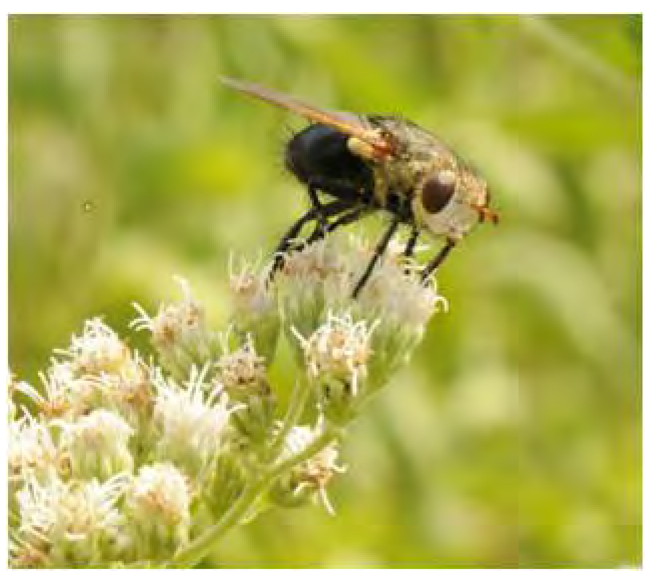
Insect Pests in Urban Landscapes Experiment
U.S. National Arboretum
Washington, D.C. Campus

Agricultural Research Service research entomologist Dr. Matthew Greenstone has partnered with the National Arboretum's research geneticist Dr. Richard Olsen to conduct an experiment at the National Arboretum. Dr. Greenstone required large parcels of land to create six 25-meter-square plots. In addition to the land, he needed a location that simulated suburban Mid-Atlantic landscapes comprising a wide variety of exotic and native landscape plants arrayed in formal gardens and park-like lands. The Arboretum was a perfect fit.

Visitors to the National Arboretum will find three sets of the experiment plots in three widely separated locations on the grounds: One set is near the National Grove of State Trees along Crabtree Road, one near the crapemyrtle research field along Meadow Road, and one north of Beech Spring pond along Valley Road. Each set contains one plot of native-only plants and one of non-native only plants; however, the focus of the experiment is animals, specifically arthropods (insects, spiders, and mites).

The experiment aims to compare the impact of native and exotic plant complexes on pest and natural enemy populations in managed urban landscapes, explicitly testing the hypothesis that landscapes dominated by native plants will have greater natural enemy abundance and diversity, and concomitantly fewer pests and less plant damage, than landscapes dominated by exotic plants. The hypothesis is based on the assumption that the long co-evolutionary history of native natural enemies and the native plants that supply them with foraging sites, alternate prey, and nutritional supplements make them better able to survive, reproduce, and attack pests than they would if foraging among exotic plants, with which they did not evolve.



Natural enemies derive nutrition from plant parts and secretions. Larvae of parasitic insects are exclusively predaceous, but their parents, like this tachnid fly (right) feeding on nectar of native boneset, require plant foods to survive and reproduce. Many predator groups once thought to be exclusively predaceous, like spiders, also feed on nectar, while predatory beetles feed on pollen and seeds; some natural enemies also feed on honeydew excreted by plant pests. If the hypothesis is correct, native natural enemies will prefer nectar, pollen, and seeds of native plants to those of exotics, and will survive and reproduce better on them.

The experiment plots simulate backyards vegetated with upper and understory trees, shrubs, and perennials, interspersed with turf walk-ways. In each pair of plots, the woody plants and perennials in one plot are all exotic, while in the other they are all native, e.g., Himalayan vs. eastern white pine, Norway vs. sugar maple, bird cherry vs. chokecherry, kousa vs. eastern flowering dogwood, and so on (see the complete plant list, below).

During the five-year course of the experiment, data will be taken on the identity and number of insect pests, the extent of insect damage to plants, and the number and density of natural enemies. DNA finger printing will be used to identify immature insects, and to document predator-prey and parasitoid-host interactions.

Landscape design and renderings: Charly Williams, University of Maryland

Plot Plant List

Stratum/Common Name	Native	Exotic
Overstory Trees		
Maple	*Acer saccharum*	*Acer platanoides*
Oak	*Quercus alba*	*Quercus robur*
Catalpa	*Catalpa bignonioides*	*Catalpa ovata*
Cherry	*Prunus virginiana*	*Prunus padus*
Holly	*Ilex opaca*	*Ilex aquifolium*
Tulip tree	*Liriodendron tulipifera*	*Liriodendron chinense*
Pine	*Pinus strobus*	*Pinus wallichiana*
Spruce	*Picea glauca*	*Picea abies*
Understory Trees		
Redbud	*Cercis canadensis*	*Cercis chinensis*
Dogwood	*Cornus florida*	*Cornus kousa*
Woody Shrubs		
Azalea	*Rhododendron calendulaceum*	*Rhododendron mucronulatum*
Hydrangea	*Hydrangea arborescens*	*Hydrangea paniculata*
Beautyberry	*Callicarpa americana*	*Callicarpa japonica*
Juniper	*Juniperus virginiana*	*Juniperus chinensis*
Trumpet vine	*Campsis radicans*	*Campsis grandiflora*
Wisteria	*Wisteria frutescens*	*Wisteria floribunda*
Viburnum	*Viburnum dentatum*	*Viburnum dilatatum*
Ground Covers		
Juniper	*Juniperus horizontalis*	*Juniperus procumbens*
Pachysandra	*Pachysandra procumbens*	*Pachysandra terminalis*
Herbaceous Perennials		
Skullcap	*Scutellaria integrifolia*	*Scutellaria baicalensis*
Meadowsweet	*Spiraea alba*	*Spiraea japonica*
Anemone	*Anemone canadensis*	*Anemone sylvestris*
Turf Grass		
Tall fescue	*Festuca arundinacea**	*Festuca arundinacea*

* There are currently no native grasses that will perform well as turf grass in sunny areas in the Mid-Atlantic Region, thus the same species of grass is used for the lawn in both the native and non-native experiment plots.

The project team is grateful to the Friends of Agricultural Research – Beltsville for providing funding for signage at the experiment plots.