**CARBONO PROJECT**
**Subproject Abstract**

**TITLE**: LONG-TERM PLOT ESTABLISHMENT CRITERIA

**Task Code**: 1001 **Investigator**: David B. Clark

**Date** (dd/mm/yy): Sept. '96 - Jan. '97 **Contact**: David B. Clark

**Other researchers involved:** Deborah A. Clark, and Leo Campos and William Miranda as surveyors.

**Key words**: plot location, sample design, replication, soil type

**Response variables**: Not applicable

**Soil Type**: Inceptisols and Ultisols (all 18 0.5 ha CARBONO Plots)

**Study location**: La Selva Biological Station, 10°26'N, 84°00'W, Costa Rica; all plots as mapped in the La Selva GIS. All are within Old La Selva, the unit bounded to the west by the Sarapiquí Annex and to the south by Braulio Carrillo National Park.

**Objectives**: To design a series of forest inventory plots to study old growth forest at La Selva. We wanted to have an unbiased sample of three major geomorphic units within the old-growth area of Old La Selva: old alluvial terraces (then classified as inceptisols), flat ridgetops on poorer soils (then classified as ultisols), and steeply sloping sites on the same poor soils. We focused on Old La Selva because of the possibility of establishing long-term plots in areas with no known recent human disturbance history.

**Experimental design/methods:** A base map for plot siting was prepared using a 5 m contour map of Old La Selva generated by the La Selva GIS system, overlaid with the streams and trails data layers, as well as the soils data layer for old-growth Old La Selva that is described in Clark, Clark and Read (1998 J. Ecol. 86:101-112.). The total old alluvial areas were outlined on the topo map. They fell into 4 blocks: CES/CEN, Sura Trail, beginning of CCL over to SHO, and back of CCL/beginning of CC. We apportioned the 6 plots among the 4 units to get the closet possible match of plot area/unit area. This was achieved by two plots in the first two units and one plot in each of the other two. A similar procedure was followed on the residual soils for the Matabuey and Jaguar series. Each of these soil series was divided into equal area blocks, as far as possible. The west Matabuey block was about twice the size of the east block, and we split it in the middle (grid E-W) on the topo map. The Jaguar unit was essentially contiguous, so we just split it (grid E-W) into 3 roughly equal area blocks. We apportioned 3 ridgetop and 3 slope plots to both the Matabuey and the Jaguar series.

Within each of these areas, we used the following procedure for establishing a particular plot location. Within the unit, we looked for the first possible 50 x 100 m rectangular area which fit the topographic criteria, staying as close to the trails and to the station as possible. The operational criteria were: flat=no more than one 5 m contour line crossing the area, steep=$\geq$3 5 m contour lines crossing the plot. We used a model plot (to scale) as our criteria to evaluate these sites, working back from the closer to the farther areas as necessary. In the case of the

slope plots we aligned the long axis of the plot parallel to the contour lines of the slope. In all cases the first site that met the topographic criteria was accepted. The model was taped on the map, and its exact coordinates and bearing in the La Selva grid system were determined with a ruler and a compass from the map.

With these coordinates in hand, we then went to the nearest La Selva grid point and surveyed in with a hand tape and compass to one of the plot corners. If the plot actually fit in that site, that became the site. Frequently however we had to move the plot 5-20 m to make it fit exactly on the topography (for example, to have the slope plots run from exactly from top of slope to base of slope, or to run exactly parallel to the contour lines). In these cases particular attention was paid to locating the plot only according to topography. We explicitly did not take forest structure into consideration. Some plots would not fit on the selected sites, because the GIS map topography differed from the real topography. A few sites were thus rejected on topographic grounds, and new sites were chosen following the procedures outlined above.

In summary, the exact locations of these plots were determined by soil type and topography. Among equal sites, we chose ones closest to trails and the station. The design was purposefully blocked to achieve approximately equal sample intensity over the entire geomorphological unit. And very importantly, forest structure was explicitly NOT INCLUDED as a site defining variable. That is, the plots are located with no knowledge of or consideration of what the forest looked liked. We therefore believe these are unbiased samples of the forests growing in these different soil and topographic conditions.

At each site we used a topographer's transit to survey in the plots on a 10 x 10 grid. Most of the surveying was done by Leo Campos and William Miranda, after training by David Clark. All distances were slope corrected, and numerous lines were cross-surveyed to assess accuracy. Slope-corrected accuracies were $\leq \pm 50$ cm/10 m. The original survey data are in a yellow field book, "Carbono #25". Grid intersections are marked with 0.5 inch re-bar stakes (2 m tall), with a race-track shaped aluminum tag with the grid coordinates (first number = long axis grid line, 0 to 50, second equals short axis, 0 - 100).

**Data files:** The original topo map with soil classifications for the grid points, from which the Clark, Clark and Read (1998) soils map was digitized is stored in one of the bottom plastic tubes of the map case in the GIS room. This also is the original map from which the plot locations were planned.

**Variables in data files**: One copy of the base soils data file is c:\projects\vegmap\postedat.xls on DBC's computer. This file was imported onto the GIS and is in several different data layers (compare to Figure 1 in Clark, Clark & Read). Documentation for development of the soils data layer can be found in Result #27 of the Clark, Clark and Read Results File (Pendi Results), or on DAC's computer, c:\worddocs\soildefs.doc.