Soil and Water Science
Research Brief
University of Florida Institute of Food and Agricultural Sciences

SPATIAL DISTRIBUTION OF SOIL PROPERTIES IN WATER CONSERVATION AREA 3 OF THE EVERGLADES

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Soils are integrators of long-term environmental change. In the Florida Everglades, soil chemistry explains more variation in community attributes than water chemistry. Furthermore, nutrient inputs to Everglades wetlands are primarily stored in the peat, as the vegetation represents only a short-term nutrient sink. Thus, the spatial distribution of soil nutrients can be used as a means of assessing long-term nutrient impacts. Correspondingly, soils are an ideal ecosystem component for assessing the baseline status of Water Conservation Area 3 (WCA-3) prior to initiation of landscape-scale restoration activities. As this area will be a central focus of future Comprehensive Everglades Restoration Plan (CERP) activities, it is essential that the pre-restoration edaphic conditions of this ecosystem are quantified so that changes in soil properties caused by future restoration and management of WCA-3 can be assessed.

In this study, we used a stratified random sampling design to collect soil cores from 388 sites (Fig. 1) in order to quantify the spatial distribution of soil properties in WCA-3. To reflect hydrologic boundaries within the system, WCA-3 was divided into three zones: 3AN, 3AS, and 3B (Fig. 1).

Geostatistical analyses were conducted separately for each hydrologic unit (3AN, 3AS, and 3B). In 3AN and 3AS, empirical semivariance values were fitted with omnidirectional spherical and exponential

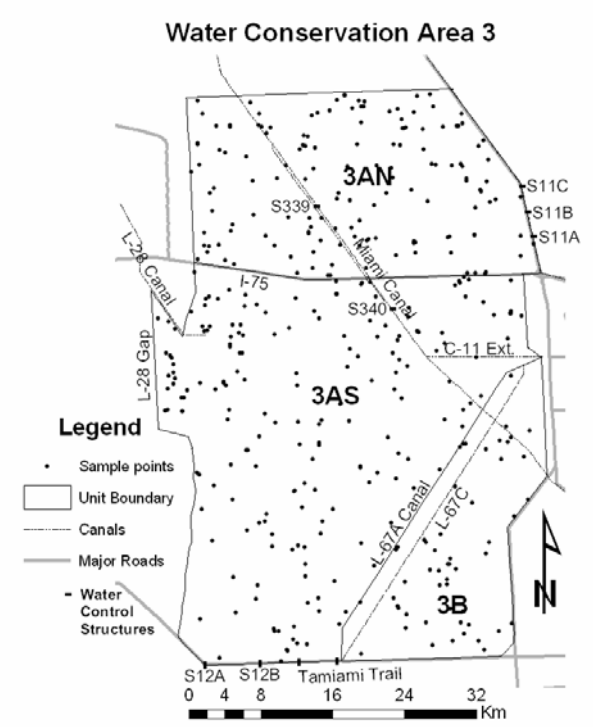

Fig. 1. Map of WCA-3 with the locations of the unit boundaries, canals, roads, water control structures, and the 388 sites from the 2003-4 sampling event.

semivariogram models. For 3B, which had a much smaller sample size ($n < 60$), we used completely regularized spline and inverse distance weighting (IDW) functions for interpolations. The spatial resolution of interpolated maps was 100x100 m.

Interpolated maps indicated that the highest bulk density (BD) values were located in western 3AN (Fig 2). These patterns may be explained by the overdrained hydrologic conditions that

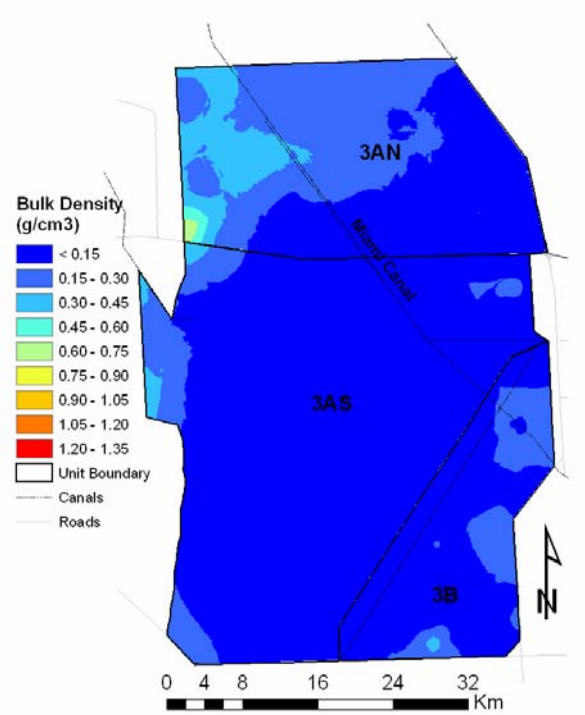

Fig. 2. Interpolated map of the spatial distribution of BD in the 0-10 cm layer of WCA-3.

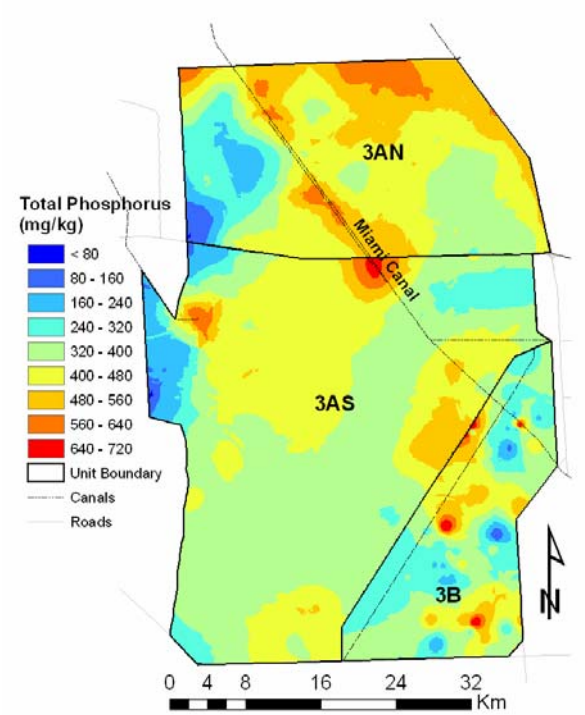

Fig. 3. Interpolated map of the spatial distribution of TP in the 0-10 cm layer of WCA-3.

exist in 3AN which have lead to oxidation of low BD surface peat layers.

Highest total soil phosphorus (TP) was found in northern 3AN and in areas adjacent to the Miami canal that bisects the area (Fig 3). One-quarter of 3AN had TP concentrations in the top 0-10 cm layer greater than 500 mg kg^{-1}, indicating enrichment beyond historic values. By comparison, only 5 % of 3AS and 6 % of 3B showed TP greater than 500 mg kg^{-1}. These differences in soil TP are related to hydrologic modifications of the Everglades landscape that have created focal points for the reception of water and nutrients. One of these points occurs where the Miami canal enters 3AS (Fig. 3). In this approximately 234 ha area, TP ranged from 640 to 720 mg kg^{-1}. This is considerably higher than the 400-580 mg kg^{-1} range that generally occurs in the remainder of 3AS.

The most impacted areas of WCA-3 appeared to be in western and northern 3AN, which had high BD and TP. The least impacted areas were the eastern and southern sections of 3AS that had quite low, homogenous nutrient distributions. This observation indicated that despite hydrologic alterations and changes in nutrient loading to WCA-3, the soils in parts of 3AS remain relatively unimpacted. Numerous other spatial patterns of physico-chemical soil properties were mapped in this study. The spatially-explicit sampling approach in combination with the geostatistical mapping effort can serve as a model to assess soil properties and adaptive management in the Everglades and other landscape-scale wetland restoration projects.

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G.L. Bruland, S. Grunwald, T.Z. Osborne, K.R. Reddy, and S. Newman. 2006. Spatial distribution of soil properties in Water Conservation Area 3 of the Everglades. Soil Sci. Soc. Am. J. 70: 1662-1676.