Low Input Grounds Care Research Proposal
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Background

Low-density, intensive land development has wide ranging and long lasting impacts on environmental quality, economic opportunity and quality of life for Lake Champlain basin communities. One of the principal impacts of development and urbanization is stormwater runoff which degrades water quality in the basin. Stormwater causes stream instability and erosion, and also contributes excess sediment to tributaries and degrades aquatic habitat in developed areas. USEPA lists 12 waterways in the basin as impaired by urban stormwater runoff, principally in urban or suburban watersheds (USEPA 2012). Stormwater runoff contains numerous pollutants, of which phosphorus, toxins, pathogens and sediments are of significant concern. Lake Champlain is impaired by phosphorus (USEPA 2016, NY DEC 2009). Acre for acre, runoff from developed land in the Lake Champlain basin contributes up to four times more nonpoint source phosphorus, the primary pollutant threatening the lake, than average agricultural lands and seven times more than forests (Troy et al. 2007). In 2001, developed land was the largest contributor of phosphorus to Burlington Bay (about 99 percent) (Lake Champlain Basin Program 2012a). Traces of lawn care chemicals found in surface waters led to restriction of pesticides by the City of Burlington (VTDEC 2001).

To reduce the amount of stormwater runoff entering tributaries and Lake Champlain, Lake Champlain Sea Grant is working with partner organizations to promote low input grounds care practices by communities, businesses and individuals. Primary outreach messages include fertilizing only in the fall and if soil tests demonstrate a need, cutting grass no shorter than 3" in height, cutting no more than 1/3 of the blade length at any one time, and leaving grass clippings to decompose in the lawn. These practices promote development of soils rich in organic matter, which both allow water to infiltrate more easily due to increased pore sizes and hold more water (Bot and Benites 2005), reducing stormwater runoff. In agriculture, infiltration rates have been demonstrated to double in areas in which no till practices were used in place of conventional tillage practices (Bot and Benites 2005). Root length increases with longer vegetation, and decomposers are diversified and increase in population, thereby increasing soil pore spaces. As a result, water holding capacity of soil also increases. Water holding capacity was demonstrated to double as soil organic matter went from 1 to 3% in one North Carolina study (Hudson 1994).

In the Lake Champlain Basin, on average, only 23% of people cut their grass to 3" in length or more (LCSG 2016). While 73% allow the clippings to stay on the lawn after cutting (LCSG 2016), if too much organic matter is left to decompose, that process can be hindered due to creation of anoxic conditions and loss of decomposers (Bot and Benites 2005). Cutting more than 1/3 of the blade at a time may hinder the decomposition process, and reduce development of organic matter. Further, cutting grass to shorter than 3" may reduce root length, thus limiting infiltration capacity of the soil.

As Lake Champlain Sea Grant's mission is to develop and share science-based knowledge to benefit the environment and economies of the Lake Champlain Basin, the goal of this research is to assess soil moisture, organic matter, root length, and drought resistance of grass over time at a series of demonstration sites primarily located at commercial businesses or public spaces. The research will provide an outreach opportunity to engage the public in understanding the influence of simple and inexpensive shifts in lawn care practices to promote

production of soil organic matter, and minimize runoff. It will also provide data to confirm or deny that such practices promote soil organic matter development in the Lake Champlain Basin.

Methods

In Spring 2017, up to 30 businesses that are members of *Vermont Businesses for Social Responsibility* within the Lake Champlain Basin and with lawns will be identified. They will be contacted in random order to assess their interest in partaking in a 10-year demonstration research project for low input grounds care methods in the Lake Champlain Basin. Once 10 businesses have agreed to take part in the project, the remaining businesses will be contacted to assess their interest in signing on to adopt low input grounds care practices as described above (simply to serve as demonstration sites to promote the practices with reference to the research website for results; not to serve as additional research sites). This option also provides the opportunity for businesses already undertaking such practices to highlight their implementation of recommended best "green" practices for the public.

Working with a graphic artist, signs (like election campaign signs) will be developed to place on the demonstration properties to identify the key lawn care practices that are being implemented and a website for more information. The Lake Champlain Sea Grant (and/or lawntolake.org) website will be updated to include background information about the research, and links to guidance materials and best recommended practices for lawn maintenance in the Lake Champlain Basin. As results become available, they will be posted and advertised via Lake Champlain Se Grant website, press releases to local news sources and Front Porch Forum lists.

A control plot 10' x 10' in area and a test plot of the same size will be demarcated and labeled with a sign at each participating research demonstration site. The control area will be maintained to a height of 2 inches, and clippings will be allowed to fall to the ground to decompose (representing practices of, on average 52% of Lake Champlain Basin homeowners who maintain their grass to 2-3" in length, and 73% who allow clippings to remain on the land). Mowing will take place weekly. The test area will be maintained to a height of 3", allowing the grass to grow to 4" and then cutting back to 3" as needed.

Pretreatment soil tests will be conducted following standard practices in June, once grasses are fully in their growth phase for the season. Soil samples will be delivered to the UVM Extension lab for "home grounds" testing (http://pss.uvm.edu/ag_testing/?Page=soils.html). This test will identify soil pH, organic matter, available phosphorus, as well as other nutrients and micronutrients, and fertility recommendations. Five test areas within each plot will be used to determine average root length at pretreatment conditions in both the test and control plots at each site. In addition, photos will be taken of the control and test plots over time, to assess if a visual difference in grass health can be observed. As longer grass with longer roots should be more drought resistant, greener grass is anticipated at test sites during periods of drought. Daily precipitation and mowing schedule for each control and treatment plot will be recorded. Care for the plots will be undertaken by UVM undergraduate interns or Lake Champlain Sea Grant staff (if interns are not available).

Initial year post treatment soil and root length sampling will take place in early October 2017 (before they become dormant for the winter). However, as soil organic matter development will take an extended time (years rather than months), the research demonstration plots will be maintained, and sampling continued (pending available resources to support student and staff time) until 2026. A partnership with the introductory soils lab at UVM (taught be Don Ross) is being explored for soil sample analyses.

Research Demonstration Site Schematic

Site	Control Plot (Lawn cut to 2", clippings left, weekly cutting)	Test Plot (Lawn cut to 3", clippings left, cutting only from 4" to 3")
Business 1	X	X
Business 2	X	X
Business 3	X	X
Business 4	X	X
Business 5	X	X
Business 6	X	X
Business 7	X	X
Business 8	X	X
Business 9	X	X
Business 10	X	X

Budget

Item	Cost Each	Quantity	Est. Shipping	Total Cost	Company	Product ID
String and stakes to mark sites				$50	Gardener Supply?	
Soil Sampler	$20	1	$10	$30	Forestry Suppliers (Gardener Supply?)	76971
Soil sampling shovel	$50				Forestry Suppliers (Gardener Supply? Borrow?)	
Plastic bags for soil samples	$5	1	--	$5	Grocery store	
Soil Tests	$14	40 (2 per control and 2 per test site at 10 locations)	--	$560	UVM Extension	"Home Grounds" test
Graphic Artist time				$300		

Sign printing	$15	30 (min. 10 for the research only sites)	$100 (est. $20 for research only sites)	$ 550 ($170 for research only sites)	Vista Print or local	"Yard Signs"
Lawn mower	$120	1	--	$120	Borrow or buy?	
LCSG student intern time	$11/hr	12 weeks x 20 hrs/wk = 240	--	$2,640		
Intern fringe				$264		
UVM truck	$50 (est)	16 weeks x 1-2 days/week = 28 est.	--	$1400	RSENR truck	
				$5,969		

Results and Analyses

Following post soil sample collection and analysis, descriptive statistics will be determined for each site for root length, soil organic matter, and soil moisture. Information sheets with photos will be Data from each of the 10 sites will be compared via mixed effects regression model to assess the relationship between control and test sites. Anonymous raw results and analyzed summary results will be made available on the project website. Site specific results will be shared with the individual businesses. A public-friendly rack card and/or infographic will be created to share recommended practices.