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Litter Decomposition

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While many factors regulate litter decomposition and nutrient flow in floodplain systems, litter quality and hydrologic influences are of primary importance (Belyea 1996, Heal and others 1997). To a large extent, these two driving forces determine the pattern and extent of nutrient immobilization and mineralization during the decomposition of leaf litter.

This study examined decomposition processes on the three Southern Forested Wetlands Initiative study sites. The Coosawhatchie River site represented a particularly valuable opportunity to examine decomposition processes within a floodplain system because it contains two distinct, but adjacent, vegetative communities that differ in terms of hydroperiod and litter quality. While both communities experienced seasonal flooding, the first, a laurel oak (*Quercus laurifolia* Michx.) community with drained soils, is typically drier than the second, a swamp tupelo (*Nyssa sylvatica* var. *biflora* [Walt.] Sarg.) community with poorly drained soils.

In fall of 1995, leaf litter from each Southern Forested Wetlands Initiative site and from two communities on the Coosawhatchie Bottomland Ecosystem Study site was collected with littertraps and tarps, returned to the lab, and sorted according to species. Litter from the five most important tree species (by air-dried weight) was combined into litterbags (30.5 by 45.7 cm with 6- and 2-mm openings on the upper and lower sides, respectively). The relative quantity of each species' litter in each bag represented the proportion of total litter collected from each community.

All litterbags contained approximately 20 g of leaf litter. On the Coosawhatchie site, litterbags in the laurel oak community contained small-leafed oaks—water (*Q. nigra* L.), willow (*Q. phellos* L.), and laurel (37 percent)—sweetgum (29 percent); large-leafed oaks—white (*Q. alba* L.) and red (*Q. falcata* Michx.) spp. (26 percent)—and red maple (*Acer rubrum* L.) (8 percent). Litterbags in the swamp tupelo community contained sweetgum (48 percent), large-leafed oaks (21 percent), swamp tupelo (16 percent), small-leafed oaks (12 percent), and red maple (3 percent). In addition, litterbags containing control litter (uniform litter quality), primarily cherrybark oak (*Q. falcata* var. *pagodifolia* Ell.) collected from the Iatt Creek site, were placed and sampled in a similar way to test the physiographic influences on decomposition processes in all but the swamp tupelo community. Litterbags were placed in the field in April 1996, and samples were collected (n = 3) at 0-, 2-, 4-, 6-, 8-, 12-, 16-, 22-, 28-, 38-, 48-, 64-, and 80-week intervals. Each sample was returned to Auburn University and material was washed of sediment, ovendried to a constant weight, weighed, and analyzed for nitrogen (N), phosphorus (P), and carbon (C). All values are expressed on an ash-free basis.

Figure 3.12 illustrates the temporal trend of mass loss for mixed- and single-species litter during an 80-week period. Table 3.3 provides descriptive statistics for mixed- and single-species litter through week 80 on the four floodplain sites. Although differences were not statistically significant,

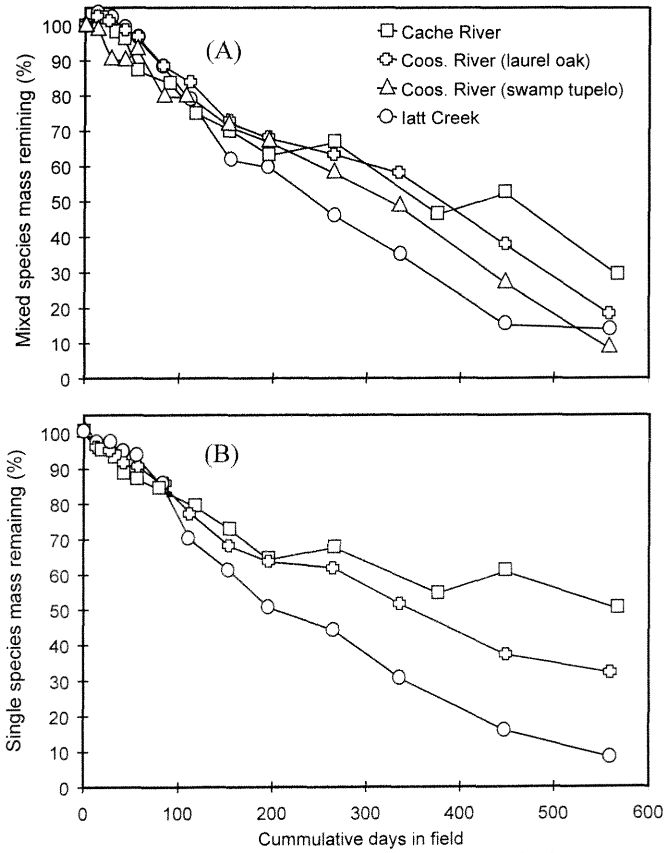

Figure 3.12—Average percent mass remaining (ash-free basis) for (A) mixed- and (B) single-species leaf litter in four and three, respectively, forested floodplain commmunities in the Southern United States.

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decomposition rates (k) were numerically greater for the mixed-species litter in the swamp tupelo community (0.96) than in the laurel oak community (0.82) on the Coosawhatchie Bottomland Ecosystem Study site. Similarly, the mixed-species litter in the swamp tupelo community contained numerically less of the original litter mass and P than the mixed-species litter in the laurel oak community. The decay rate for single-species litter on the Coosawhatchie River site was intermediate to that on the other two sites, being significantly greater than the Cache River but significantly less than the Iatt Creek sites. The dramatic separation of the Iatt Creek site in terms of decay rate, mass remaining, and P remaining is not surprising because this site is the least flooded. Although the data cannot explain the mechanisms behind this tendency, soil temperature and hydrologic data collected during this study are being analyzed to improve understanding of the decay and mineralization patterns on these four floodplain sites.

Photo by Marianne Burke

Installation of decomposition litter bags.

Table 3.3—Decomposition rates[a] and percentage of mass and phosphorus remaining in leaf litter of mixed and single species in four forested floodplain sites in the Southern United States after 80 weeks

	Decay coefficient		Mass		Phosphorus	
Site	Mixed	Single[b]	Mixed	Single	Mixed	Single
			Percent			
Cache River, AR	0.7095 (0.02)[c]A[d]a[e]	0.4667 (0.03)Ab	29.34 (2.82)Aa	50.14 (2.96)Ab	27.05 (1.80)Aa	65.00 (5.69)Ab
Coosawhatchie River, SC						
Laurel oak	.8210 (.04)ABa	.7557 (.07)Ba	18.20 (1.50)Ba	32.18 (5.34)Ba	23.98 (4.58)Aa	53.51 (4.81)Ab
Swamp tupelo	.9572 (.43)B	NA	8.32 (4.75)B	NA	18.54 (10.73)A	NA
Iatt Creek, LA	1.2499 (.06)Ca	1.3378 (.08)Ca	13.84 (2.25)Ba	8.23 (2.13)Ca	18.67 (2.50)Aa	10.82 (3.07)Ba

NA = Not applicable.

[a] Calculated as $\{X/X_0\} = e^{-xt}$.

[b] Control litter.

[c] Standard error of the mean is in parentheses.

[d] Means for each floodplain site within each litter type with the same uppercase letter do not differ significantly at the p = 0.05 level.

[e] Lowercase letters compare k, mass, and P among litter types; means with same lowercase letter do not differ significantly at the p = 0.05 level.