RESTORING ECOSYSTEM RESILIENCE TO URBAN FORESTS USING DUTCH ELM DISEASE-TOLERANT AMERICAN ELM TREES

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Extended Abstract.—Urban forests contribute significantly to human health and environmental quality (Sanesi et al. 2011). As such, maintaining healthy urban forests resilient to pollution (atmospheric and soil), high temperatures, compacted soils, and poor drainage is critical. However, these forests have been hard hit by development, pests, and pathogens, consequently reshaping their diversity, structure, and resilience.

Pests and pathogens either selectively target specific genera (e.g., Dutch elm disease and emerald ash borer) or indiscriminately kill a variety of host species (e.g., Asian longhorned beetle). Many of the trees commonly targeted by pests and pathogens are (e.g., maple) or historically (e.g., elm and ash) were widely distributed across urban areas. Such disturbances reduce native tree diversity and compromise the ecosystem services delivered by forests (both urban and rural), negatively impacting their resilience to future outbreaks and climate change (Flower and Gonzalez-Meler 2015). This could have considerable economic implications for municipalities (Kovacs et al. 2010).

Reintroducing newly cultivated DED-tolerant selections of American elm across the urban-rural gradient in tandem with suitable understory species will enhance the long-term resilience of these systems by increasing the genetic diversity of elm and enhancing the functional redundancy in these systems.

Research efforts are underway to bring the once-dominant American elm back into the urban landscape where it was once ubiquitous. Urban foresters and citizens are again planting American elm trees, yet widespread availability of American elm is limited to a handful of cultivars: "Princeton", "Accolade", and "Valley Forge" (Giblin and Johnson 2017). Enhancing the genetic diversity of American elm genotypes used in urban forests is essential to maintaining durability of Dutch elm disease (DED) tolerance and the resilience of urban forests. U.S. Forest Service researchers have cultivated more than 100 American elm selections, many of which exhibit DED tolerance and may be suitable for urban and rural restoration plantings (Flower et al. 2017). Research has been initiated in Columbus, OH to simultaneously test the suitability of these selections in urban plantings, methods for reintroducing elm across the rural-urban gradient, and interactions among restoration treatments and ecosystem dynamics.

To complement the existing forest restoration plantings around the Midwest and northeastern United States (Knight et al. 2017), we are initiating a project to simultaneously test methods for reintroducing elm across the rural-urban gradient as well as the interactions among restoration treatments and ecosystem dynamics using a network of sites in the Columbus, Ohio, metropolitan area. The diversity in habitat types ranging from degraded riparian forests to urban street plantings in and around Columbus will allow us to test restoration approaches across a variety of habitats. These treatments will span a gradient of land-use intensity and associated levels of pollutants, impervious surface, community uses, etc. Restoration treatments on degraded riparian forest and abandoned agricultural lands will include 1) invasive species

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removal; 2) invasive species removal in combination with multi-species tree and shrub plantings; and 3) control. We will use multiple elm selections to address the lack of elm diversity across the urban forest. Results from this study will offer guidance for introducing DED-tolerant elm selections into urban forests, provide restoration strategies for degraded areas, and enhance our understanding of the ecological functions provided by American elm.

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