Exotic Species Patterns and Function in Urban Landscapes

Wayne C. Zipperer

USDA Forest Service, c/o SUNY-ESF, 5 Moon Library, Syracuse, NY 13210

Abstract

Mack et al. (2000) state "Biotic invaders are species that establish a new range in which they proliferate, spread, and persist to the detriment of the environment." This statement is true for many natural landscapes. In urban landscapes, however, exotic species are critical components of the landscape and enhance its livability. Exotic species provide aesthetic beauty, recreational opportunities, and ecosystem services and benefits.

Urbanization directly and indirectly affects natural ecosystems and species composition (McDonnell and others 1997). The most obvious direct effects are deforestation and fragmentation. Deforestation reduces forest cover, creates new forest edge, simplifies edges, decreases of forest interior habitat, and increases patch isolation (Zipperer 1993). Examples of indirect effects include urban heat island effect, soil hydrophobicity (White and McDonnell 1988), air pollution (Lovett and others 2000), and altered disturbance regime (Pickett 1998). Because of direct and indirect effects, native species may not be able to grow or survive on sites previously occupied. Although exotics species do displace native species, exotic species may be occupying niches left empty by native species and new niches created by urbanization.

In forested systems, studies of exotic species distribution reveal an increase in density and number as a landscape becomes more urbanized. This pattern, however, may be dependent on the strata of the forest. For example, for riparian forest habitats, the canopy stratum (woody stems ≥ 2.5 cm dbh) had greater stem density and higher number of exotic species in the urban landscape than in rural landscapes (Brush and Zipperer in review). For the shrub stratum (woody stems <2.5 cm dbh and ≥ 1 m in height), a different pattern was observed. The rural landscape had a greater stem density but a fewer number of exotic species than the urban landscape. These differences were attributed to site legacy and species performances.

In urban landscapes, exotic species contribute to the ecosystem benefits. An analysis of net carbon sequestration for the entire city of Syracuse, New York revealed that exotic species account for 45 percent of the net carbon sequestered (Nowak and Crane 2000, Nowak and others 2001). This percent varied by land use. In commercial land use, exotic species sequestered only 14 percent of the total net carbon sequestered by vegetation in that land use, whereas in residential land use, the percentage was 56 percent. Similar observations have been observed for air pollution removal. The removal of exotic species from the urban landscape potentially could create an ecological disaster for urban residents and significantly impair air and water quality.

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