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Root Growth

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While vegetation dynamics of forested floodplains have received considerable attention (Megonigal and others 1997, Mitch and Gosselink 1993), the highly dynamic fine root component of these ecosystems has been primarily ignored. Characterizing fine root growth is a challenging endeavor in any system, but the difficulties are particularly evident in forested floodplains where frequent hydrologic changes may directly influence fine root growth.

Within the mixed-oak (*Quercus* spp.) community on the Coosawhatchie Bottomland Ecosystem Study site, three distinct soil series were identified (Murray and others 2000). The Coosaw, Meggett, and Brookman soil series were classified as well drained, intermediately drained, and poorly drained, respectively; and this drainage was confirmed by the depth of rusting on steel welding rods inserted into the soil for each soil series. In March 1995, fine root biomass distribution was estimated by collecting 12 soil cores along each of 3 transects that intersected the 3 soil series and did not extend beyond the perimeter of the mixed-oak community. In addition, six *in-situ* screens were installed in close proximity to each of the coring locations and sampled in May, June, July, August, and November 1995 and April 1996 to estimate fine root productivity. Nutrient contents (nitrogen [N] and phosphorus [P]) of fine roots intersecting the screens also were determined for all but the first of the six sample dates. Along each of two additional transects, six minirhizotron tubes were installed, and root lengths were measured monthly to a 30-cm
depth for 1 year using a fiber-optic video camera (Bartz Technology, Inc., Santa Barbara, CA).

Root elongation was quantified using minirhizotron technology.

Within the surface to 45-cm depth, 74 percent of total fine root biomass was restricted to the surface 15 cm, 17 percent within the 15- to 30-cm depth, and 9 percent within the 30- to 45-cm depth. Comparison of fine root biomass among the three soil series revealed that biomass plus necromass was greatest in the well-drained soil and least in the poorly drained soil (p = 0.1). Both the *in-situ* screen and

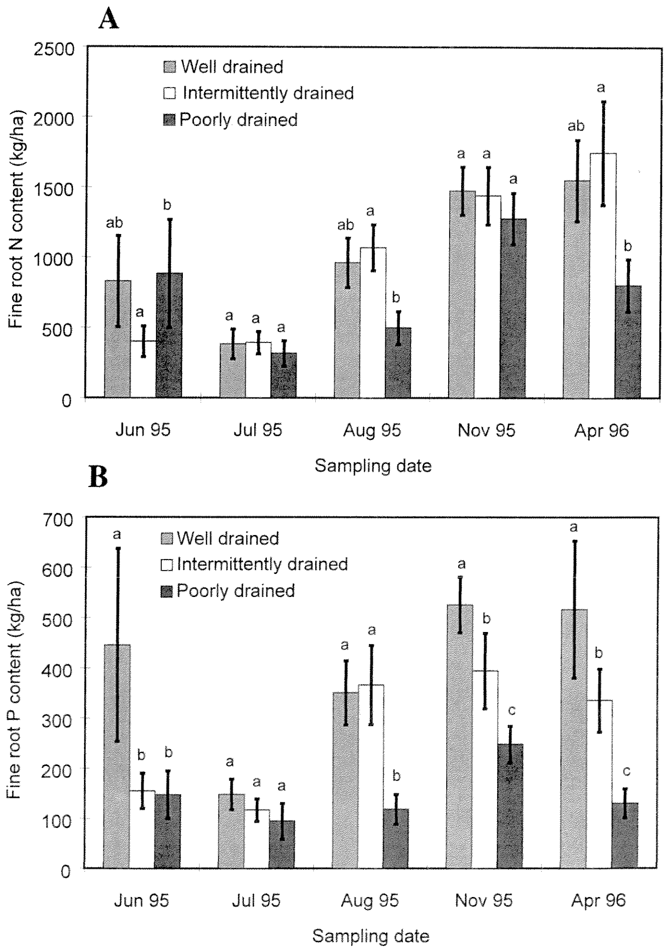

Figure 3.4—Temporal changes in fine root N (A) and P (B) among three drainage categories in the mixed-oak community. Different letters indicate significant differences (p = 0.1) among soil types at that sampling date. (The I indicates standard error.)

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minirhizotron methods showed that fine root length and densities changed with time of sampling, indicating that changes occur throughout the year, not just seasonally. The frequency of changes suggested that frequent sampling is needed to accurately assess fine root growth phenology and production. Fine root production, using measurements of significant ($p = 0.1$) increases in roots between sampling dates taken with *in-situ* screens, was estimated at 1.5, 1.8, and 0.9 Mg per hectare per year in the well-drained, intermediately drained, and poorly drained soils, respectively.

Figure 3.4 compares temporal changes in fine root N and P contents among the three drainage categories, indicating the pool of nutrients associated with fine roots at each sampling interval. Fine root N content tended to increase throughout the year and was generally greater in better-drained soils. Fine root P content exhibited a similar temporal pattern suggesting that nutrient cycling of both N and P through fine root turnover is greater in better-drained soils. Minirhizotron results (fig. 3.5) showed that fine root length density was consistently greater ($p = 0.1$) in both the 0- to 15- and 15- to 30-cm soil depths in the intermediately drained compared with the poorly drained soil. Results from the minirhizotrons also suggested that fine roots typically grow to greater depths in the intermediately drained soil relative to the poorly drained soil (data not shown). Root images collected in the minirhizotrons were classified according to morphological categories, e.g., very fine (< 0.5 mm) rootlike structures, white roots, and brown roots. In the intermediately drained and poorly drained soils, the majority of observations were of very fine rootlike structures. White and brown roots were proportionally more abundant in the intermediately drained than in the poorly drained soil.

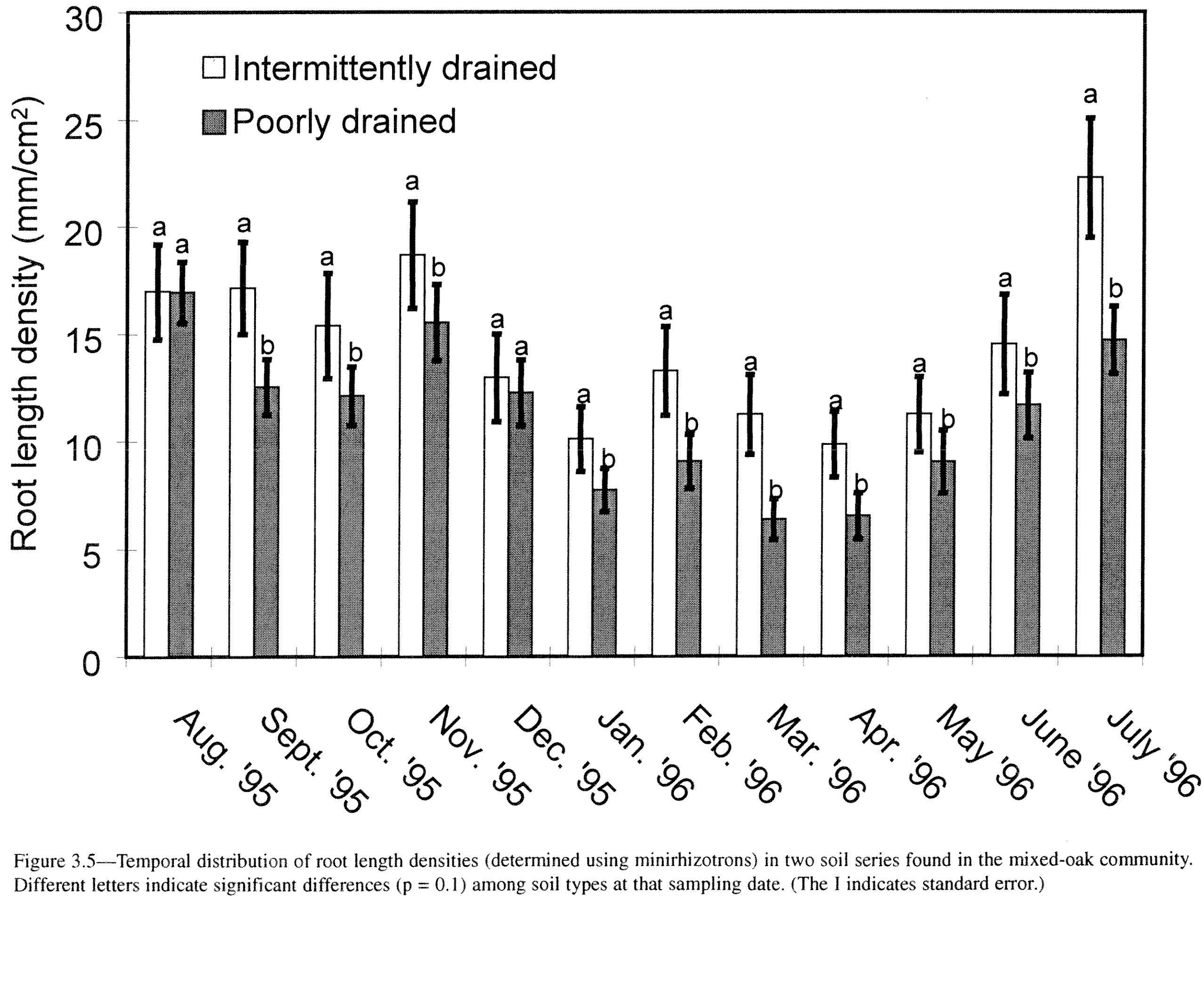

Figure 3.5—Temporal distribution of root length densities (determined using minirhizotrons) in two soil series found in the mixed-oak community. Different letters indicate significant differences ($p = 0.1$) among soil types at that sampling date. (The I indicates standard error.)