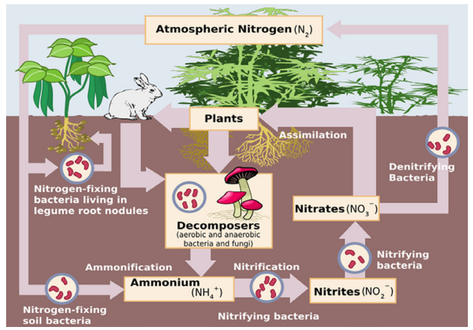
Nutrient Cycling and Soil Fertility

Proper diversity and concentrations of microinvertebrates, including fungi, bacteria, protozoa and nematodes, are critical to successful nutrient cycling in the soil. By supplementing and nurturing these populations, we can capacitate the soil's natural nutrient cycle, rather than depending on infusions of synthetic nutrients every season.

At the project's inception, the struggling soil ecosystem in Mertz Lawn generated about 40 pounds of plant-available nitrogen per acre-- not nearly enough to support idyllic green turf without recurring supplementation. In contrast, the organisms in the college's compost pile were, themselves, producing over 200 pounds of nitrogen per acre, thanks to the rich supply of organic feedstocks and the moist, oxygenated environment. This is more nitrogen than required by the average synthetic fertility program.



By transforming the site into a healthier habitat for soil organisms and introducing a larger, more diverse community of microbes, the soil will become naturally fertile, giving rise to a naturally beautiful lawn.

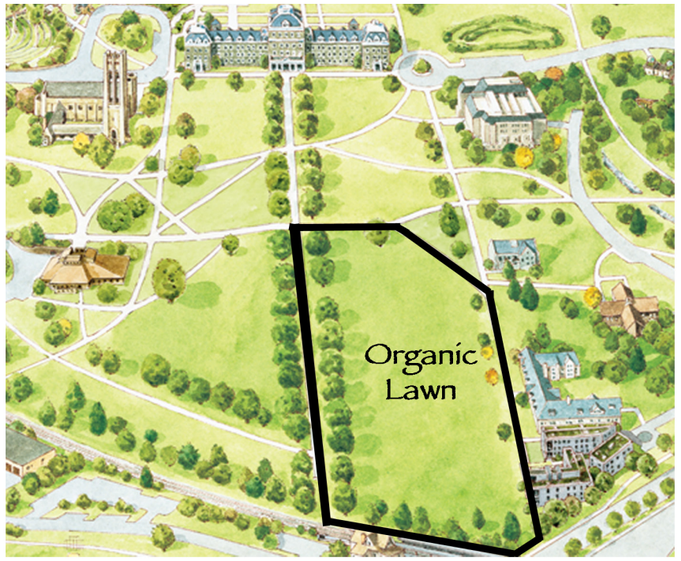
Compost and Compost Tea

Garden trimmings and food scraps from the College are transported to a local municipal facility where they are mixed and turned in long, hot windrows as they break down into compost. The compost's quality is tested by Cooperative Extension and Soil Foodweb laboratories. We use the compost directly on the lawn as a topdressing and for "brewing" into "tea."

Compost Tea Brewer

To make tea, compost is put in a tank of water along with fish hydrolysate, kelp, and humic acid as feedstocks. An air bubbler continuously mixes the solution and keeps oxygen levels high. The organisms reproduce rapidly in this ideal environment. The resulting liquid is applied to the organic lawn. Over time, these populations become established in the soil and fewer treatments are needed to maintain the system.

Once introduced to the lawn, bacteria from the compost incorporate nitrogen and other essential nutrients into their bodies, "fixing" them in the soil. The protozoa and nematodes that feed on the bacteria convert this nitrogen into a form readily accessible to plants. Plant roots, in turn, exude substances that feed the growing bacterial populations.



About the Scott Arboretum

The Scott Arboretum is a green oasis uniquely situated on the Swarthmore College campus. Over 300 acres create the College landscape and provide a display of the best ornamental plants recommended for Delaware Valley gardens.

Established in 1929 as a living memorial to Arthur Hoyt Scott, Class of 1895, through a bequest from his family, the Arboretum continues to thrive today. There are over 4,000 different kinds of plants grown on the campus, selected for their outstanding ornamental qualities, ease of maintenance, and resistance to disease. Major plant collections include: flowering cherries, crabapples, hollies, lilacs, magnolias, tree peonies, rhododendrons, hydrangeas, conifers, vines, summer flowering shrubs, viburnums, and witch-hazels.

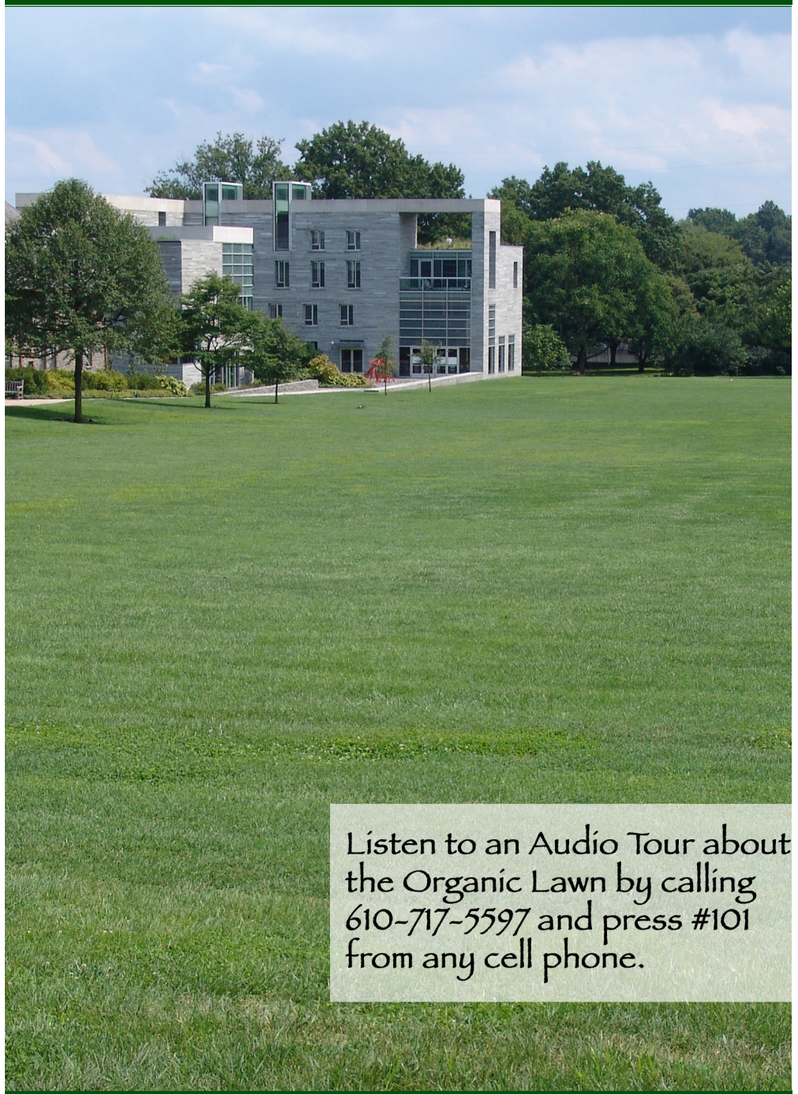
Maps and specialized brochures on plants growing on the campus are available at the Arboretum headquarters, which also houses a horticultural reference library. The Arboretum grounds are open from dawn to dusk year-round. Admission is free.

The Arboretum is supported in part by the Associates of the Scott Arboretum, a membership group. Join today and enjoy an array of fun and educational events year-round. For additional information, call 610-328-8025, Monday through Friday, 8:30 to noon and 1:30-4:30.

Support from Swarthmore College's Lang Center, Sustainability Committee & Swarthmore Foundation, and by Tech Terra Organics helped to make this project possible. This brochure designed by Erin Curtis, Nicole Lewis & Camille Robertson in February 2011. Cover photo by L. Stiebitz.

THE SCOTT ARBORETUM
OF SWARTHMORE COLLEGE
500 College Avenue, Swarthmore, PA 19081
www.scottarboretum.org

The Organic Lawn Initiative



Listen to an Audio Tour about the Organic Lawn by calling 610-717-5597 and press #101 from any cell phone.

THE SCOTT ARBORETUM
OF SWARTHMORE COLLEGE

Organic Lawn Initiative

The Scott Arboretum and Swarthmore College are transitioning the 5-acre lawn between Mertz Residence Hall and Magill Walk to an organic management program. Since Fall 2010, our practices have focused on improving soil structure and nutrient availability. We regularly aerate the soil and apply only natural products. Our goal is to reduce chemical inputs and increase sustainability, while maintaining the lawn's beauty. This pilot project allows us to evaluate the possibility of expanding organic practices to other areas of the landscape. As a demonstration site for local homeowners and horticultural professionals, it aims to influence landscaping practices beyond the campus.

A Holistic Approach

The Swarthmore College Organic Lawn Initiative is based on the premise that healthy turf is best achieved and sustained by maintaining healthy soil. When soil texture, organic matter ratios, moisture content, and biodiversity are well balanced, natural nutrient cycling provides what plants need to grow and thrive. Synthetic herbicides and fertilizers may distort this system, often harming populations of beneficial microorganisms.

Lawn management under this initiative includes aerating the highly-used, highly-compacted Mertz lawn each spring and fall with a machine that uses vibrating tines to fracture the soil, loosening deep into the soil profile. Less compacted soil allows compost tea, water, air, and microorganisms to penetrate deeper and allows root systems to expand, fostering healthy development. As the grass absorbs more water and slow-release nutrients, blades exhibit steady growth. This healthier grass competes better against undesired species, reducing weed competition in the lawn.

Gardeners apply compost tea twice a year to restore important microorganisms to the soil ecosystem. The organisms feed on the organic materials present –including grass clippings and humus – and they release plant-available nutrients as byproducts of their metabolism.

The AERA-vator aeration machine vibrates and loosens the soil on Mertz lawn twice a year.

Pollution and Resource Conservation

Societal demand for open lawns has brought with it often-overlooked environmental stresses: conventional maintenance programs consume large quantities of water and fossil fuels, and pollute the air and water. Grass stimulated by quick-release, petroleum-based fertilizers grows quickly and needs to be mowed frequently. Lawn mowers in the US use 800 million gallons of gas each year, emitting greenhouse gases (e.g. carbon dioxide) and 5% of all national volatile organic compounds (e.g. carbon monoxide – a potent air polluter and contributor to ozone formation). Also, on the East Coast, about 30% of residential water – more than 7 billion gallons per day – is dedicated to lawns and gardens; the arid West and Southwest draw even more.*

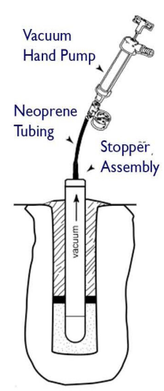
By restoring beneficial organisms and natural nutrient cycling systems in the soil, organic lawn treatment fosters slow and constant grass growth, reducing mowing frequency by up to 50%.** Healthier root systems retain more water, decreasing runoff and reducing the need to irrigate.

*US Environmental Protection Agency
**Harvard Yard Soils Restoration Project

Research and Monitoring

Evaluating the biological, chemical, and physical changes of the organic lawn is an essential component of the Organic Lawn Initiative. Turf and weed density, nutrient concentrations, and soil compaction are all indicators of the health of the lawn and will be monitored throughout the duration of the project.

Swarthmore students test lysimeter equipment in the lab before installing it in Mertz lawn.



Lysimeters – PVC tubes with porous ceramic tips that pull water out of the soil when a vacuum is applied – are used to collect water samples from the soil (pictured above). Student researchers run lab tests on these samples to track fluctuations in pH and concentrations of nitrates and phosphates on the organic lawn and compare them to a nearby conventionally treated lawn. The College has partnered with the Chester-Ridley-Crum Watershed Association to test for the presence of these nutrients in the surface water runoff that flows into Crum Creek. Irrigation, mowing frequency, and turf aesthetics are also being tracked.

Data collected during the transition will allow staff to make necessary adjustments to the maintenance program and share the results of our approach with others interested in organic lawn care. Experimental design, field and lab work, and data analysis are carried out by students working with college faculty.

Organic in the Swarthmore Ecosystem

The expansive lawns of "the most beautiful campus in the United States" are frequented by students, faculty, staff, local families seeking recreation, and native fauna who call this land home. Although Swarthmore College has long subscribed to integrated pest management (IPM) principles to minimize pesticide spraying, organic lawn management goes a step further to reduce the risks that the synthetic compounds pose to our community members. "EPA evaluates pesticides to ensure that they will not have unreasonable adverse effects on humans, the environment, and non-target species, but because they are designed to kill or otherwise adversely affect living organisms, pesticides may pose some risk to humans, animals, or the environment."*

Wildlife – Mertz lawn is closely integrated into a vibrant, if subtle, ecosystem. The soil supports diverse populations of microorganisms and invertebrates, food for macroorganisms including birds such as Barn Swallows, American Robins, Northern Flickers, and Baltimore Orioles. Bioaccumulation causes some synthetic herbicides to be classified as "highly toxic" to these birds, bees, or marine organisms.**

Watershed – Swarthmore College is located within the Crum Creek watershed, home to eels, beavers, trout, and turtles. The stream also hosts phosphorus-limited algae populations; small increases of this nutrient may cause sudden algal blooms, upsetting delicate ecosystem balances. Because the organic lawn may be able to better retain nutrient additives, they are less likely to pollute waterways.

*US Environmental Protection Agency
**University of Florida IFAS Extension

The Northern Flicker can often be seen feeding on insects that live in Swarthmore's many lawns.

Organic in Home Lawns

Home lawns comprise 70% of Pennsylvania's 2 million acres of turfgrass.* Like choices made by large institutions, lawn care practices at the individual level have cumulative environmental impact and directly affect the health of residents. Here are some steps you can take in your home lawn:

Soil Tests – Local laboratories can help determine the soil conditions of a site. You can send a soil sample for nutrient and organic matter analysis to PSU-Extension for as little as $14. Visit: aasl.psu.edu/howto.htm

Compaction – To test your soil's compaction, stab a screwdriver into the soil – if it is difficult to fully insert, this suggests a compaction problem. If your soil is compacted, local hardware stores rent home-scale aeration machines.

Compost Tea Brewing – This project brews compost tea up to 250 gallons at a time, but compost tea can be brewed on a much smaller scale. Harvard has compiled instructions on how to easily construct your own home brewer: http://www.uos.harvard.edu/fmo/landscape/organiclandscaping/

*Penn State College of Ag. Sciences Center for Turfgrass Science