A Simple Device for Measuring Elevation Changes in Wetlands

Judith Stribling, PhD
Professor, Department of Biological Sciences
Salisbury University

Introducing students to the study of wetlands involves conveying both the science of wetlands and the process of wetland investigation. The starting point is often defining and characterizing hydrology, which is at the heart of every wetland. We explain to students the interplay between climate and basin geomorphology to bring hydrology to light (e.g. Mitsch and Gosselink 2007).

It is common to characterize hydrology by measuring elevation along one or several transects across ecological gradients. This exercise gives students a better understanding of how this physiographic feature serves as a structural control on wetland communities. As part of the activity, students may assess variability of other features such as plant community composition or soil texture in relation to the changing elevation. Hummock/hollow microtopography may also be included to illustrate the feedbacks between vegetation and geomorphology, for example, in forested wetlands. In tidal systems, quantifying the magnitude of change in elevation can provide a dramatic illustration of the inland propagation of apparently small increases in sea level. Other erosional and depositional dynamics also can be shown to depend on topographic variability.

The advantages of having students investigate elevation can be offset by the relative cost and logistic difficulty of using conventional surveying instruments to transfer the level of one point to another. These devices are difficult to set up and maintain in flooded, muddy, and uneven wetland terrain (they don't work very well when dropped in the mud!), and they are not useful for measuring elevation where sight is obscured by large trees as in a forested wetland.

A water level is a simple and ancient device based on the principle that water equalizes to the same elevation on both sides of a U-shaped tube. The tube thus establishes a reference to measure distance to the soil surface (Fig. 1). The distance is measured from the bottom of the meniscus within the tube, with the reference end of the water level positioned on the control (benchmark) elevation. Such instruments were used at least as early as the time of construction of the Roman aqueducts, to establish grade (Lyman 2012).

Our device consists of a 15-m length of clear laboratory tubing (I.D. 6.35 mm [1/4”]; wall thickness 1.6mm [1/16”], with quick-release clamps at each end. In controlled use, the accuracy of this water level is at least ±0.25 cm (Stribling et al. 2006).

To describe the elevation along a wetland transect, we choose a reference point (usually at the water’s edge if there is surface water present). A fencing stake is planted and marked at an arbitrary 100 cm from the soil surface. This mark represents the control, and elevation measurements are made at intervals along the transect. One end of the water level is held above the reference point, while the other is positioned next to a 2 m measuring stick or folding rule, held vertically on the soil surface. The second end of the tube (end B) is moved up or down along the measuring stick until the water level in end A end meets the 100 cm reference point. The distance from the water level to the soil surface at end B (the 3 m point) is then measured with the 2-m stick.

A reservoir may be used at the reference end of the water level, which will increase accuracy of the measurements. However, if water spills out of the tube (which can happen easily in the field) the reference must be re-established, so for most applications the resolution provided by the tube alone is sufficient.

Elevation is calculated as the difference between the control and the measured distance to the soil surface. If the transect is longer than 15 m, repositioning of the control will be necessary, marking a fencing stake with the last reading at end B for a new end A. If the elevation change is greater than 100 cm, vertical repositioning of the control will be necessary; usually it’s sufficient to simply add increments of 100 cm, remembering to adjust the elevation calculations accordingly.

Literature Cited

Lyman, J. 2012. Surveying. Encyclopædia Britannica Online. Retrieved 27 July, 2012, from http://www.britannica.com/EBchecked/topic/575433/surveying

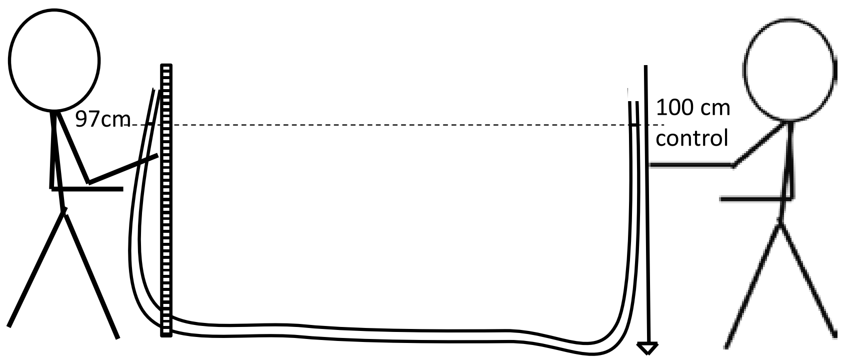

Figure 1: Using a water level to measure distance to soil surface.

Mitsch, W.J. and J.G. Gosselink. 2007. Wetlands, 4th ed. John Wiley and Sons, Inc., Hoboken, NJ. 582 pp.

Stribling, J.M., O.A. Glahn, X.M. Chen and J.C. Cornwell. 2006. Microtopographic variability in plant distribution and biogeochemistry in a brackish-marsh system. Marine Ecology Progress Series 320: 121-129.