Aboveground and Belowground Net Primary Production

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The relationship among net primary productivity (NPP), hydroperiod, and fertility in forested wetlands is poorly understood (Burke and others 1999), particularly with respect to belowground NPP (Megonigal and others 1997). Although some researchers have studied aboveground and belowground primary production in depressional, forested wetland systems, e.g., Day and Megonigal (1993), there are no published studies of aboveground and belowground NPP in riverine systems in the Southeastern United States.

During the summer of 1995, a baseline study of NPP was initiated on the Coosawhatchie site. Sixteen of the 68 permanent vegetation plots (Burke and others 2000a) were randomly selected as representatives of each of the main vegetation types: water tupelo (*Nyssa aquatica* L.), swamp tupelo (*N. sylvatica* var. *biflora* [Walt.] Sarg.), laurel oak (*Quercus laurifolia* Michx.), and mixed oak (*Q.* spp.) (fig. 3.1). Each plot was expanded to 0.1 ha (15 by 66.6 m), and five litter traps were installed in each plot. During the winter of 1995–96, diameter and height were measured for all woody stems over 5 cm in d.b.h. Remeasurements of the d.b.h. during the following three winters and species-specific volumetric tables (Clark and others 1985, 1986; Clark and Taras 1976; McNab and others 1983; Phillips 1981; Schlaegel 1981, 1984a, 1984b; Taras and Clark 1974) were used in estimating stemwood production. Foliage, seed, and miscellaneous litterfall components were estimated between April 1996 and April 1999 from litter trap contents. Results up to April 1997 are presented here.

Stem basal area, tree height, tree diameter, and tree density declined up the flooding gradient (table 3.1). Total aboveground production for 1996–97 did not differ significantly among communities ($p > 0.1$) although stemwood production in the laurel oak community was greater than in the water tupelo community (fig. 3.2). Seed production was greater in the mixed oak than in both water tupelo and laurel oak communities ($p = 0.05$), but foliage and miscellaneous litterfall production were similar ($p > 0.10$).

Biomass, production, mortality, and turnover of fine roots (< 3 mm in diameter) were estimated along 200-m-long transects during 1996–97 for two of the communities:

Photo by Marianne Burke

Litter traps were elevated above flood level.

swamp tupelo and laurel oak. Sequential coring showed that root biomass was greater ($p = 0.05$) in the laurel oak community (5.7 Mg per hectare) than in the swamp tupelo community (2.4 Mg per hectare). There was no significant difference in necromass between the communities (2.4 and 1.3 Mg per hectare). Fine root production, estimated as the sum of significant ($p = 0.05$) increments in biomass, was 2.3 Mg per hectare per year for the laurel oak and 0.3 Mg per hectare per year for the swamp tupelo communities. Fine root mortality, estimated as the sum of significant increments in necromass, was 1.3 Mg per hectare per year for the laurel oak and 2.8 Mg per hectare per year for the swamp tupelo communities. Fine root turnover, calculated as production/biomass, was greater in the laurel oak community (26 percent per year) than in the swamp tupelo community (7 percent per year).

Aboveground biomass partitioning was equal between stemwood and litterfall for all but the laurel oak community, where more was partitioned to the stemwood. This observation can be interpreted as greatest growth efficiency in the laurel oak community. More biomass was partitioned to root production in the laurel oak than in the swamp tupelo community (fig. 3.3), suggesting that either the tree species in the swamp tupelo community partitioned more biomass to aboveground production, or that the wetter sediments stimulated shoot growth relative to root growth in that community.

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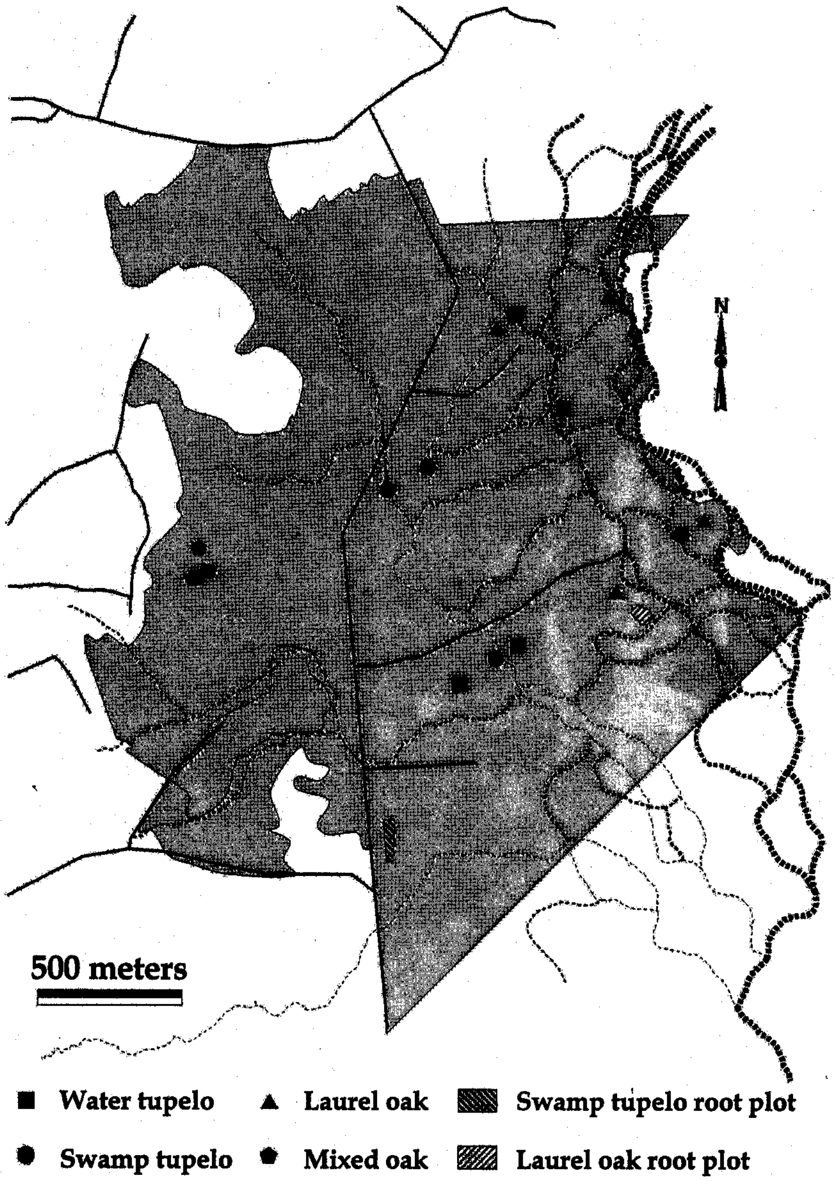

Figure 3.1—Locations of 16 aboveground and 2 belowground productivity plots on the Coosawhatchie Bottomland Ecosystem Study site.

Table 3.1—Statistics, shown as mean (standard error[a]), for woody plants (> 5 cm diameter) at the Coosawhatchie Bottomland Ecosystem Study site (winter of 1995–96)

Community	Basal area	Aboveground biomass	Tree Height	Tree Diameter	Tree Density
	m^2/ha	*Mg/ha*	*m*	*D.b.h. in cm*	*No./ha*
Mixed oak	36.0 (1.7)	288 (11.5)	15.3 (0.4)	18.6 (0.6)	773 (55)
Laurel oak	40.7 (1.4)	334 (47.5)	16.3 (1.8)	20.7 (3.4)	885 (328)
Swamp tupelo	45.9 (1.5)	297 (16.9)	19.0 (1.0)	21.7 (1.4)	945 (241)
Water tupelo	58.3 (3.9)	306 (25.5)	20.1 (1.7)	22.6 (1.1)	1138 (46)

[a] Standard error of the mean is in parenthesis.

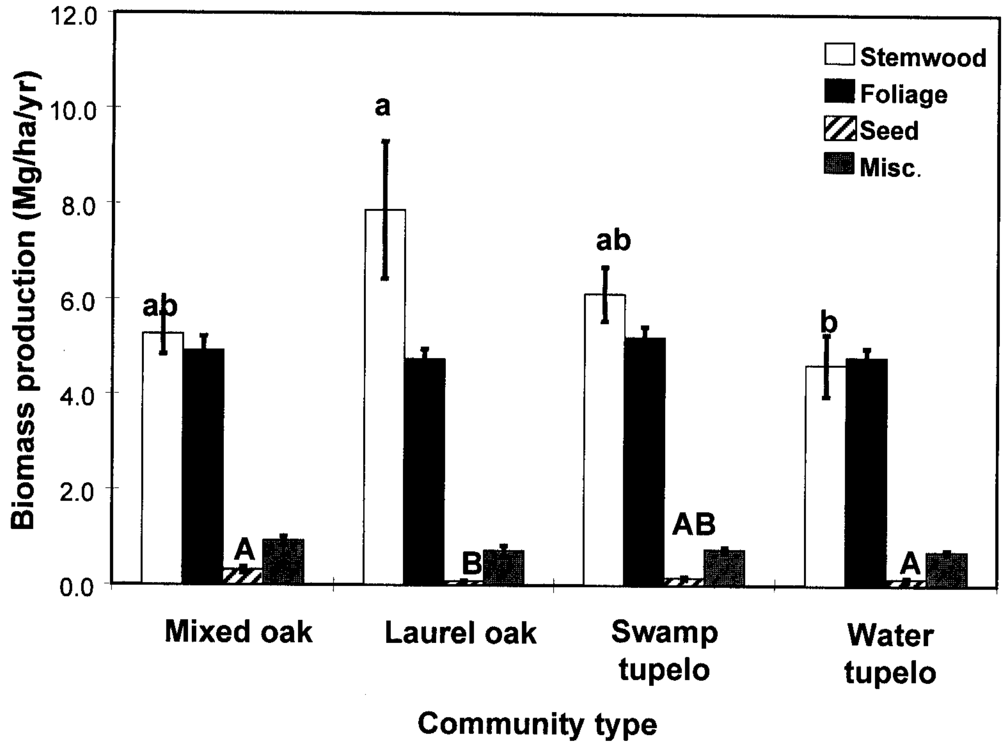

Figure 3.2—Aboveground biomass production between April 1996 and April 1997. Significant differences within component communities are indicated by different lowercase (p = 0.10) and uppercase (p = 0.05) letters. (The I indicates standard error.)

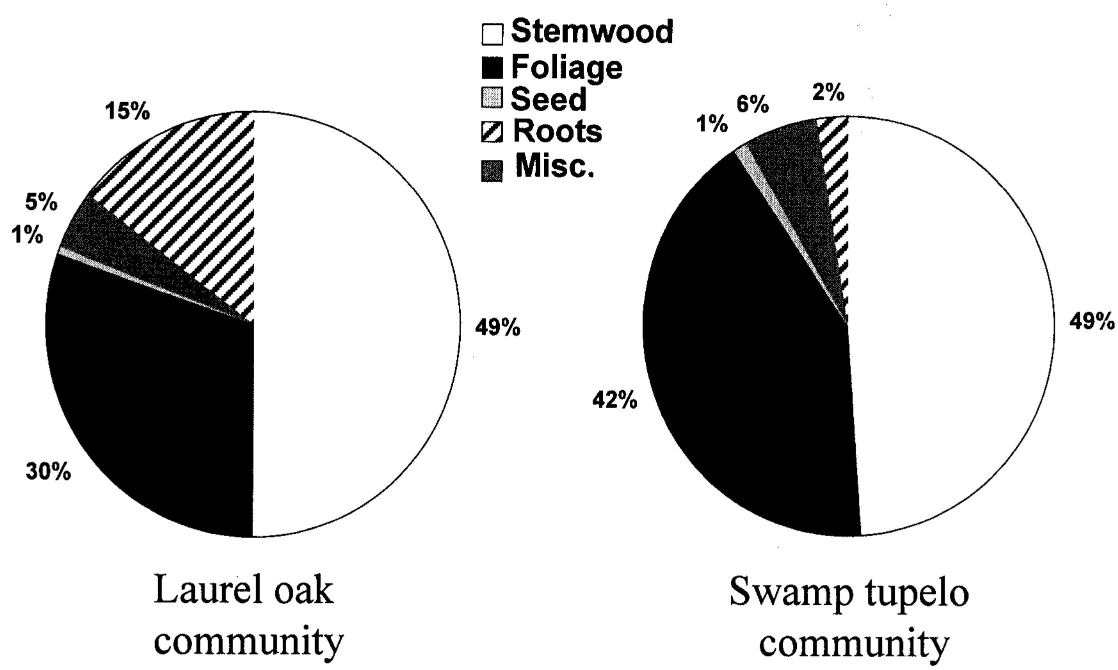

Figure 3.3—Biomass partitioning to stand components in the two most productive communities.