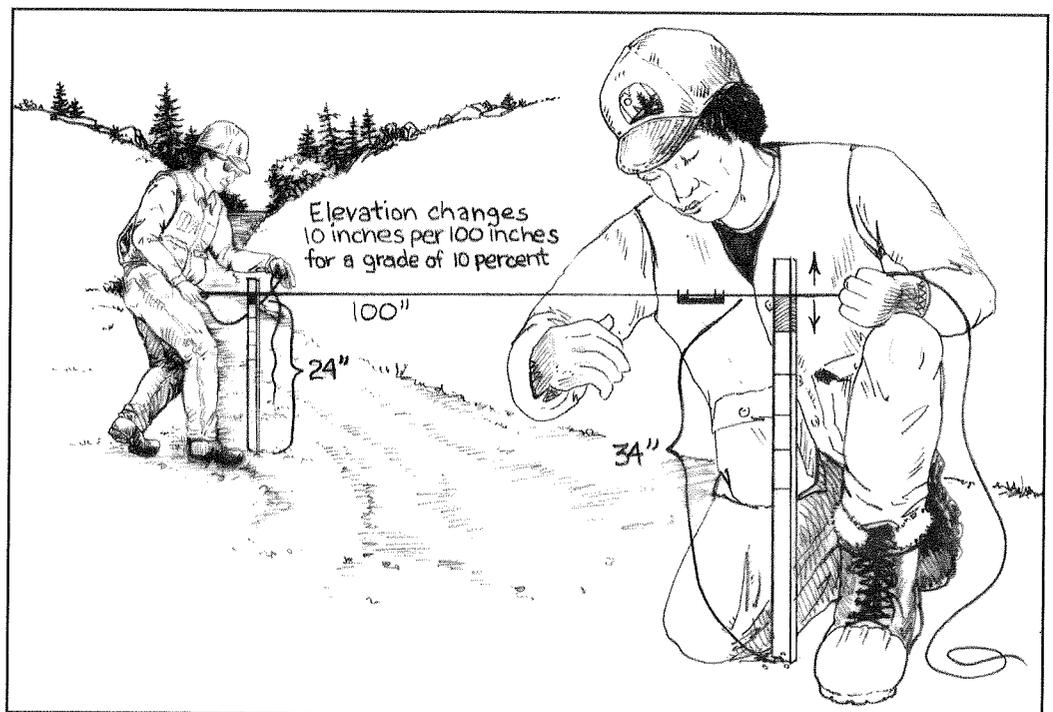
Best Management Practices (BMPs) can prevent or minimize the impact of forestry activities on rivers, lakes, streams, groundwater, wetlands, and visual quality.

*Slope* is the change in elevation between two points. It is expressed as a percent change in elevation per unit of distance traveled. Loggers and foresters need to determine slope when constructing roads and determining the spacing of water bars and broad-based dips. Water bars and broad-based dips help prevent erosion and keep sediment from reaching water.

### Application

You can determine slope using a measurement tool made with two wooden dowels or stakes, string, a felt marker or tape, a line level, and a ruler. While the dowels or stakes do not need to be the same length, they may be easier to use if their length is equal. To make the tool:

- ▶ Lay each dowel (or stake) flat on the ground. Starting from one end of each dowel, make a mark every six inches with a felt marker or tape.
- ▶ Cut a piece of string about 10 feet long.
- ▶ Firmly tie one end of the string to one dowel at the six-inch mark farthest away from the point where you began marking that dowel.



To measure the slope:

- ▶ Select the points where the difference in slope is to be measured. Place one dowel at each point. If you pound the dowels into the ground, make sure they are at the same depth.
- ▶ Measure the distance between the dowels.
- ▶ Pull the string tight between the dowels.
- ▶ On the dowel that doesn't have the string attached to it, hold the loose end of the string at the same increment mark as on the other dowel. Attach the line level to the string.
- ▶ Slide the string up or down until the level indicates it is level. The distance the string had to be moved up or down is the difference in elevation between the two points.
- ▶ Divide the change in elevation by the distance between the two dowels. Then multiply that number by 100 to figure out the percent slope.

$$\% \text{ slope} = (\text{change in elevation/horizontal distance}) \times 100$$

As an example, assume the dowels are 100 inches apart and the string had to be moved 10 inches to make it level. The slope is then calculated as:

$$\% \text{ slope} = (10 \text{ inches}/100 \text{ inches}) \times 100 = 10\% \text{ slope}$$

Once you determine slope, you can determine the spacing between water bars and broad-based dips by referring to the appropriate table(s) in your state's water quality BMP manual.

### **Advantages**

Homemade tools for calculating slope are less expensive than commercially available tools. They provide accurate enough estimates of slope to determine the spacing of water bars and broad-based dips.

### **Disadvantages**

Homemade tools are less accurate than commercially available tools. They may be more difficult to use, too. Also, they are limited to measuring slope, whereas commercially available tools may have additional capabilities.

### **Related Fact Sheets in This Series**

*Project Planning: Locating Roads, Landings, Skid Trails, and Crossings* (FS-6970); *Managing Water on Roads, Skid Trails, and Landings* (FS-6971); and *Making and Using Measurement Tools—Basal Area* (FS-6981).

### **Reference**

For more information about the spacing of water bars and broad-based dips, see your state's water quality BMP manual.

### **Cooperators**

University of Minnesota Extension Service, Minnesota Department of Natural Resources, Minnesota Logger Education Program, Michigan Department of Natural Resources, Michigan State University Extension, and Wisconsin Department of Natural Resources.



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