

## **Data Collection Protocol Sedimentation-Erosion Tables (SET's)**

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### **Introduction**

Sedimentation-erosion tables (SET's) offer a method of measuring wetland surface elevation with very high precision, e.g., within 1.5 millimeters (Boumans and Day 1993; Cahoon et al. 1995). Measurements of elevation changes with the SET's, when simultaneously combined with short-term accretion marker horizons, allow for the determination of shallow compaction (Cahoon et al. 1995). If no compaction is occurring at the site, short-term accretion rates will equal changes in elevation. When compaction occurs, it will serve to reduce elevation, and compaction is calculated as sediment accretion minus the change in elevation. The use of both methods together can yield short-term estimates of sediment dynamics plus compaction rates. Long-term estimates can also be determined, i.e. when SET elevation data is used in conjunction with other methods for measuring accretion, such as <sup>137</sup>Cs dating. Despite the value of these comparative data (Callaway et al. 1996b; Rybczyk et al. 1998), very few studies have made these combined measurements (Oenema and DeLaune 1988, Roman et al. 1997; Orson et al. 1998). Combining data from the above methods can be used to improve understanding of sediment dynamics in San Francisco Estuary tidal wetlands.

### **SET Station Locations**

Locate SET stations in areas where sediment surface is not obscured by deep water (> 0.5m) or dense vegetation (Boumans and Day, 1993). The exact location of the sampling sites should be determined based on access, indications of disturbance, vegetation type, local elevation gradient, and other field indicators. Location determination largely depends on data collection objectives and should meet the need to characterize sedimentary conditions within and among strata for other concerns, such as the structure of plant and animal communities (see WRMP version 1 Part 1 Science Framework).

## Data Collection Frequency

Determine frequency of data collection based on expected sedimentation rates in the monitored area. Although frequent collection in areas with high sediment fluxes will yield a higher resolution of elevation changes over time, less frequent measurements may sufficiently detect a trend. Alternatively, frequent data collection in low-sedimentation environments may yield results within the range of methodological uncertainty, and therefore preclude analyzing elevation change. In such instances, less periodic measurements would be preferred. Whenever possible, collect data at times of lowest water level. Lower accuracy in measurements occurs when pins are lowered via gravity (i.e. when site is covered in water) than when lowered by hand (Boumans and Day, 1993).

## Personnel

Volunteers can be trained by skilled personnel to install SET's and/or collect data.

## SET Installation

At all SET station locations, construct platforms with removable planks to minimize effects of trampling on the monitored site. Access sites from platforms during instrument installation and data collection. Platform supports may be left in the field during the course of monitoring, but planks should be in place only during times of actual work.

## Structure of the Sedimentation-erosion Table<sup>1</sup>

The SET has a supporting aluminum base pipe<sup>2</sup> (10 cm diameter, 1 mm wall thickness) placed permanently at each site that is designed to receive the upper portable part of the SET (Fig.1). This core pipe was driven into the soil to refusal using either a vibracorer<sup>3</sup> or a hand-held pile driver as near to vertical as possible. The core pipe was then cut off a few cm above the sediment surface and filled to within a meter of the surface with quick-setting cement. The elevation of the top of the pipe after cutting will vary depending on water depth at the site and the tidal range.

Next an aluminum base support pipe (diameter 7 cm, length 60 cm, wall thickness 3 mm) was cemented into the top of the core pipe with mortar mix. No cement was placed inside the top 30 cm of the base support pipe to allow the portable part of the SET to be inserted. The support piped extended about 5 cm above the core pipe and was leveled to vertical. The portable part of the SET has four components: a vertical arm, a horizontal arm, a flat plate or table, and ninepins. The vertical arm fits 25 cm into the

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<sup>1</sup> From Boumans and Day, 1993.

<sup>2</sup> The supporting base pipe serves as a benchmark at each site. Any factor that alters the elevation of the base pipe must be separately accounted for.

<sup>3</sup> Vibracorer not recommended, as it contributes to site disturbance.

base support pipe, and measurements can be made in four different directions. A horizontal pin fits into notches in the base support pipe so that the four positions are always in the same place.

The horizontal arm of the SET can be leveled in two planes. It attaches to the vertical arm with a pin at the pivot point. This pivot point allows the arm to be leveled up or down with a double-threaded adjustment screw. The horizontal arm can be leveled from side to side by rotating the arm in the two collars and tightening with screws. A bubble level determines when the horizontal arm is level in both planes. When leveled, the table on the end of the horizontal arm provides a constant reference plane in space.

The plate measures 255 mm x 280 mm. The distance to the sediment surface is measured with nine pins passing through holes in the table. The holes were drilled in a square design (3x3) and 75 mm apart. The number of pins allows for an equal number of replicate measurements. The table has three separate plates with nine holes in each plate. The upper and lower plates are fixed and the middle plate can be moved back and forth. This movement is controlled by the operator, who uses the locking screw at the non-table end of the SET. This particular screw is attached to a threaded rod, which runs through the horizontal arm to the middle plate. Detailed specifications of the SET are available from the authors.

## Operation

To operate the SET, the vertical arm is set into the base support pipe so that the horizontal pin fits into the notches. The plates are lined up to insert the pins, then by moving the middle plate slightly, rubber o-rings inserted in the middle plate secure the pins in position to allow the table to be leveled in two directions. After leveling, the pins are unlocked and lowered until they just touch the sediment surface. The pins can be lowered differently depending on whether the site is covered by water or not. When there is no water, the locking screw is loosened slightly and the pins are lowered manually until they just touch the sediment surface.

When the site is covered by water, the locking screw is loosened until the pins slide down under the influence of gravity and come to rest on the sediment surface. Flat "feet" are attached to the bottoms. These floats retard falling speed through the water column.<sup>4</sup> After the pins sit on the sediment surface, they are locked in place by tightening the locking screw. The length of each pin above the table is measured with a ruler to the nearest mm. This procedure is repeated for each of the four directions to yield a maximum of 36 elevation measurements at each site.

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<sup>4</sup> The reduction of penetration potential provided by the floats can be determined using the average weight of the combined pin and foot, as well as the specified buoyancy of the floats.

## **Data Analysis**

Each SET station yields four different samples (taken from four SET directions). Each sample is calculated from the average of nine subsamples (taken from each of the nine pin readings). Samples can then be compared temporally at one SET station and spatially between SET stations. Actual comparisons will depend on the data collection objectives.

## Literature Cited

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Figure 1. Overview of the sedimentation-erosion table. (from Boumans and Day, 1993,. High precision measurements of sediment elevation in shallow coastal areas using a sedimentation-erosion table. Estuaries 16:375-380, permission pending.)

