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Department of Landscape Architecture,
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Integrating Landscape Performance

My class is a two-credit course taught in the final year of our MLA program. It is intended to extend and polish the plant knowledge of our students. As such, there are three distinct areas covered: basic botany, plant identification methods, and basic plant ecology. Adding landscape performance as a program layer proved to be worthwhile experiment; it provided a rubric within which we could discuss the three focus areas and demanded clarity of observation methods.

We set about defining our approach to quantifying **Rain Garden Landscape Performance**. Our goal was to identify important categories of information and find straight-forward objective and quantifiable subjective approaches. As a result, we hope that we have developed a clear process that could reasonably be completed by anyone, from landscape architect to student intern to citizen scientist.

But, this is only a beginning. I would love to get feedback from educators who try to follow our approach, especially from other parts of the country. What works? What needs adjustments? What do you think can be replaced by your idea?

Our Process

Much of what we did and how we did it is well documented in the accompanying *Rain Garden Measurement & Evaluation Guide*. But what follows is a brief overview of the approach I took to the development of the overall process as a portion of class time and field study.

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During the first four weeks of class we developed a system of assessing the rain gardens landscape performance and eventually collected data at seven sites. Our goal was to create a system that would be straight-forward and could make assessments rapidly. We completed field work in less than two hours with four to seven students involved. Individual student assignments included running the soil texture analysis and creating the summary sheets; tasks were assigned as homework.

Here is a brief overview of our course-long process: We began with plant identification. We visited the rain garden in front of our building and collected examples of all the species we could find. In the classroom, students learned to use *Newcomb's Wildflower Guide* to identify forbs (herbaceous plants with showy flowers) and *Field Guide to the Grasses, Sedges and Rushes of the United States* to identify graminoids (grasses and grass-like plants). This exercise demonstrated the depth of species diversity on a site and taught how one differentiates plant species. In class discussion, we agreed that identification to species of all plants in a garden was not a realistic requirement for the rapid assessment tool we wished to develop. Therefore, we agreed that we would continue to find as many species as possible and, instead of identifying them to species, we would count the number of species in the following categories:

Category	Sub-Category	Number of Species	Estimated % Cover
Ferns		#	%
Gymnosperms		#	%
Angiosperms		-	-
	Trees	#	%
	Shrubs	#	%
	Vines	#	%
	Forbs	#	%
	Graminoids	#	%
	Other Monocots	#	%

We agreed that using these categories would be within the capacity of any landscape architect and would provide a rapid and meaningful method for calculating diversity. *Species richness* can be calculated by adding the number of species in all of the categories.

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For *diversity*, we chose the simple and widely used Simpson Diversity Index:

$$D = 1 - \left(\frac{\Sigma\, n(n-1)}{N(N-1)} \right)$$

n = the total number of organisms of a particular species
N = the total number of organisms of all species
From: https://geographyfieldwork.com/SimpsonsDiversityIndex.htm

In our case we used the *% cover* for each category in the calculation. The other option would have been to use the number of taxa in each category, but again, our decision was informed by ease and speed of process while achieving reasonable accuracy.

The next step in developing our process addressed soil conditions. After two lectures/discussions about soils, we began collecting soil samples and performing water infiltration tests at each site we visited. The purchase of a Turf-Tec Infiltrometer and tube sampler soil probe facilitated this phase of work. We found that the following information was useful and easily collected:

(a) Site Level Soil Type (using the NRCS WebSoilSurvey),
(b) soil texture (with soil collected systematically in the garden and analyzed using a LaMott Soil Texture Kit), and
(c) saturated soil infiltration rate (K_{sat}) at systematically selected points in and near the garden.

Our final development in the process introduced methods for subjective quantification of Ecological and Aesthetic Considerations. The latter, the students agreed, was of particular importance if the rain garden was to be socially appreciated and accepted for the long-term in a landscape.

I will leave you to review the attached report for greater detail about the process and to examine several of the student generated assessments for the sites we visited. But worth noting, as we developed these processes and applied them in the field, I observed among the students a truly high level of engagement. They readily developed and tweaked sampling processes. They

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were eager to be involved in all parts of the site visits and found ways to take turns at different roles so that everyone could have a chance to do everything. As we got close to finishing the sampling and beginning the design exercise, I felt they had a good to excellent understanding of what was required to make a high performing rain garden.

The Final Project

The final exercise for the class was the design of a rain garden for a site on Busch Campus in Piscataway, NJ. The site is relatively small and roof gutters are already draining into an area designed to manage stormwater, but instead of plants the present design only employs river stones. This assignment was intended to test how well the students understood the technical and aesthetic issues of developing a planting design for a rain garden. Four examples of the resulting designs are included as PDFs for your review. The design jury was made up of staff from campus Facilities Office who design or manage rain gardens. They found the designs to be realistic and will review them for possible implementation. The practical insights that students gained from their input was invaluable.

What to change and improve

Thanks to the funding from LAF, this class included off-campus field trips and new pieces of equipment. Funding field trips can be difficult at our University, but enough examples of rain gardens can be visited on or near campus to teach how to use the methods. In future years, off campus rain gardens will be assigned as homework so students can visit them independently and report back to the class. The equipment and materials that were purchased for the class should last several years, so these parts of the exercises can certainly continue.

I was surprised at the aesthetic scores the students gave the sites we visited. The scores are higher than I would have assigned myself and I wonder if the students would give gardens that were not functioning rain gardens the same high scores. I may include some aesthetic and ecological assessments of campus gardens that are not designated as rain or conservation gardens with next year's students. I suspect I will see a difference in scores.

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One of my disappointments is that we did not systematically collect information about maintenance, management and related issues. At each site, we spoke to the designer, maintenance staff, or supervisory staff. Their stories, examples, points of pride and frustration would add an essential layer of information. Since I believe that ongoing maintenance is a necessity to long-term effectiveness of rain gardens, I regret this shortcoming and think I will re-engage the people who manage these sites and see if I can add the information.

Some words of thanks

James Erdogdu was very generous with his knowledge and time. His enthusiasm for creating more rain gardens on campus was contagious. His practical insights and the diversity of sites he showed the class helped shape our study and results.

Tobiah Horton kindly set up opportunities for us to visit some of the rain gardens he has designed over the past 5 years. His experience in design, implementation and community outreach informed our observations and our data collection process. His availability to answer questions and react to our development of ideas was critical.

Michelle Bakacs shared her experience with successful and failed designs. Her depth of knowledge about the site she showed us helped students grapple with the difference between design intentions and implementation realities. Her honest answers about the things that can go wrong are priceless.

Brian Clemson played several roles. He helped me find James. He gave an excellent lecture on planting design and provided important technical guidance in class. He also helped with technical reviews of student designs, giving feedback that will serve students well as they become professionals.

Megan Barnes' encouragement and positive attitude was consistent and appreciated. LAF's financial support made this work possible and enlightening. The way I teach Advanced Plants has been permanently improved.