

## Scientific Note

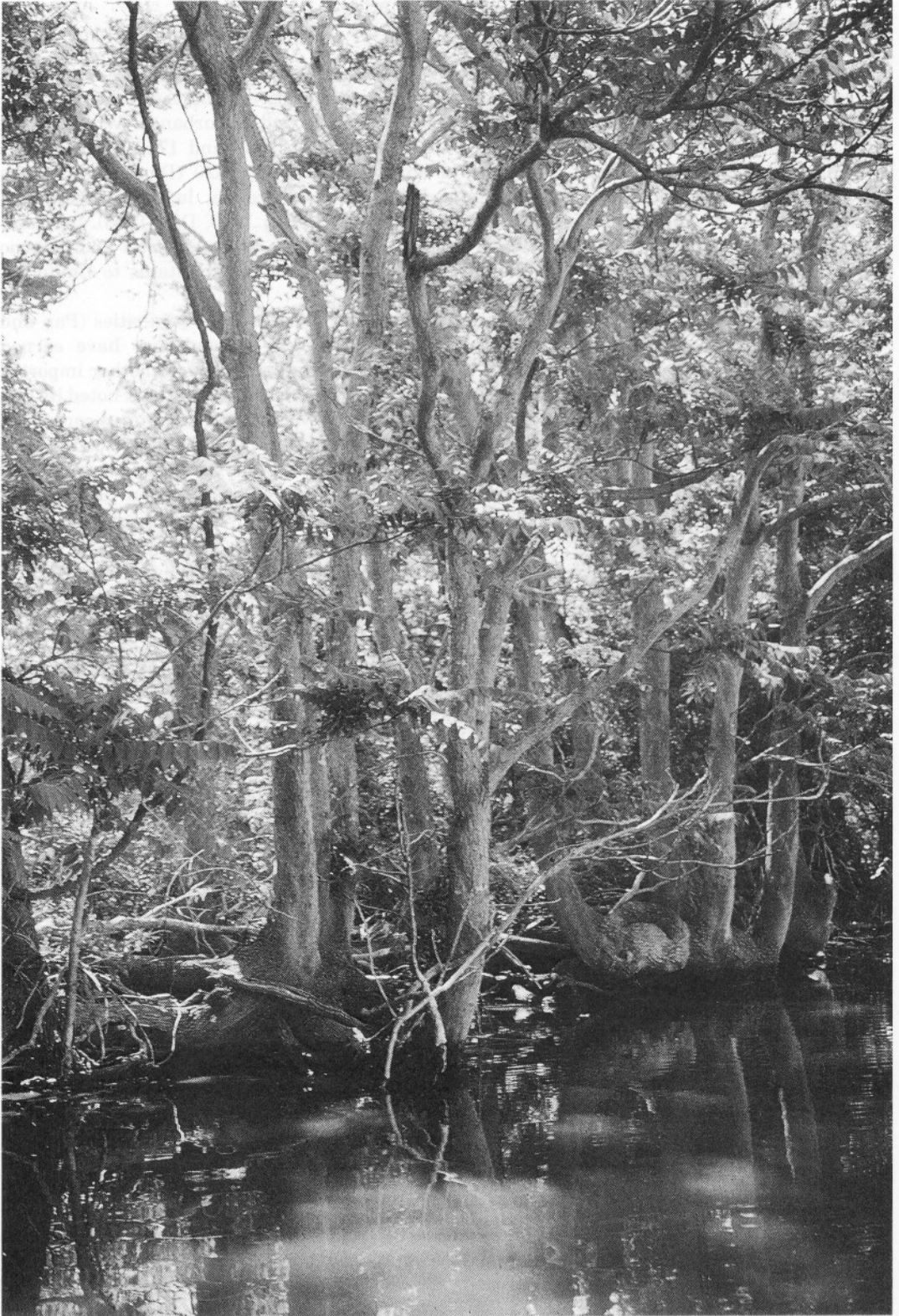
OCCURRENCE OF *Ailanthus altissima* IN A MARYLAND FRESHWATER TIDAL ESTUARY—*Ailanthus altissima* (Mill.) Swingle (Simaroubaceae, tree-of-heaven) is native to northern China where it has a long history of association with human habitation and disturbance (Whitney and Adams 1980). It was introduced from China to Paris between 1740 and 1750 (Hu 1979). It was introduced into the United States on an extensive scale in 1820 (Dame and Brooks 1972) as an ornamental shade tree recognized for its rapid growth, luxuriant compound leaves, and ability to tolerate the stresses of urban areas (Hough 1960, Dirr 1983). It is now naturalized throughout the eastern United States, growing from Massachusetts and Ontario south, and also occurs to a lesser extent from the southern Rocky Mountains to California (Elias 1980).

*Ailanthus altissima* is a pioneer species of disturbed sites, especially in cities (Pan and Bassuk 1986). Its resilience and persistence under the worst of conditions have earned *A. altissima* a reputation for being a weed. Barlow (1969) described it as yet another imported species among the estimated 40% of New York City flora of non-native origins, and noted its foul odor and propensity to "spring up everywhere, particularly in vacant lots." *Ailanthus* commonly occurs on disturbed mesic sites and on "waste grounds" lacking topsoil, in habitats such as road and railroad verges, borders of agricultural fields, old fields, and other stressed, disturbed, or altered habitats. It is known to tolerate wet, cold soils in exposed areas (Clouston 1984) as well as periodic water deficits (Bernatzky 1978). It usually invades native vegetation only if a site is disturbed, but is known to invade naturally-disturbed floodplains, rock outcrops, and similar open habitats. Although it is not shade tolerant, it has on occasion invaded forests (Kowarik 1995, Knapp and Canham 2000). It has been reported anecdotally in the most unlikely of settings, from a rain gutter in Milwaukee, Wisconsin to Rhode Island where a stand was found with roots submerged in sea water (Newton 1986).

A dense stand of *Ailanthus altissima* was found along the shoreline at Jug Bay Wetlands Sanctuary on the freshwater tidal Patuxent River in Anne Arundel County, Maryland (Figure 1). Descriptions of typical habitats for this introduced deciduous tree would not predict its occurrence in a tidal habitat (Dame and Brooks 1972, Elias 1980). Nonetheless, I have observed single individuals or sparse stands of *Ailanthus* in estuaries in Connecticut, New York, and New Jersey in the vicinity of the Mean High Water (MHW) level. In 1997, I sampled vegetation to characterize a stand of *Ailanthus* that covered approximately 1,000 m<sup>2</sup> of tidally flooded shoreline on the Patuxent River.

The study site followed a nearly straight shoreline in a narrow belt from River Farm Point (south) to the mouth of Two Run Branch (north) in Jug Bay Wetlands Sanctuary, an Anne Arundel County Park and a component of the Chesapeake Bay National Estuarine Research Reserve. The site was on the east side of the Patuxent River (United States Geological Survey, Bristol, Maryland, 7.5 minute topographic map). The fetch (i.e., exposure to unimpeded winds across the water) was ca. 700 m to the northwest and southwest across the bay and river channel. Maximum salinity in a typical year in Jug Bay is about 0.5 ppt and the mean tide range is about 0.76 m (Friebele et al. 2001). The western edge of the stand coincided with MHW elevation. The eastern edge of the stand extended slightly beyond the limits of the larger trees that bordered the shoreline. Beyond the eastern boundary was a narrow belt of planted trees and old field-like vegetation, then an area of fallow field that had been planted with a cover crop or mowed in recent years (from 1994 to the time of this observation in 1997) and was farmed prior to 1994 for about 50 years (Christopher Swarth, pers. comm.).

The soils of the stand were mapped as Adelpia sandy loam in the south, and at the north end of the site, Evesboro loamy sand with a clayey substratum. Adelpia is a deep, moderately well drained, seasonally wet soil, that dries out slowly (Kirby and Matthews 1973). Evesboro is a very deep, very sandy soil with low natural fertility, a droughty, extremely acid A horizon, and a clayey layer 102–165 cm below the surface that typically retains moisture (Kirby and Matthews 1973).



**Table 1. Species composition and structure of the overstory ( $\geq 2.5$  cm dbh)**

Species <sup>a</sup>	Total Number	Relative Frequency (%)	Relative Density (%)	Relative Dominance (%)	IV <sup>b</sup>
<i>Ailanthus altissima</i>	28	50	76	77	203
<i>Celtis occidentalis</i>	2	10	5	1	16
<i>Fraxinus americana</i>	1	10	3	1	14
<i>Platanus occidentalis</i>	3	10	8	16	34
<i>Prunus serotina</i>	1	10	3	2	15
<i>Robinia pseudoacacia</i>	2	10	5	2	17

<sup>a</sup> Nomenclature follows Gleason and Cronquist (1991).

<sup>b</sup> IV (Importance Value) = Relative Frequency + Relative Density + Relative Dominance.

Five (25 m<sup>2</sup>) quadrats were randomly located one in each of five 40 m segments of a 200 m transect. The total area of the plots represented ~12% of the stand (total stand area ca. 0.1 ha). Within each sample plot, all overstory trees  $\geq 2.5$  cm dbh were identified and measured; all understory trees  $< 2.5$  cm dbh were identified and counted. A list of tree species and their relative frequency, relative density, relative dominance and an importance value (IV) are given in Table 1.

The overstory was composed of six species, with *Ailanthus altissima* having the highest relative density (76%) overall and highest relative dominance (77%). Total tree density (all species) was 6–9 trees per 25 m<sup>2</sup> plot. Basal area for *Ailanthus* was 43.0 m<sup>2</sup>·ha<sup>-1</sup>; for all species combined, the basal area was 55.9 m<sup>2</sup>·ha<sup>-1</sup>. *Ailanthus* mean dbh was 14.7 cm, and for the other five species combined, mean dbh was 13.1 cm. *Ailanthus* was present in all plots, and the other five species occurred in one plot each. *Ailanthus* ranked highest in all respects (Table 1).

Vegetation in the five sample plots was characterized by identifying all taxa and visually estimating cover by stratum. A total of 41 taxa was identified in all strata. Many of the species that occurred in the stand are indicative of disturbance or early stages of recovery (Dennis F. Whigham, pers. comm.). These species included *Ailanthus altissima*, *Sassafras albidum*, *Rhus typhina*, *Rubus allegheniensis*, *Lonicera japonica*, and *Duchesnea indica*. On the five sample plots, woody vine cover ranged from 5 to 45%, with seven species present. Shrub cover ranged from 5 to 25% and was made up of four species. Herbaceous plant cover ranged from 10 to 60%, and 21 taxa were identified. *Allium vineale* and *Galium aparine* occurred in all five plots, and *Verbesina occidentalis* occurred in 4 plots.

Three of the six species in the overstory were also found in the understory as saplings (*Ailanthus altissima*, *Prunus serotina*, and *Robinia pseudoacacia*). Two additional species (*Acer negundo* and *Asimina triloba*) were also found in the sapling layer. Total stem densities were low in the sapling size class (with a total of 12 saplings on all five plots combined); 50% of the saplings were *Robinia pseudoacacia*. One additional species (*Sassafras albidum*) was present as a seedling.

The moderately high species richness and cover of associated woody vines, shrubs, and herbs is noteworthy because *Ailanthus altissima* is known for its allelopathic properties in greenhouse experiments (Mergen 1959, Heisey 1990). Although allelochemicals produced by *A. altissima* may affect neighboring species, its toxicity has been demonstrated to decline in the field during periods of high rainfall and moderate temperatures and increase during periods of little precipitation and higher temperatures (Lawrence et al. 1991). Given the soil characteristics of this site and the effects of tidal fluctuation, it is possible that levels of toxins are reduced by frequent wetting of the soils. Land managers should be aware of the potential of *Ailanthus altissima* to invade estuarine shorelines.

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Figure 1. *Ailanthus altissima* on the tidal shoreline at Jug Bay Wetlands Sanctuary, Patuxent River, Maryland, 9 June 1997. Photograph by Erik Kiviat.

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