

Changing Homeowner's Lawn Care Behavior to Reduce Nutrient Losses in New England's Urbanizing Watersheds

Final Social Science Project Evaluation Report
July 15, 2010



Dr. Brian W. Eisenhauer
Associate Director
Center for The Environment
Plymouth State University

Nicholas Stevenson
Christian Weber
Center for the Environment
Plymouth State University

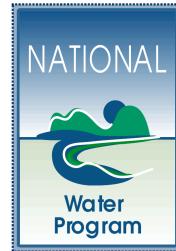
Julia Peterson
Extension Specialist
NH Sea Grant
University of New Hampshire

Project Partners:



Funding Information:

Funding for this project was provided in part by USDA CSREES project # 2006-51130-03656



Acknowledgements:

The authors of this report would like to thank the project team for all their invaluable contributions and, the people living in communities throughout New England who took their time to share their opinions to help protect water quality.

All research conducted involving human subjects received federally approved Institutional Review Board approval.

ContentsPage Number

<u>Contents</u>	<u>Page Number</u>
Executive Summary	1
Introduction: The Importance Of <i>Changing Homeowner's Lawn Care Behavior to Reduce Nutrient Losses in New England's Urbanizing Watersheds</i>	2
Goals For The Evaluation	5
The Effectiveness of the Outreach Campaigns: The Survey of Residents in Four States	6
Introduction and Research Methods	6
Results	7
Conclusions - The Effectiveness of the Outreach Campaigns: The Survey of Residents in Four States	15
Findings From The Message Evaluation In Maine	16
Introduction and Research Methods	16
Results	18
Conclusions – Message Evaluation In Maine	29
The Formative Evaluation of the Project Process: In Depth Interviews with Team Members and Stakeholders	30
Introduction and Research Methods	30
Results	31
Conclusions – Message Evaluation In Maine	36
Evaluation Conclusion	38
Appendices	
Questionnaire Used to Evaluate The Effectiveness of the Outreach Campaigns: The Survey of Residents in Four States	41
Questionnaire Used To Determine The Effectiveness of Various Approaches to Framing and Delivering Specific Messages: The Evaluation in Maine	45
References	52

Executive Summary

NPS pollution is a major threat to water quality, and the Changing Homeowner's Lawn Care Behavior to Reduce Nutrient Losses in New England's Urbanizing Watersheds project was designed to merge turf science, social science, and Extension knowledge and efforts into a concerted effort to change DIYers' turf care behavior to protect water quality through the development and delivery of outreach and education. Evaluation research is an essential part of any effort to understand if a project achieved the intended results. In addition to judging if a project was successful, evaluations can also include a formative component that analyzes project processes to inform the design of future projects to improve their effectiveness. The evaluation of this project to protect water quality was designed to achieve three goals.

The first evaluation goal was to determine if behavior change occurred among members of targeted audiences by conducting post-project surveys in four of the study communities surveyed in the original social science research in the project. Data from all communities (n= 103) indicated that some DIYers' turf care behaviors had changed in the ways that the project had intended: using less chemicals for turf care. As with many education efforts a major challenge is reaching audiences. Fifty-five percent of respondents experiencing Extension programs stated they used less lawn chemicals as a result, but only 25% of respondents had encountered turf care information from Extension in the last 3 years. Overall results indicate the project achieved desired goals, but perhaps not at the magnitude desired. Continued efforts to apply the information generated by the turf science and social science research in this project are warranted to protect water quality impacted by turf care practices.

The second evaluation goal was to examine the results from the project and also to evaluate the effectiveness of various message framing approaches using an experimental research design model to identify the most effective ones for instigating behavioral change. These efforts required not only a more sophisticated research design, but also a larger sample size (n=139). The study site in Maine was able to leverage the research from this project into a larger campaign than in other study communities, and the data indicate that their efforts were successful. A relatively large number of residents had encountered the campaign, and those who had were statistically significantly more likely to have reduced their use of lawn chemicals than those not seeing any campaign materials. Perhaps even more importantly, the normative framing of messages was the most effective at stimulating behavior change, an important finding for framing messages in future endeavors.

The third evaluation goal was to conduct a formative evaluation to assess the workings of the project itself, as well as its outcomes. Responses from in-depth interviews (n=22) with key stakeholders indicate that project results reached some desired educator audiences, but that there were variances in how much the project information was applied in each state. The majority of educators exposed to project information are using it, and they found the turf science and social science valuable for providing usable information. However, the greatest concerns expressed were over the need for more dissemination of the information from the project, among both professional educators and audiences. Respondents knowledgeable about the workings of the project consistently commented on the quality of the project team and how well the endeavor was coordinated.

Introduction: The Importance Of Changing Homeowner's Lawn Care Behavior to Reduce Nutrient Losses in New England's Urbanizing Watersheds

Like many regions of the country, New England is experiencing high rates of conversion of formerly agricultural and forested lands to residential development. Acres that were once farms or forests are being subdivided and covered with asphalt, buildings and turf. Often, newcomers are trading their small homes on small lots in high-priced metropolitan areas for large homes on large lots at the suburban-rural fringe or "exurbs". This conversion and high pressure to convert is believed to be the result of a complex mix of influences within the region including housing costs, second home markets, tax structures, lack of permanent land protection, technology and an aging population.

Along with the conversion of land comes a conversion of ownership from one land steward (e.g. farmer or woodlot manager) with primarily commercial or traditional interest in the land to many land stewards (e.g. subdivision residents) with primarily non-commercial interest in the land. The acreage that was once under a single land manager is now under many land managers with diverse interests, attitudes, knowledge, practices and connections to the land. When land is converted from farm or forest to residences, water quality threats may compound because of both environmental and behavioral influences. Ecologically functioning natural areas become developed areas and land stewardship transfers from a single, presumably prudent owner to multiple owners with varying levels of environmentally responsible behavior.

When land is converted for urban and suburban purposes, a turfgrass lawn is often planted as ground cover (Jenkins 1994). The effects of lawns and lawn care behavior contribute to a variety of negative impacts on the environment, including degrading water quality through the use of lawn chemicals (such as fertilizers and pesticides), diminishing air quality through lawn mower exhaust, and increasing water consumption for watering (Bormann et al. 2001). An issue of particular importance concerns fertilizer and pesticide runoff from lawns, which is a significant contributor to nonpoint source pollution (NPS). Fertilizer runoff has been associated with algal blooms, eutrophication, and contaminated groundwater and pesticides can be very toxic to humans and copious non-human species. In fact, the United States Environmental Protection Agency (EPA) states that nonpoint source pollution is the Nation's leading source of water quality degradation (EPA's "Managing Nonpoint Source Pollution from Households" 2009). While residential contributions are not the only source of excess nutrients in threatened and impaired waters, they are significant. That significance is expected to grow as greater amounts of land are converted from farms, fields and forests to residential uses.

Excess nutrients pose a threat to many water bodies in New England, both coastal and inland. While nitrogen (N) is considered the limiting nutrient in estuaries and phosphorus (P) in fresh waters, residential runoff is considered a source of both. The ability of forested land to sequester nutrients more efficiently than developed land is well documented. In Maine, Dennis (1986) reported that runoff from a low density, single-family residential development exports five to ten times more phosphorus than an adjacent forested watershed. In addition, coastal watersheds show increasing concentrations of nitrogen attributed to various causes including wastewater treatment facility effluent, lawn fertilizer residue, septic systems, atmospheric deposition and runoff, which are all related to population growth and its associated land development patterns.¹

¹ Determination of nutrient inputs was derived from *A Technical Characterization of Estuarine and Coastal New Hampshire* (Jones, 2000), which "provides a comprehensive compilation of information on key issues related to water quality and natural resources in the estuaries of New Hampshire."

Despite concerns with N losses from turf, there have been relatively few changes in fertilization practices of lawns in the past 30 years. There are no reliable soil-based N tests used to guide N fertilization of turf, and only a scant few golf course superintendents rely routinely on tissue N testing. The majority of lawncare professionals and homeowners still rely on decades-old fertilization recommendations and practices where N is applied on a schedule at a set rate (usually 49 kg N/ha at each application, three or four times a year) rather than being based on soil nutrient availability as measured by an objective testing method. This greatly increases the chance of over-application of N, thereby posing a threat to water quality. Soil tests are routinely used to guide N recommendations for most agricultural and horticultural field crops, but development of such tests are lacking for turf. Without objective tests to guide if and how much N is needed for lawns at any given time, applicators of fertilizers are only guessing; and they frequently guess incorrectly.

Concerns with P losses from turf have prompted some municipalities to ban the use of P-containing fertilizers in sensitive watershed areas. Routine soil tests for P can indicate critical levels of soil extractable P required to maximize quality and growth responses of turf (Guillard and Dest, 2003). Applications of P-containing fertilizers that result in soil extractable P beyond critical levels needed for optimum plant growth increases dissolved reactive P losses in runoff (Sims et al., 2002; Morris et al., 2006) and in leachate (Maguire and Sims, 2002). There is a need to promote the use of more recent soil P test results to guide P fertilization of turf. It is time to implement changes to long-standing lawn fertilization practices that will address current water quality concerns.

Other than in a handful of cases (such as around Lake Champlain VT) the harmful lawn chemicals, found in increasing abundance in the nation's surface and ground waterways, remain largely unregulated despite congressional appeals and testimony. It is also noteworthy to mention that NPS problems caused by fertilizer and pesticide use have yet to be adequately addressed some 30 years after the passage of the Clean Water Act (Adler et al. 1993). This is testament to the difficulty in managing NPS pollution not only due to its diffuse source, literally millions of lawns across the country, but also because it works against the cultural auspices of maintaining the traditional lawn.

There are a range of organizations interested in influencing lawn care practices, such as University extension, watershed councils, and state and federal agencies. In most cases, these organizations are encouraging voluntary behavioral changes aimed to reduce environmental impacts, such as leaving clippings on the lawn, eliminating the use of lawn chemicals, and mowing less often. These non-regulatory approaches used to address this issue seem the best, and perhaps only, method given the challenges present for addressing NPS pollution. However, there has been very little research that either investigates lawn care behavior or evaluates the effectiveness of programs used to promote environmentally responsible lawn care behavior (Robbins et al. 2001).

To help address the issue of NPS pollution from lawns in New England the research project titled *Changing Homeowner's Lawn Care Behavior to Reduce Nutrient Losses in New England's Urbanizing Watersheds* was developed (USDA CSREES (now NIFA) project # 2006-51130-03656). This project was funded by the United State Department of Agriculture's (USDA) Cooperative State Research, Education, and Extension Service (CSREES), which recently was renamed to be the National Institute for Food and Agriculture (NIFA). This regional study is located in the northeastern region of the United States and includes the states of New Hampshire, Maine, Vermont, Rhode Island, and Connecticut.

This research project is a multiple university trans-disciplinary project integrating different academic fields into a cohesive effort, and is quite novel in its subject, extent, and multifaceted collaboration. The universities involved include the University of New Hampshire, the University of Maine, the University of Connecticut, the University of Rhode Island, the University of Vermont, and Plymouth State University. This project involves the integration of both soil chemistry and social science research. This project also employs the knowledge, expertise, and efforts of various extension programs throughout the region for guidance and implementation. This group corroborates the scope and complexity of the issue at hand, and the necessity of having such a diverse interdisciplinary team.

Many beneficial research and extension outcomes have resulted from this project. The soil science research was used to develop regionally specific recommendations for fertilizer use to minimize negative water quality impacts. The social science research looked into lawn care behaviors, the underlying factors that drive that behavior, the correlates of environmentally responsible behavior, and important considerations for program delivery. Additionally the level of trust and influence of opinion leaders (e.g. Master gardeners, local garden centers, mass media) and the relative influence of different types of informational messages was assessed. This research was instrumental in determining how best to facilitate behavioral change among people engaging in lawn care (also referred to as “Do-It-Yourselfers” (DIYers)) by elucidating target “problem” behaviors, better understanding the attitudes and concerns of the audience, guiding the development of appropriate messaging, and discerning the best avenues for information dissemination. Based on the research, outreach and education messages and delivery methods recommendations were developed for extension for delivery to DIYers.

Goals Of The Evaluation

Evaluation is an essential part of any project to determine if it achieved its objectives and to identify useful insights for future efforts. Throughout this multiple year effort progress reports on project activities, deliverables, the students supported, and the ways in which information was disseminated have been filed, providing documentation of many of these important outcomes. At the conclusion of a project it is important to supplement such benchmarks by reviewing the outcomes and process with those involved in the work. Findings from these interviews can contribute to a formative evaluation that may improve efforts related to this work, as well as future projects. Finally, to be useful in an effort designed to affect behavioral change evaluation must also include an examination of the effectiveness of the programs designed and delivered that directly involves the target audience, in this case lawn care DIYers.

To meet these goals this evaluation is divided into three parts, each reporting on separate research endeavors designed to:

- 1. Determine if measurable behavior change occurred as a result of this project by conducting a “post-test” evaluation survey of residents of the neighborhoods in NH, CT, VT, and RI sampled in the original survey stage of the behavioral research.*
- 2. Assess the effectiveness of various approaches to framing and delivering specific messages by conducting research using a survey of the residents of the neighborhood in ME sampled in the original survey stage of the behavioral research. The sample size of this evaluation survey in ME is larger than in the other four communities to enable the needed analyses, and the research design uses an experimental model.*
- 3. Examine the effectiveness of the project and its process using a second wave of interviews with a subset of stakeholders to inform this formative evaluation.*

The remainder of this report presents the research designed and conducted in each of the three parts of the evaluation identified above. Each section includes a description of objectives for each part of the evaluation research, the research methods used to collect data, and a presentation of key results, conclusions, and recommendations. An overall summary of conclusions and recommendations concludes the evaluation report.

The Effectiveness of the Outreach Campaigns: The Survey of Residents in Four States

Introduction and Research Methods

A critical task in any evaluation of communication efforts is determining the actual effects on the target audience. In this multi-disciplinary project designed to protect water quality by affecting DIYer's turf care behaviors a great deal of work in the natural and social sciences informed the development of methods and tools that could be used by Extension staff and others to protect water quality. To evaluate the effectiveness of these efforts a self-administered mail survey was conducted in four of the neighborhoods originally sampled in the social science work in this project. These neighborhoods were purposively selected in the original study design because of the presence of Extension efforts which would allow for the assessment of program effectiveness. The four communities included in this stage of the study were:

- East Lyme, Connecticut
- Milton, New Hampshire
- Brandon, Vermont
- East Kingstown, Rhode Island

Research questions were specifically developed to guide this stage of the evaluation that focused on the effects of the overall effort on the target population: DIYers in the neighborhoods in which extension activities informed by this project took place. Specifically, the research questions posed were:

Evaluation Research Questions – Second Survey of Study Neighborhoods

- *What were the fertilization lawn care behaviors of respondents during the last turf care season? What changes have occurred over the life of the project?*
- *How were their decisions about lawn care chemical application choices made?*
- *Have DIYers made any changes to their lawn care practices in the last 3 years (the timeline of the project)?*
- *If changes were made, why?*
- *Were respondents exposed to Extension information programs in the last 3 years? Through what vector?*
- *What effects did extension information programs have on DIYers?*
- *Who replied to the survey? Are there important differences across key demographics?*

After careful consideration and deliberation the sampling frame for the project was purchased from Survey Sampling International (SSI), a well-known and respected sampling service. SSI draws its records from a combination of phone listings, driver license information, and other available sources and asserts that more than 85% of the residents of a community are accounted for in their data. A review of the information available for the states involved in this research indicated that the rates of representation were even higher. Other options were available for developing the sampling frames, including building off property tax lists, but all introduced more potentially significant biases in the sample than the SSI alternative. It should be noted that while utility connection lists are nearly ideal for developing community samples, a recent NH court ruling made such data unavailable by law.

The survey was conducted in spring of 2010 using appropriate sociological data collection techniques, and was administered using a modified tailored design method (Dillman 2009) that employs several techniques intended to enhance response rates (including customizing letters, sending carefully timed

reminders in multiple waves of contacts, and providing information about the need for responses). Analysis of the survey data was conducted using Statistical Package for the Social Sciences (SPSS).

A total of 282 residents from these communities were sampled in proportions equal to those used in the earlier stages of the research which were determined to adequately represent the neighborhoods selected (NH-80, CT-79, RI-51, VT-72). Questionnaires were mailed out to potential respondents and 47 addresses were returned as non-deliverable, which results in 235 eligible recipients. A total of 103 completed questionnaires were returned, for a final response rate of 43.8% (n=103). A response rate of nearly 44%, is absolutely respectable in a general population community survey of this kind.

Results

What were the fertilization lawn care behaviors of respondents during the last turf care season? What changes have occurred over the life of the project?

To understand if the project was effective at reducing DIYer's use of lawn chemicals a necessary step is documenting the current turf practices of homeowners to determine if change occurred. To collect this data the evaluation questionnaire asked respondents to indicate how many times they used fertilizer, pesticides, and "weed and feed" products on their lawn last season.

Table 2.1. Percentage of Respondents Indicating How Many Times They Applied Lawn Chemicals During Last Season			
	<i>Fertilizer</i>	<i>Pesticides</i>	<i>Weed and Feed</i>
<i>Not Applied</i>	59.8	75.6	64.1
<i>1 Time</i>	27.2	17.8	26.1
<i>2 Times</i>	7.5	5.5	6.5
<i>3 Times</i>	2.2	0	1.1
<i>4 Or More</i>	3.3	1.1	2.2
<i>Total</i>	100.0	100.0	100.0
<i>Missing (Don't know)</i>	11	13	11
<i>Sample size (n)</i>	92	90	92

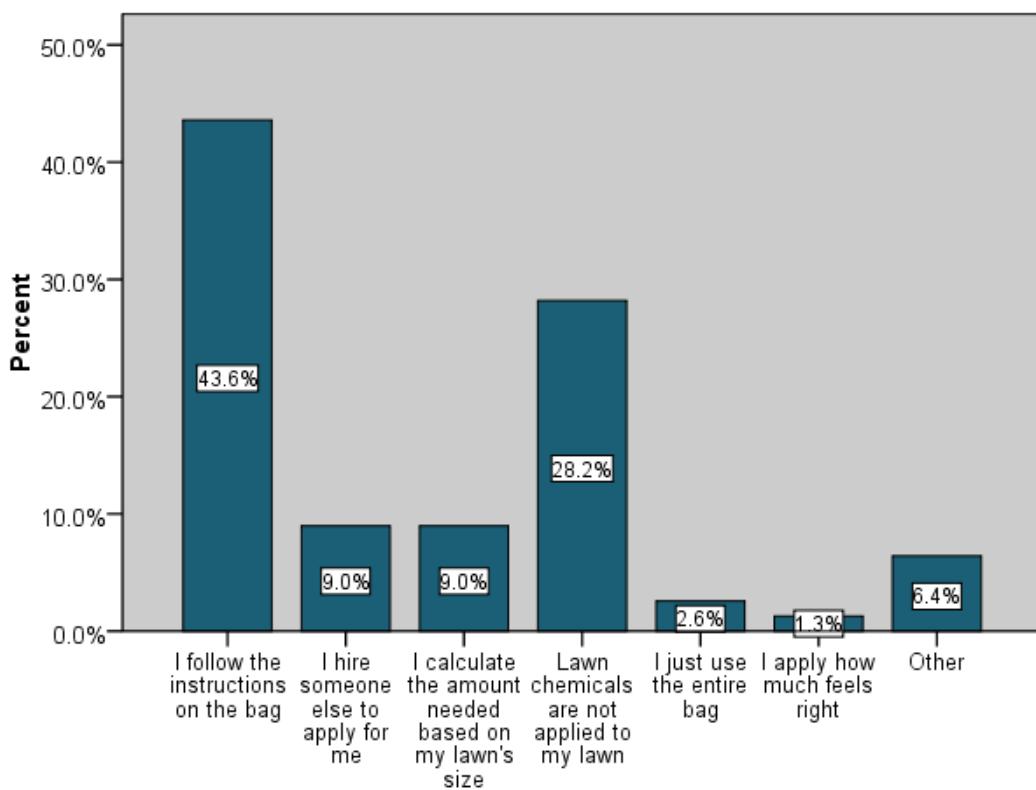
When comparing this data with data from the first behavioral research conducted almost four years ago in the same neighborhoods it is apparent that there have been reductions in the amount of fertilizer used by residents, which was the primary focus of the project. In the first survey only 9.1% of respondents claimed to fertilize less than one time per year on average, and 29.1% of respondents fertilized once per year. About 27% of respondents indicated fertilizing twice a year in the original survey, with 14% fertilizing 3 times a year and 20.6% claiming they fertilize 4 times a year or more. Clearly large reductions in fertilizer use in these neighborhoods are evident in the changes indicated by the data, which was a major goal of the project. Given the focus of the project only fertilization practices were examined in the first stage of the research, other practices were examined in the second survey to

provide information on related issues of interest but are not discussed further based on evaluation goals.

How were their decisions about lawn care chemical application choices made?

Determining how DIYers decide how much fertilizer to use on their lawn is an essential step in changing current practices, and has been one of the goals of the project. Social science data indicated that most respondents to the first survey relied on directions on the bag, and several project efforts have attempted to direct DIYers to more environmentally appropriate means of determining nutrient inputs for turf. The chart below indicates how respondents to the evaluation survey determine how much fertilizer to apply to their lawn.

Figure 2.1. How Respondents Determine The Amount Of Fertilizer Applied To Their Lawn



The results indicate that most fertilizer users still use information from the product packaging as the primary guide for decisions about how much fertilizer to apply to their lawns. There was a small increase in the proportion of respondents calculating need based on lawn size compared to the initial social science surveys, a positive sign for the project but one whose magnitude of change is not great. Continued efforts to encourage DIYers to use environmentally appropriate ways to determine how much fertilizer to apply are warranted.

Have DIYers made any changes to their lawn care practices in the last 3 years (the timeline of the project)? If changes were made, why?

To protect water quality the project was designed to instigate behavioral change in homeowners' turf care practices through the informed development and delivery of outreach and education. To measure changes directly respondents were asked to indicate if the amounts of fertilizer and pesticides used on their lawns have changed over the life of the project. The charts below report the results to these important evaluation questions.

Figure 2.2. Changes In Respondents' Fertilizer Use On Their Lawn Over The Last Three Years

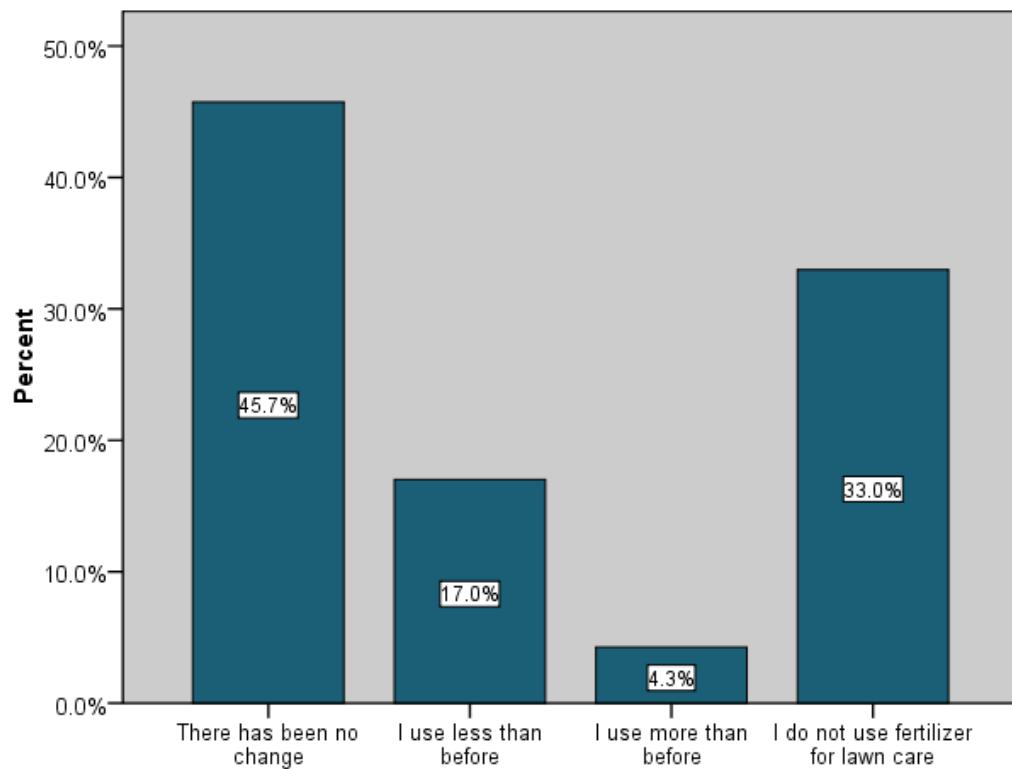
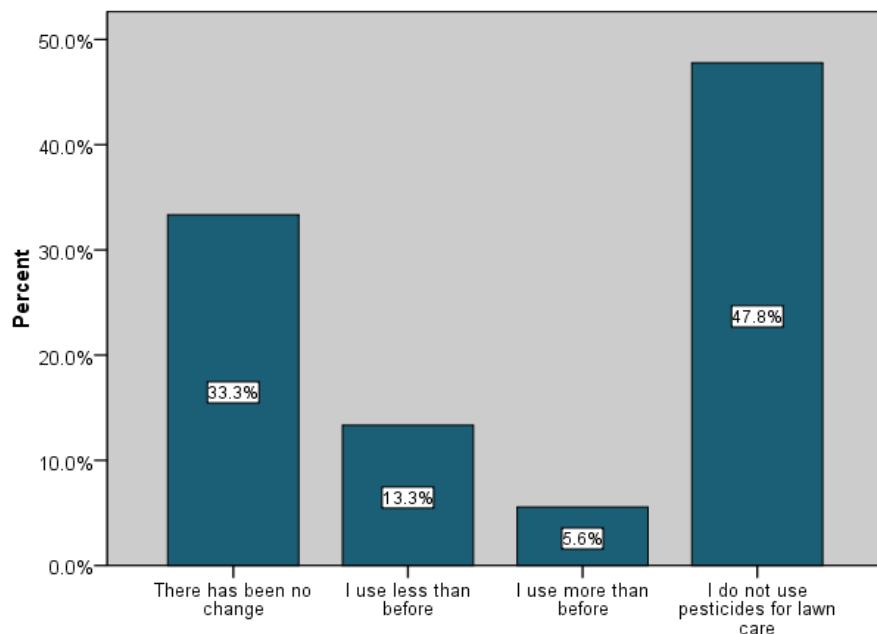
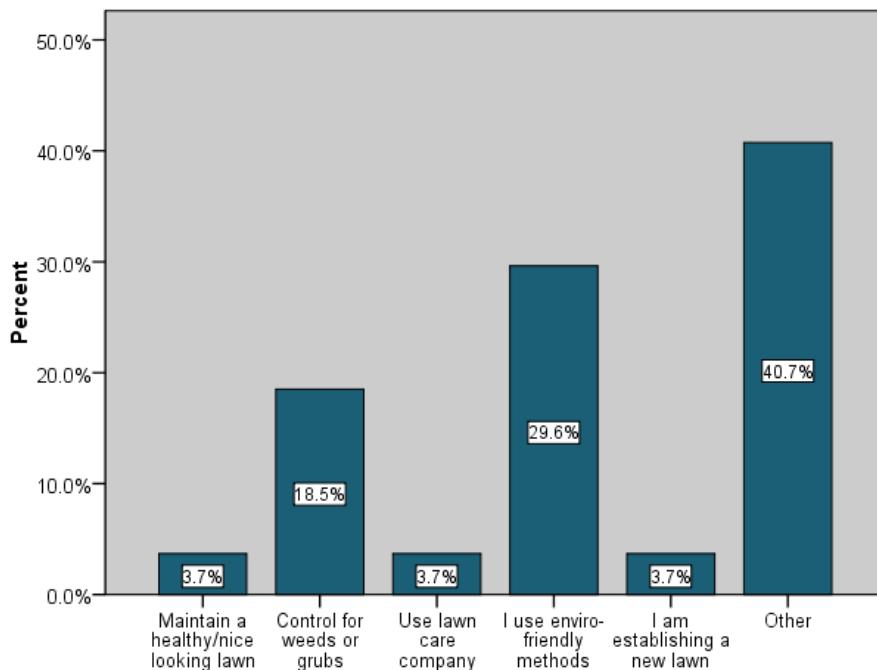


Figure 2.3. Changes In Respondents' Pesticide Use On Their Lawn Over The Last Three Years



The charts above indicate that 17.0% of respondents made changes to use less fertilizer on their lawns, and 13.3% reduced their use of pesticides. Only 4.3% of respondents are using more fertilizer in the last three years, and 5.6% are using more pesticides. While most respondents have not changed practices or do not use lawn chemicals at all, the changes that have occurred are in line with the goals of the project. To better understand project effectiveness it helps to document the reasons why respondents have changed their practices. The chart below indicates the reasons DIYers gave for any changes made.

Figure 2.4. Why Respondents' Lawn Care Practices Changed



Most changes were made as a switch to more environmentally friendly methods, which is the specific goal of the project and a key finding for supporting the effectiveness of the project, although it must be noted other reasons for the changes that were not tested for in this survey may be influencing this finding. An “other” response was also included with this questionnaire item and respondents were asked to fill in the blank. Responses in the “Other” category included:

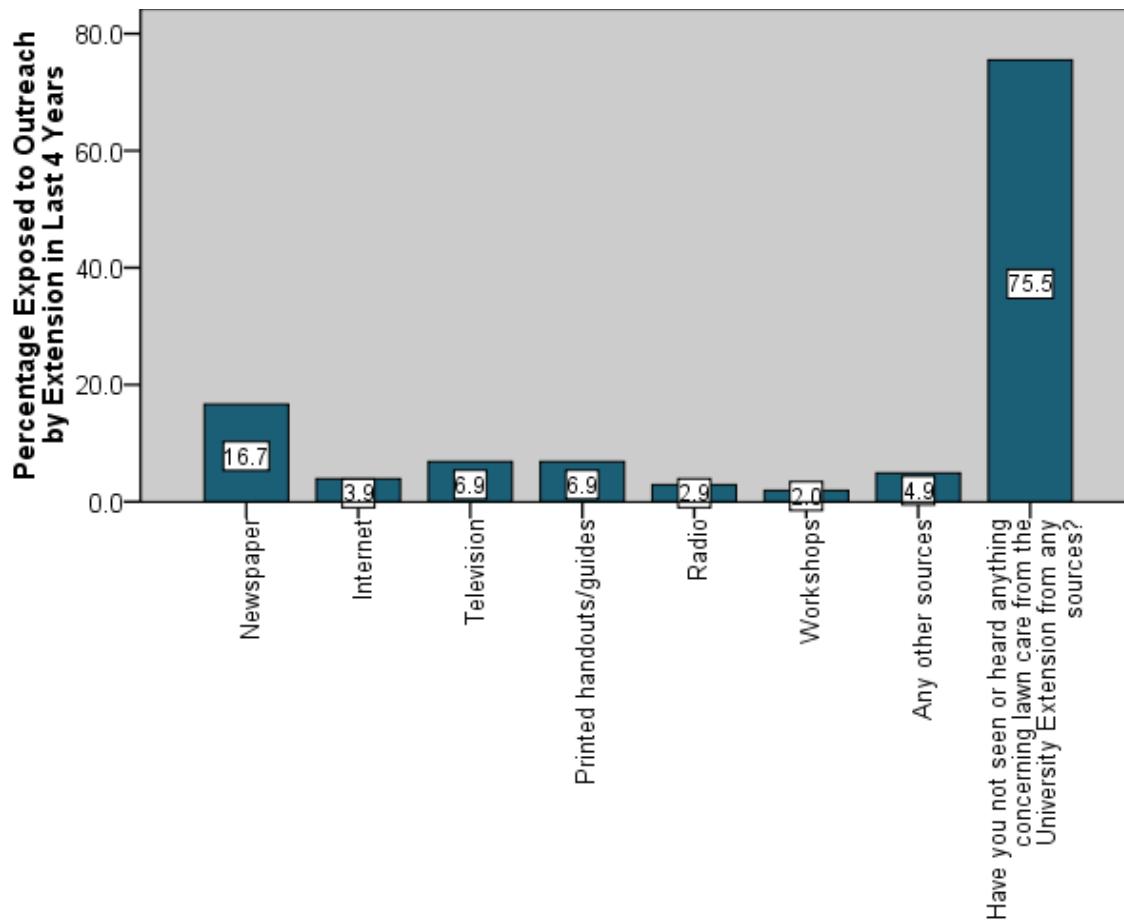
- Concern for local pond (1 response)
- Concern that lawn chemical use pollutes ground and surface water (1)
- Too expensive (4)
- No need for large amount of fertilizer or pesticide use, only for specific insect problems (1)
- Use sheep to mow/fertilize lawn (1)
- Concern for pets (1)

Overall these results reflect changes in practices that have the potential to improve water quality.

Were respondents exposed to Extension programs in the last 3 years? If so, through what vector?

Audience exposure to education and outreach is essential for its success, and in an evaluation it is important to determine if audiences were reached. In addition, by identifying the vectors through which information reached DIYers, future efforts can consider vectors when targeting their efforts.

Figure 2.5. Percentage of Respondents' Exposed To Lawn Care Information From Extension Through Various Delivery Vectors



The data above indicate that most respondents did not recall seeing information from University Extension, but that those who did encounter such information do so in a wide variety of ways. No single information delivery method stands out as the most effective one. Continuing to deliver information through a wide variety of mechanisms is important given the results.

What effects did extension information programs have on DIYers?

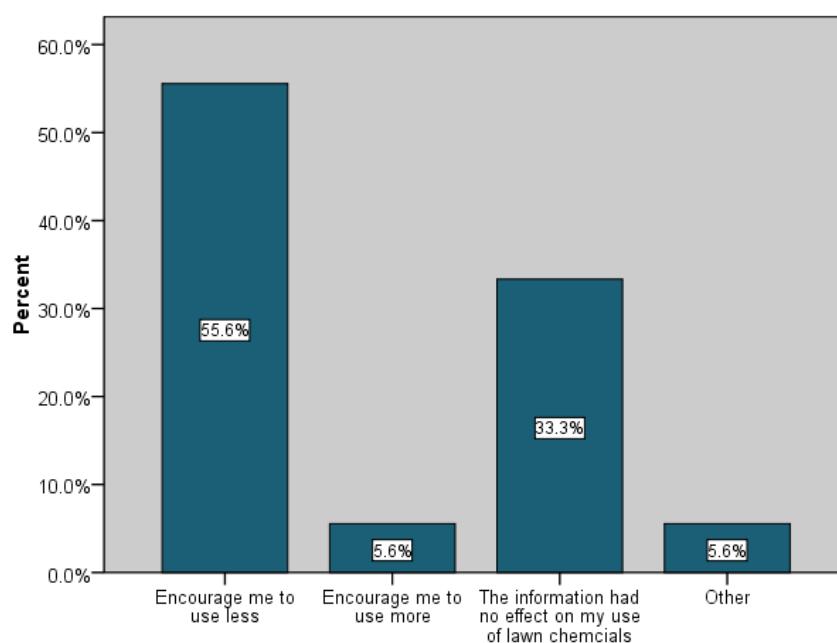
To fully understand the effects of Extension programs it is necessary to know not only that audiences were exposed to the information, but even more importantly how it affected them. To gather this information the self-administered questionnaire included a question asking, "If you heard anything concerning lawn care from (local university) Extension in the last 3 years please share a brief summary of what you learned." Perhaps due to the open ended nature of the question this query had a large amount of non-responses, however the responses received included:

- Pesticide/Fertilizer in runoff is affecting surface/ground water (most common response)
- Send soil samples out to get analyzed to determine the appropriate grass seed/fertilizer
- Just reminded me of what was already known
- Seen information in other news sources
- Saw brochures
- Reduce lawn size
- Do not over water lawn

The responses were limited in number (28), however the results collected are in line with project goals.

To further assess the effects of the programs developed on lawn care behaviors a final question directly asked respondents how the information they saw or heard from extension affected their use of lawn chemicals.

Figure 2.6. Percentage of Respondents' Indicating How Exposure To University Extension Affected Their Use of Lawn Chemicals



The results show that the majority of respondents (55.6%) exposed to these programs were encouraged to use less chemicals on their lawn, and indicated doing so. One third of respondents indicated that exposure to these programs did not change their lawn care behavior. To supplement these findings bivariate statistical data analysis was conducted using chi-square tests to determine the relationship between questions asking about program exposure and reduction in fertilizer use, but the small sample size precluded meaningful statistical conclusions. Overall the data collected indicates that Extension programs informed by the project were successful in meeting their goals to reduce the use of lawn chemicals to protect water quality.

Who replied to the survey? Are there important differences across key demographics?

To best understand the data collected and reported it is necessary to critically examine who responded in a survey effort and if there are any meaningful differences in responses across categories of respondents.

Table 2: Demographic Data Describing Respondents to Evaluation Survey (n=103)

Variable	Responses	Percentage
Respondent has a lawn at their current residence? (n=99)	Yes No	96.0% 4.0%
Respondent rents or owns current residence (n=102)	Rent Own Other	3.9% 95.1% 1.0%
Respondent's annual household income (n=88)	Less than \$20,000 \$20,000-\$39,999 \$40,000-\$59,999 \$60,000-\$79,999 \$80,000-\$99,999 \$100,000-\$119,999 \$120,000-\$139,999 \$140,000 or over	4.5% 25.0% 19.3% 17.0% 15.9% 10.2% 2.3% 5.7%
Gender of respondent (N=102)	Female Male	39.6% 60.4%
Respondents' educational attainment (n=99)	Less than 12 years, no high school diploma High School/GED Some college Vocational/Trade Certificate Bachelor's Degree Masters Degree or higher	2.0% 17.2% 24.2% 6.1% 34.3% 16.2%
Age of respondent	31-40 41-50 51-60 61-70 71 and over	8.2% 7.2% 35.1% 21.6% 27.8%

Bivariate analytical procedures revealed no statistically significant relationships between demographic variables and other variables of interest in the study, which is not surprising given the relatively small sample size.

Conclusions - The Effectiveness of the Outreach Campaigns: The Survey of Residents in Four States

Overall the data collected indicates that Extension programs informed by the project were successful in meeting their goals to reduce the use of lawn chemicals to protect water quality. While some of the problem issues, such as relying on fertilizer bag text for application instructions, still exist as indicated by the data collected, some encouraging changes have taken place. Seventeen percent of respondents indicated they are using less fertilizer, and 13% are using less pesticides than three years ago.

The data also indicated that respondents were exposed to University Extension programs, and that the effects of these programs were to encourage reduced use of lawn chemicals. About 25% of respondents had been exposed to information from Extension about turf care, and 55.6% of those exposed stated that the information resulted in them using fewer lawn chemicals. These reductions are an integral part of protecting water quality from non-point source pollution, and represent the ultimate goal of the project.

While these is certainly a desire to reach more audiences, the data collected from the second survey of study communities indicates that the project was able to inform programs that reached target audiences and influenced behavior change. Those respondents who were exposed to extension material were more likely to make changes with their lawn care practices than those who did not receive information. This finding indicates the importance of broader efforts by extension and other agencies to provide information to DIYers and foster wide-spread behavioral change. The information produced by the project can continue to be applied to outreach and education, and significantly contribute to efforts to address lawn related NPS issues.

The Effectiveness of Various Approaches to Framing and Delivering Specific Messages: The Evaluation in Maine

Introduction and Research Methods

This report presents the work that has been conducted in the Bangor Area of Maine, as part of the *Changing Lawn Care Behavior to Reduce Nutrient Runoff in New England's Urbanizing Watersheds* project and partnering with the University of Maine Extension Services, and the Bangor Area Stormwater Group (BASWG). A behavior change outreach and education campaign was developed and implemented throughout the communities of Bangor, Brewer, Veazie, Hampden, Milford, Old Town, and Orono. All the campaign materials, and dissemination methods, were guided by key findings from an initial region wide study of community lawn care behavior. The campaign material can be viewed in the appendix of this report.

Additionally a project evaluation study was conducted after the implementation of the outreach and education campaign. This evaluation was conducted to establish whether changes in knowledge, attitudes, and behavioral intention has occurred, and to test overall campaign effectiveness. In addition, this evaluation study included a test of normatively framed messaging to see if this method could improve desired outcomes. This report includes discussions of the results of this study, lessons learned, and presents ideas for improving campaign effectiveness. This evaluation study will seek to answer the following research questions:

Evaluation Research Questions: Framing Messages and Program Delivery In Maine

1. *Was the outreach and education campaign successful at encouraging behavior change?*
2. *Do normatively framed messages have a greater impact than messages excluding the use of norms?*
3. *What aspects of the campaign could be improved upon in future efforts?*

Using Social Norms to Change Behavior

An immaculate lawn is considered by many to be a civic responsibility and a necessary component of neighborhood living (Steinberg, 2006). As suggested by Shern et al. (1994) lawns are valued for aesthetic, psychological, normative, and economic reasons. Much of this desire to maintain a socially acceptable lawn may be explained by various psychological factors that have been theorized to drive behavior, such as values, attitudes, sense of responsibility, and particularly social norms (e.g. Ajzen and Fishbein 1980; Thogersen 2006; Cialdini et al. 1990). For example, homeowner's commonly feel a sense of responsibility to adhere to their neighborhood's standard of lawn care, which could also be defined as the neighborhood norm. Furthermore, if this individual decides to deviate from this norm, social sanctioning from the neighbors who do fit the norm may ensue (Robbins 2007).

The degree to which lawn norms impact people's decision and behaviors can be profound. As demonstrated by Robbins (2007), many people who intensely manage their lawns with lawn chemicals are often more likely to be aware of the negative environmental impacts caused by these chemicals

than the general population. Furthermore, many of these same people express great concern for the environment. Of these seeming conflicting values, the desire to fit the norm and maintain a suitable lawn takes precedence over environmental responsibility. Well aware of the consequences, these people often choose to perform a behavior that they know could potentially cause harm to the members of their household and the environment.

The desire for a “perfect” lawn is indeed deep-rooted in American culture and involves complex socio-psychological issues, such as influential social norms, that drive lawn care behaviors. Empirical social science research, that can elucidate behaviors as well as the factors that drive behavior, is needed to understand this phenomenon. This understanding will better equip behavior change practitioners to influence meaningful behavioral changes that will reduce NPS pollution and ultimately lead to a healthier environment.

Using Norms in the Campaign

A *social norm* is a shared cultural expectation of behavior that connotes what is considered appropriate and desirable for a given situation (Scott and Marshall 2005). In other words is a set of beliefs about what people are and should be doing. For example, homeowners may believe that their neighbors apply large amounts of lawn chemicals to their lawns (beliefs about what people are doing) and as a member of a community they also might be expected to produce a suitable lawn (beliefs about what should be done). Many recent studies have found that using social norms in behavior change campaigns concerning environmental issues is a power tool that is able to significantly improve desired outcomes (Griskevicius 2008; Mckenzie-Mohr and Smith 1999). For example, norm based campaigns intending to generate environmentally responsible behavior have been used to encourage towel reuse at major hotels (Goldstein et al. 2008), prevent littering (e.g. Kort et al. 2008; Kallgren et al. 2000; Cialdini 1991), increase curbside recycling (e.g. Schultz 1998; Hopper and Nielsen 1991), encourage the purchase of organic foods (Gotschi et al. 2010), and to reduce household energy consumption (e.g. Schultz et al. 2007).

A *social norm* is a shared cultural expectation of behavior that connotes what is considered appropriate and desirable for a given situation

Norm focused campaign messaging has a lot of merit for creating successful outreach and education campaigns aimed to encourage environmentally responsible behavior. In the article *A Focus of Normative Theory: When Norms Do and Do Not Work* the authors state that, “Our data suggests that including strong normative elements in campaign messages may well be effective in creating desirable conduct” (Kellgren et al 2000, pp. 1011). Much research has gone into understanding how social norms influence behavior and how they can be used effectively by practitioners. Social norms, when used correctly can be an effective and low cost tactic to utilize with behavioral change campaigns. Additionally, American lawn culture provides an intriguing milieu to further test the use of normative influences in a new context.

Evaluation Study Methods

A self-administered questionnaire was administered door-to-door in six neighborhoods throughout the Bangor Area. Each of the six neighborhoods was randomly assigned one of three treatments; control, standard messaging, and normative messaging. The normative messaging group and the standard group received all of the campaign material (doorhanger, stencils, and reference to the website) while the control group received no material. The normative message group, however, received a variation of the doorhanger where the content was altered to elicit lawn care norms and encourage participation in this norm. The norm used here was that most neighbors choose not to use fertilizers and pesticides on their lawns (a finding elucidated from the initial research conducted as part of the *Changing Homeowner's Lawn Care Behavior to Reduce Nutrient Runoff in New England's Urbanizing Watersheds* project). See the appendix to view the two versions of the doorhangers used, as well as an example of the stencil.

The methods employed by this study (assigning three treatment groups and comparing differences among groups), known as the experimental design method, was chosen over another common evaluation study method called the pre-test/post-test method. The pretest/posttest method requires the implementation of two tests, a pre-test (administered prior to campaign implementation) and a post-test (administered after campaign implementation). The experimental design method only requires a onetime survey administration and still allows for comparisons to be made between the groups and is an effective means of determining campaign effectiveness while answering the research questions. See Neuman (2007) for a more detailed explanation of the benefits to using the experimental design method with social science research.

The six neighborhoods were purposively selected using criteria appropriate for the survey methodology and the desired outcomes of the study. All the neighborhoods were selected using local knowledge and were all high amenity suburban communities with heavily managed lawns. These neighborhoods were also chosen to be spatially diffuse to prevent "overflow" of campaign exposure. It is imperative to the study that neighborhood are only exposed to their intended treatment as not to botch the comparisons that will be made between neighborhoods.

Given the relatively small population size, the nature of the research questions, and the logistics of campaign delivery the drop-off/pick-up method was deemed best for this study. With this method researchers personally deliver the questionnaires and cover letters door to door to the homes in the study neighborhoods. Respondents were instructed to complete the questionnaire and hang it on their doorknob in a provided bag during established pickup times when the researchers would return to collect the completed questionnaire. This method has proven to yield very high responses rates, be appropriate for small sample sizes, and work to develop relationships between researchers and community members. Additionally, this method works well with the experimental design method allowing for control of coverage that would be more difficult for mailed or internet surveys (Steele et al 2001). This survey also employed many techniques outlined in the Tailored Design Method (Dillman et al. 2009) intended to enhance response rates including customizing letters, using multiple waves of contacts with carefully timed reminders, and providing clear information about the need for responses.

Results

The six neighborhoods that were selected for this study included anywhere from 31 to 54 homes with a total of 244 homes included in the study. Two neighborhoods received the standard campaign messaging, two received the normative messaging, and two were used as controls and received no

campaign material. The neighborhood response rates ranged from 75% to 31%, with an overall combined responses rate of 57%, which is slightly below the expected response rate for this type of survey at around 65% (n=139) (Steele et al. 2001). This slightly lower than desired response rate can in part be attributed to a snow/wind storm that complicated collection and resulted in several completed questionnaires being lost. Figure 3 below shows the summary for total questionnaires delivered and returned for each neighborhood.

Figure 3: Response Summary

Neighborhood	Treatment	Total attempted	Total refused	Total returned	Response rate
Main Trail	Control	40	0	30	75
Mt. Hope	Control	39	1	25	64.1
Francis	Norm	31	2	20	64.5
Judson Heights	Norm	45	3	26	57.7
Constitution	Standard	54	2	27	50
Hillside	Standard	35	6	11	31.4

Intention to Reduce the Use of Lawn Chemicals

Intention to reduce the use of lawn chemicals was assessed across the three treatment groups to compare for differences. A one-way analysis of variance (ANOVA) test was performed to statistically analyze the responses. ANOVA tests how much the mean values of a numerical variable differ among the categories of a categorical variable. In this instance, the numerical variable is the intention to reduce either fertilizer or pesticide use and the categorical variable is treatment type (standard, norm, and control). In addition a tukey LSD post hoc test was performed so that comparisons across groups could be determined, included mean differences and statistical significance (see figure 4). The tukey LSD shows the relationship of each group and indicates what groups means differ from one another, whereas ANOVA simple shows the significance between treatment groups and intention. This post hoc test is essential to this analysis since comparing the differences between each treatment group is essential to the evaluation study.

Figure 4: Post Hoc ANOVA Results: Treatment Type Compared to Intentions					
Dependent Variable	(I) Treatment type	(J) Treatment type	Mean Difference (I-J)	Std. Error	Sig.
Intention to fertilize	Standard	Norm	.14382	.11746	.223
		Control	-.09472	.11240	.401
	Norm	Standard	-.14382	.11746	.223
		Control	-.23854*	.10356	.023
	Control	Standard	.09472	.11240	.401
		Norm	.23854*	.10356	.023
Intention to pesticide	Standard	Norm	.18889	.12178	.124
		Control	-.11111	.11687	.344
	Norm	Standard	-.18889	.12178	.124
		Control	-.30000*	.11348	.010
	Control	Standard	.11111	.11687	.344
		Norm	.30000*	.11348	.010

This analysis indicates that according to the differences in mean scores, the standard group is more likely to intend to reduce or eliminate both fertilizer and pesticide use than the control group. Furthermore, the norm group is more likely to intend to reduce or eliminate both fertilizer and pesticide than the standard. The relationship was the desired outcome for this project and indicates that our efforts are having effects in these neighborhoods. Also, the differences between the norm groups and the control groups revealed statistical significance, at a level of .023 for intention to reduce fertilizer use and .01 for intention to reduce pesticide use, revealing a clear difference between these groups (remember that statistical significance is a value of .05 or less). The evidence is clear that the neighborhoods receiving normatively framed messages were the most likely to express intention to reduce lawn chemical use, and future messaging should be developed with this finding in mind.

Exposure to the Campaign

Questions were asked concerning whether or not neighborhood residents have been exposed to any of the campaign materials including the doorhanger, the stencils, and the web material. The results of this evaluation study indicate that both the doorhangers and the stencils were highly visible in these neighborhoods, see figures 5 and 6. However, the website was rarely visited, highlighting an area for improvement for this campaign (see figure 7).

Figure 5: Exposure to Doorhangers by Treatment Type

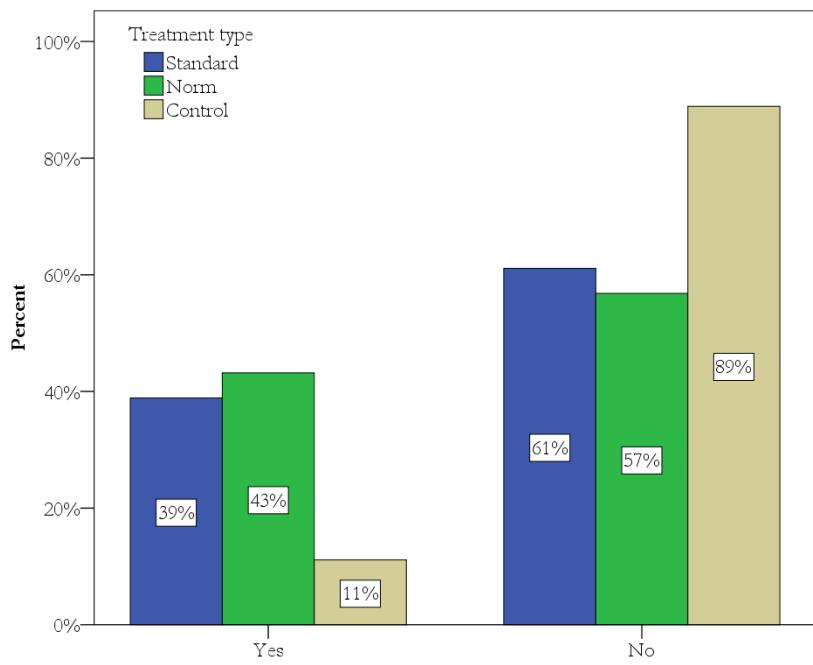


Figure 6: Exposure to Stencils by Treatment Type

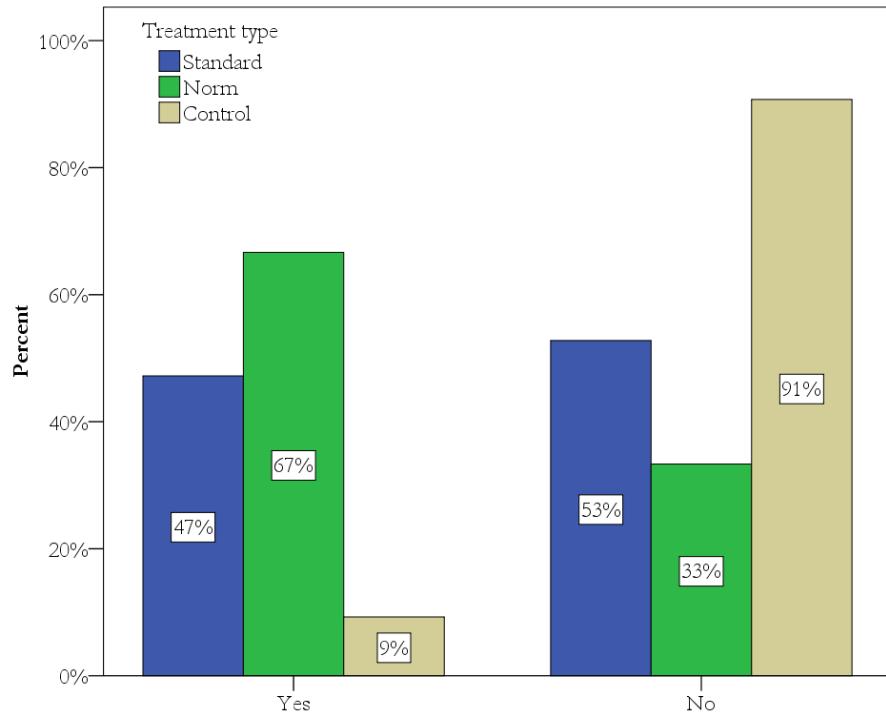
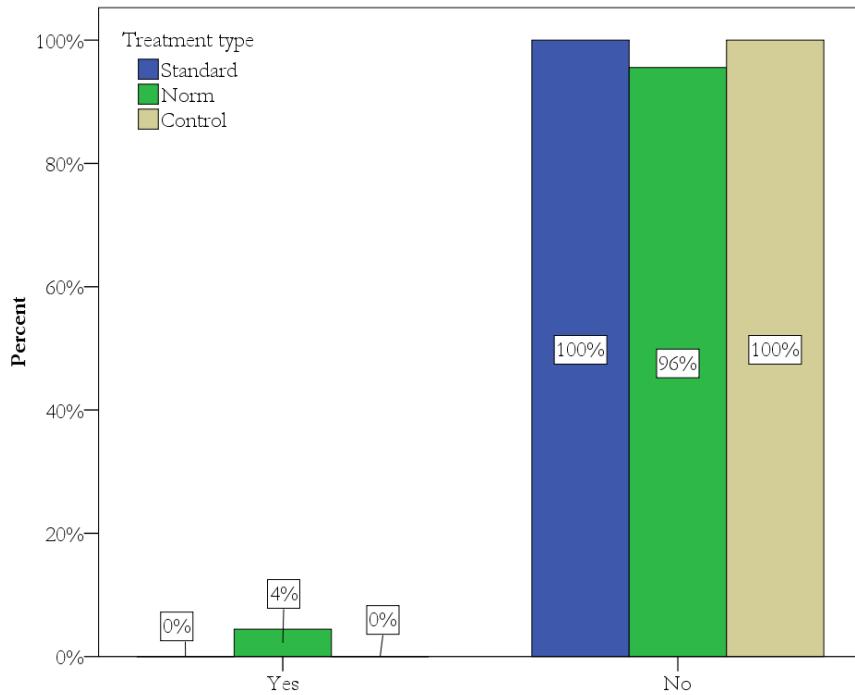


Figure 7: Exposure to Website by Treatment Type



Furthermore respondent were asked if they had seen or heard about any BASWG activities or information from the following media sources: newspaper, television, radio, internet, and a fill in the blank “other” option. Very few of the respondents indicated that they had seen or heard any BASWG activities. The most notable results are: 11% of respondents indicated they had seen BASWG on television and 5% saw us in the newspaper. Responses for the “other” category include: at a local fair, at work, and from a friend.

Neighborhood Perceptions of Lawn Care Issues

A series of questions were asked concerning how respondents think their neighbors maintain their lawns and what the neighborhood attitudes are concerning lawn care behavior. This information can be useful to determine what the neighborhood standards of lawn care are, and how this might be used to direct future campaign efforts. Despite my hopes, statistical analysis reveals no meaningful differences across the three treatment groups. Therefore these questions will be analyzed using the total population, rather than treatment by treatment. This also indicates that despite the normative messaging presented to the two norm treatments, those respondents were not more likely to acknowledge the presented norms.

Most respondents either disagree or strongly disagree that people in their neighborhood choose not use fertilizers and pesticides on their lawns. This is affirmed in figure 8 (next page) showing that most respondents agree or strongly agree that most of their neighbors use lawn chemicals. This is indicative of the perceived prevalence of lawn chemical use, and should be a target for future outreach and education campaigns. Additionally most respondents indicated a high concern for protecting water quality in their neighborhoods see figure 9 (next page). These results are similar to the results found be Robbins (2007) where residents express concern for the environment, yet still choose to apply deleterious chemicals.

Figure 8: Level of Agreement that Most Neighbors Use Lawn Chemicals

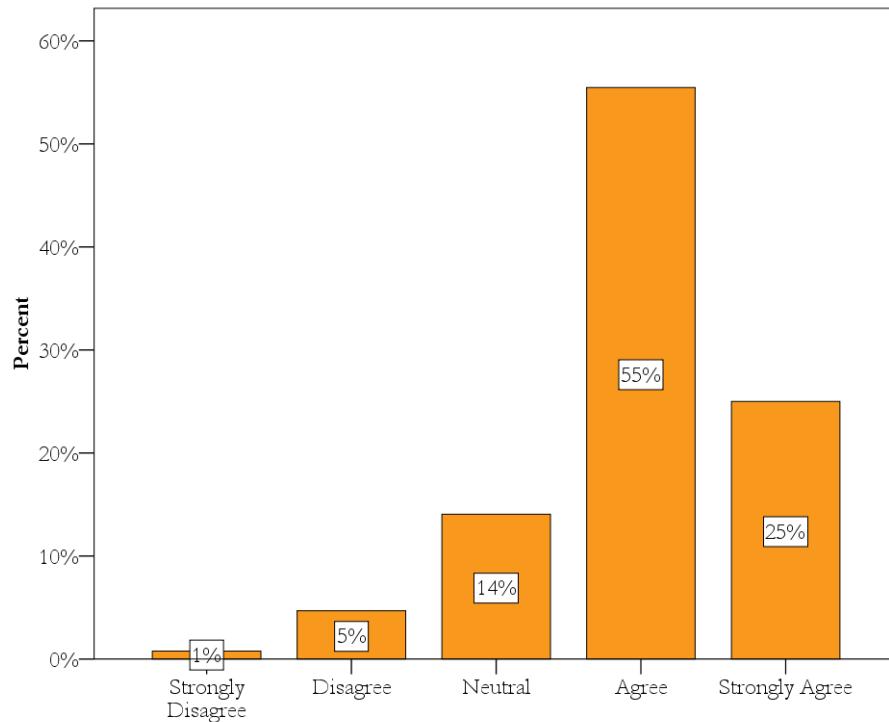
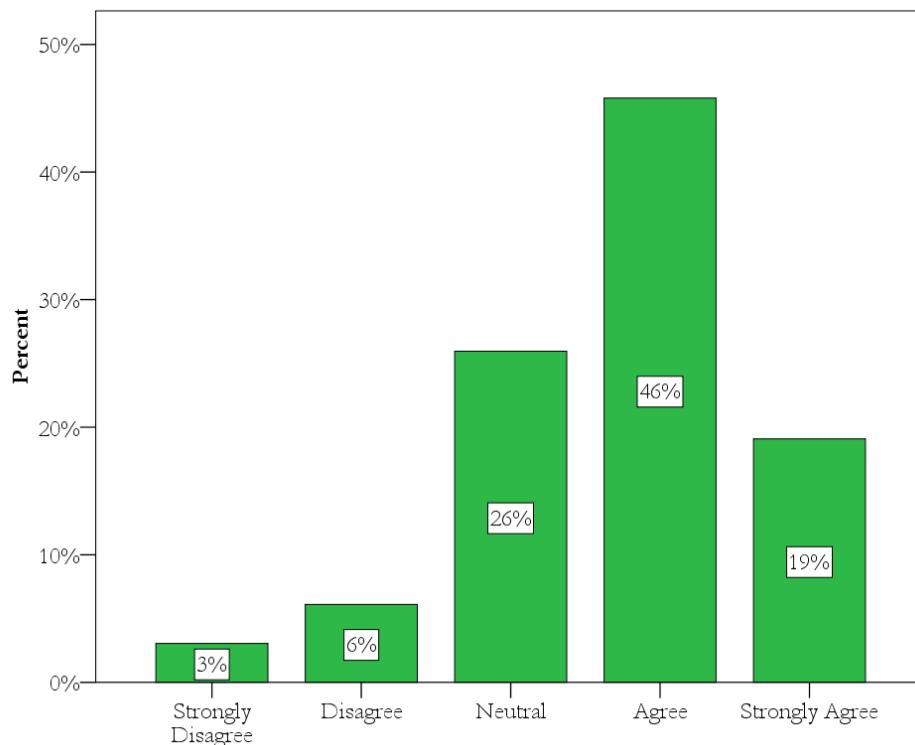


Figure 9: Level of Concern for Water Quality



How often do you Apply Lawn Chemicals?

Questions 3 concerned how much lawn chemicals are applied to the respondent's lawn. After performing statistical analysis, no significant differences were discerned between treatment groups. Therefore this section is also analyzed at the whole sample level. Most residents of these neighborhoods indicated that they apply fertilizers, pesticides, and combination weed and feed products at least 1 time a season. Pesticides however, had the highest percentage of respondents indicating that they did not apply at nearly 50%, see figure 10. Fertilizer application is very common in these neighborhoods as can be seen in figure 11, with many respondents applying more than once a year. Weed and feed products are also quite popular, again with many respondents applying more than once a year. These results are slightly different than those of the initial lawn care study which found that most people actually do not apply fertilizer to their lawns.

Figure 10: Number of Pesticide Applications Last Season

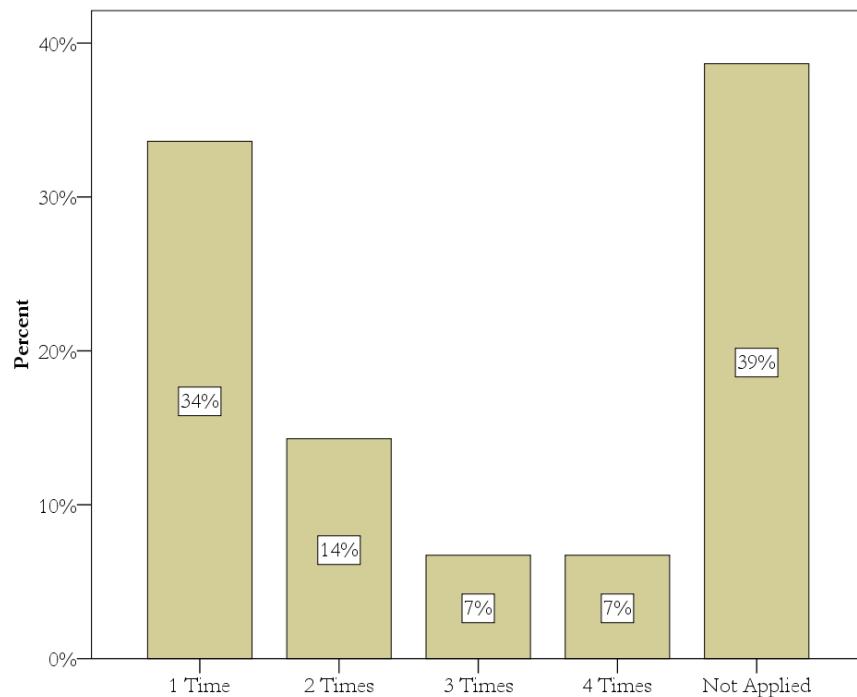
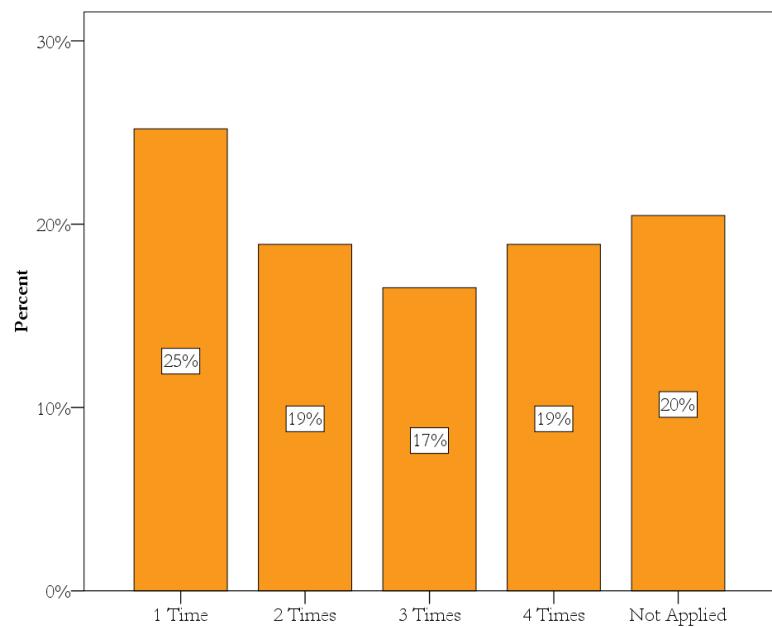
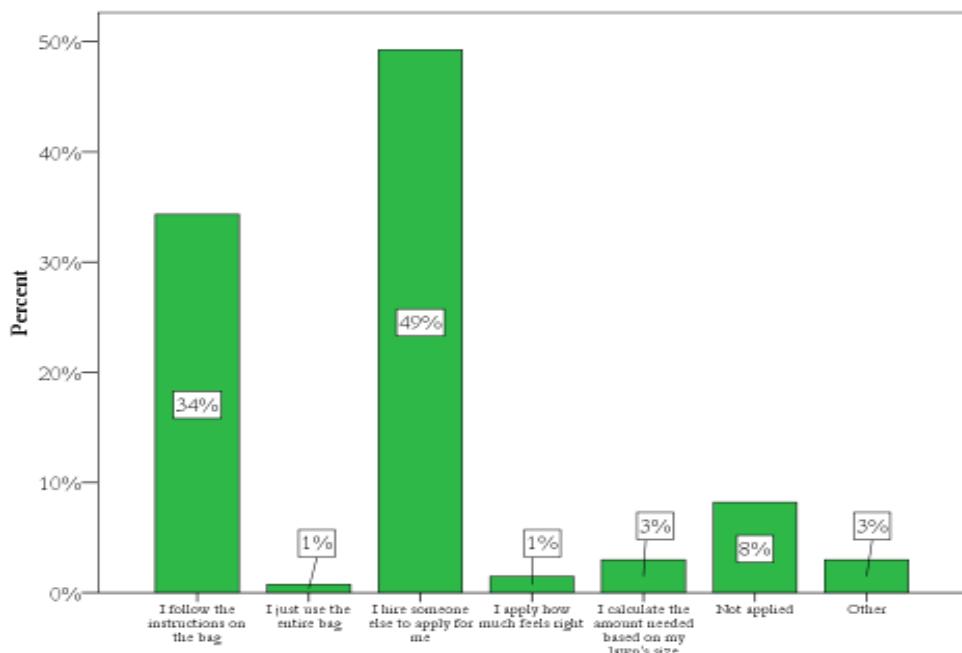


Figure 11: Number of Fertilizer Applications Last Season



An additional question asked what method respondents use to determine how much lawn chemicals to apply. Most notably, 49% of respondents hire someone to apply their chemicals for them and another 34% follow the instructions on the bag, while the other methods presented are only marginally used (see figure 12 below).

Figure 12: How Respondent's Determine How Much to Apply



Knowledge about nutrient runoff

Questionnaire items were included to test respondents knowledge about the adverse affects of lawn chemicals to the environment. After statistical analysis, no significant differences were found across groups. This finding is unfortunate in that I was hoping differences would be found and we could assert that our campaign increased knowledge significantly, perhaps explaining the differences in intention. As can be seen in figure 13 and 14 the vast majority of respondents agree or strongly agree that lawn chemicals can cause harm to kids (84%) and pets (88%). These high levels of agreement across the board indicate that there is likely preexisting knowledge of potential harm to kids and pets, and while our campaign material may in fact be increasing knowledge this change is not explained strongly by the data.

Figure 13: Level of Agreement that Lawn Chemicals can cause Harm to Kids

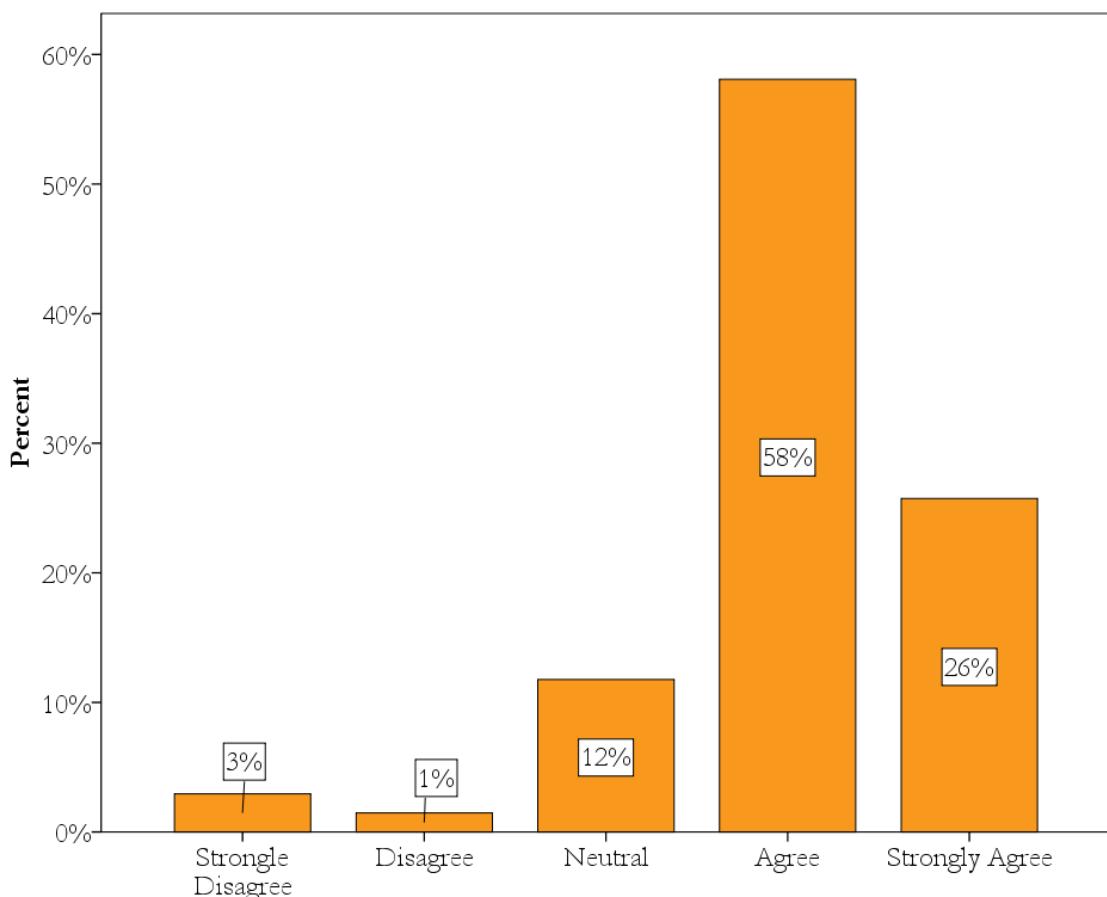
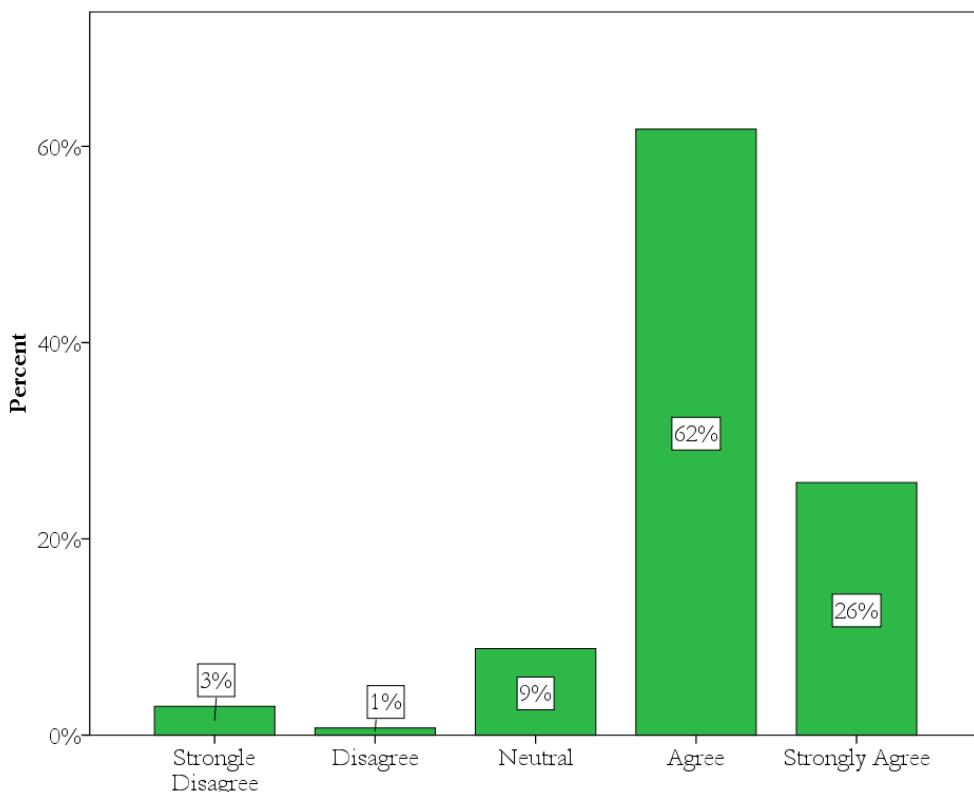


Figure 14: Level of Agreement that Lawn Chemicals can cause Harm to Pets



Respondents were asked if they agree that lawn chemicals do not affect have negative impacts on water quality. The majority of respondents either disagrees or strongly disagrees with this statement at 66% (see figure 15). Another 26% indicated that they were neutral so perhaps these respondents, and those who disagree with this statement, could be targeted for future educational campaign making the link between lawn chemical use and potential affects to local water quality. Additionally, respondents were asked if agree that lawn chemicals can runoff into local waterways, see figure 16. Most respondents (88%) agree or strongly agree that chemicals can runoff into waterways. These findings suggest that most respondents have a preexisting understanding that lawn chemicals can runoff into waterways and negatively affect water quality. While this information should not necessarily be excluded from future material, the data suggests that putting an emphasis on other information, such as shifting norms, to facilitate change may be more effective.

Figure 15: Level of Agreement that Lawn Chemicals do not affect Water Quality

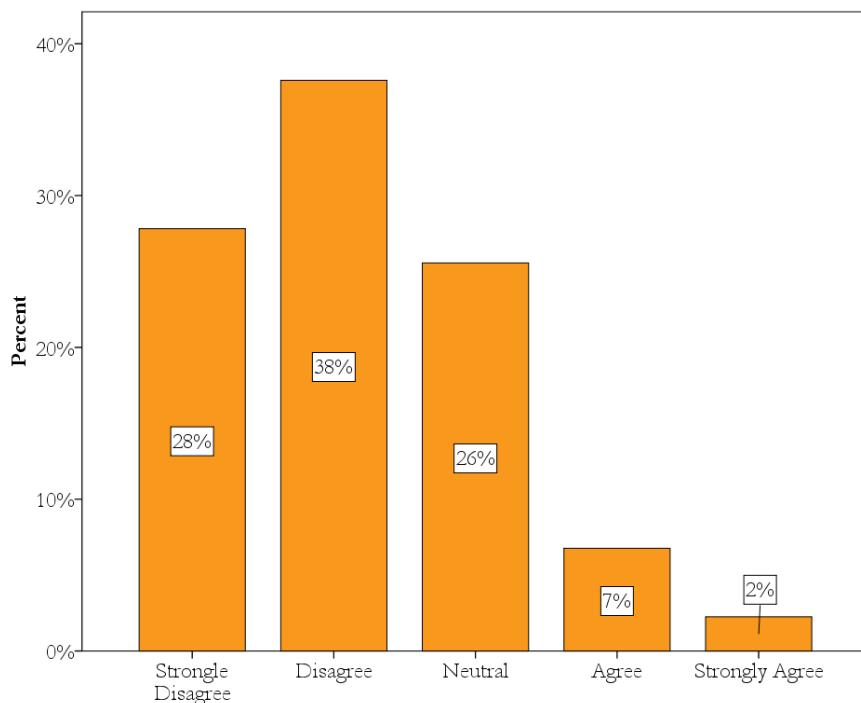
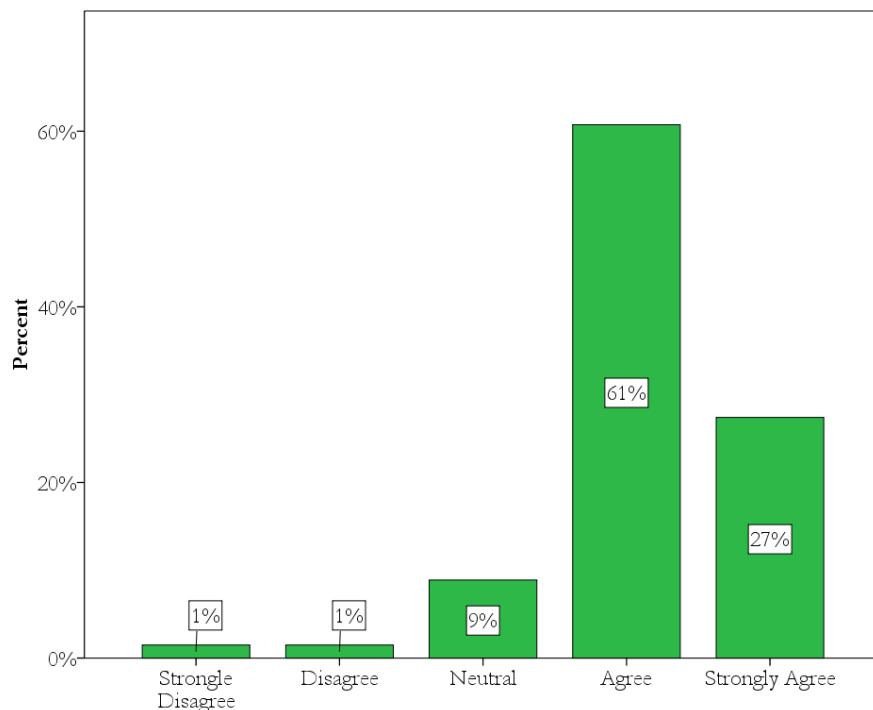


Figure 16: Level of Agreement that Lawn Chemicals can Runoff into Local Waterways



Demographics

Demographic questions were included in the questionnaire so that responses from people of differing background characteristics could be compared to identify any important trends across groups. In this case statistical analysis revealed no significant demographic differences within the sample. However, when compared with census data, some notable differences can be seen between our sample and averages for the state of Maine. For example, these neighborhoods are in a higher income and education bracket than typical for Maine (www.factfinder.census.gov). This was expected since these neighborhoods were selected to be high-amenity. This may explain some of the discrepancy between the initial lawn care study and this evaluation study, where in the initial study the norm was not to apply and in this study the norm is to apply. These results suggest those high amenity neighborhoods are more likely to apply lawn chemicals, which supports a recent study correlating lawn expenditures and lawn greenness by Zhou et al. (2009). This also affirms those high amenity neighborhoods are a good target for future campaigns aimed to reduce the use of lawn chemicals.

Another finding from the demographics section of this study found that 54% of the respondents have lived in their communities for 5 or less years. Some of the neighborhoods in the study area are newer developments (e.g. Mt. Hope and Judson Heights). Perhaps many homeowners' in these neighborhoods are attempting to establish new lawns and this could explain the higher frequencies of lawn chemical application.

Conclusions

Many respondents from the sampled neighborhoods do indeed use lawn chemicals as part of the lawn management behavior. Our efforts have shown to be successful at changing intention to apply lawn chemicals next season. Additionally, the use of normative framed messaging has proven to have a greater impact than messages without this framing. Future campaigns are needed to continue to affect people's lawn care decisions and norms can be a powerful tool.

As was the case with the initial lawn care survey, this evaluation found that most people get their lawn chemical application information from the product packaging. This affirms the need for point of sale products in place in stores, as well as a continuation of education and outreach. This is a great place for the dissemination of the site specific fertilizer recommendations developed from the soil science component lawn care project.

Many respondents in these neighborhoods utilize lawn care services. It would behoove us to consider this issue with both homeowners and lawn care service providers to encourage the use of more environmentally responsible lawn care techniques. Additionally, as affirmed in this study and the initial study, there is an expressed concern for water quality, lawn care alternatives which still maintain the community's standard of lawn care need to continue to be encouraged.

The Formative Evaluation of the Project Process: In Depth Interviews with Team Members and Stakeholders

Introduction and Research Methods

A final part of this project evaluation was designed to focus on the internal processes and the design of the project, rather than its behavioral outcomes, to formatively contribute to thinking about means for improving efforts to change NPS related behaviors through education and outreach. To achieve this important evaluation goal a second wave of interviews with a subset of opinion leaders was conducted to contribute to the project evaluation being conducted on the Changing Homeowner's Lawn Care Behavior to Reduce Nutrient Runoff in New England's Urbanizing Watersheds project. Opinion leaders, such as Extension staff, master gardeners, and project team members, were asked about their experiences with the program, their perceptions of it, and their ideas about what worked well and also what could be improved upon. Respondents were asked specifically what aspects of the project they had been exposed to, such as the research results, outreach and education products, and/or professional presentations. Respondents were also asked about changes in lawn care educational content, as well as any shifts in attitudes or behaviors that have occurred with homeowners over the past four years. Lastly respondents were questioned about what future works they are planning regarding lawn care and protecting water quality and what resources they would need to effectively conduct this work. These data produced from the interviews contribute to the solid foundation of this formative evaluation and provide a qualitative look into the effectiveness of this project told through the experiences of the opinion leaders interviewed.

Twenty-two in-depth semi-structured interviews were conducted with opinion leaders, primarily Extension staff, in and around the study communities in New Hampshire, Maine, Rhode Island, Connecticut, and Vermont. A semi-structured, open-ended protocol was used which allowed for unanticipated digressions but also maintained structure enough for meaningful analyses to be conducted (Berg 2007). The freedom to explore unforeseen areas of interest during these interviews is especially important to a descriptive investigation as these topics may generate significant analytical insights. Opinion leaders were identified by the project team as the initial pool of respondents, and then snowball sampling techniques (following leads from initial respondents) were used to identify additional respondents. Additionally, conducting in-depth interview allows for respondents to express their opinions freely and confidentially. Detailed notes were taken during the course of these interviews and the content was inductively analyzed into conceptual categories and patterns that emerge from the data, an analysis process known as content analysis (Glaser and Strauss 1969).

Research questions were developed to provide structure to the study and to ensure that a degree of consistency was present from interview to interview and to make sure that our study effectively addressed the goal of formative project evaluation. These questions also aid in the analysis in that comparisons can be made across groups and individuals. The research questions used for this study are outlined below.

- Who are the people who have been exposed to the changing lawn care project and what do they do regarding lawn care?
- Have there been changes in the practices of homeowners over the past four years?
 - What were the key factors influencing these changes?
- If you are an educator, has the content of your material/resources changed in the past four years?
 - What were the key factors influencing these changes?
- What were some of the most important impacts/outcomes that came of this project?
 - Social science component?
 - Natural science component?
 - Outreach/education component?
 - Products?
- What were some of the biggest setbacks or limitations of this project?
 - Social science component?
 - Natural science component?
 - Outreach/education component?
 - Products?
 - What could have been done differently to enhance this project?
- What will be done in the future to continue these efforts?
 - What, if any, resources would you need to help these efforts?
- Additional comments

The results section below for this report is organized by research question.

Results

Who are the people who have been exposed to the changing lawn care project and what do they do regarding lawn care?

It is important to understand who the opinion leaders are and how they are involved with lawn care and water quality so that their opinions are put into the context of their work and that the recommendations can be tailored to best meet their needs. This question was also asked so that we could discern what state the respondents hail from as well as their affiliations. The respondents predominately fit into the following categories:

- Educators: professionals, mainly working for university Extension who are either coordinators or educators who deal directly with homeowners. Several of the members of this group were also part of the project team.
- Scientists: several of the project team members and university employees interviewed were involved with research in either the soil or turf sciences. There was also a professor of horticulture interviewed who conducts research for Extension.
- Master Gardeners: several certified master gardeners were interviewed. These are volunteers who work with Extension staff to provide resources and answer questions from homeowners regarding lawns and gardens.

- State or City Employees: several respondents either worked for their state environmental protection/quality agency or for some municipal entity such as soil and water conservation district or city engineering office.
- Other: a couple respondents did not fit into the above categories and were either involved with a private business or consulting firm or were simply just an avid gardener but had still been exposed to the project at some capacity.

There was a broad array of respondents from those who were directly involved with the project as a team member to those who had only been exposed to the project by a single presentation or personal communications. Respondents also had varying degrees of involvement with homeowners from some who deal directly with educating homeowners on a daily basis to some who were just simply neighbors. However the majority of respondents are involved with educating home owners about lawn care practices at some capacity either by directly working with homeowners or coordinating faculty who work directly with homeowners. The sample for this study represents a broad array of practitioners and educators who deal with lawn care practices and the associated environmental concerns, who can offer valuable input for this evaluation study and comment on the effects of the project.

Have there been changes in the practices of homeowners over the past four years? What were the key factors influencing these changes?

As this project intended to generate behavior changes in the targeted communities, encouraging the adoption of practices and attitudes amendable to the protection of water quality, this question was asked to see if the opinion leaders perceive changes happening in the past four years with their constituents. While there are of course many influences affecting behavioral change, this question will help to discern to what extent the changing lawn care behavior project is contributing to these changes. The most common responses are bulleted below:

- A fair amount of respondents were under the impression that there is a general increase in concern for the environmental impacts caused from lawns. This is most clearly evident where master gardeners are receiving high volumes of questions from homeowners about using organic products. This trend was most commonly attributed to the general growth in environmental concern across the country driven largely by the media. However it was also mentioned several times that the outreach and/or education efforts of local Extension and other was influencing changes with homeowners.
- Respondents who work around the Great Bay region of New Hampshire indicated that many of their constituents are becoming increasingly concerned with Nitrogen runoff. This was attributed to education efforts and social marketing being conducted in the region.
- Many respondents did not feel comfortable responding to this question either because they said they were too removed from homeowners or that there was no solid evidence to back up their impressions.
- It was also often times mentioned that no changes in attitudes or behaviors are present. In fact one respondent warned that lawn chemical sales were actually increasing in their region in Maine due to development and growing suburban areas. Although contradictory to that another respondent from Maine said that he/she believes phosphorus containing fertilizer sales are declining due to the state's law discouraging the use of these products and the in-store signage associated that has been implemented by law.

There were mixed feeling about whether or not actual changes in homeowner's lawn care behavior during the last four year. Some respondents feel strongly that there are changes happening as a result of either local education and/or outreach or because of more global trends in concern for environmental health. However many respondents either did not feel like any significant changes had occurred or did not feel qualified or informed enough to comment.

If you are an educator, has the content of your material/resources changed in the past four years? What were the key factors influencing these changes?

Much of the research results reports, outreach and education recommendations, and behavior change products developed as part of this project were created by and for educators dealing with lawn care issues. This question sought to discovery if any of the outcomes of this project are being utilized by educators and to see if their content and materials have changed as a result of this exposure. The key points from the responses to this question are bulleted below:

- The content has changed greatly and now included much more emphasis on water quality and environmental health. This is either driven because of green trends or increased focus on these issues driven by grants and institutional goals.
- Educators are using the evidence driven recommendation for fertilizer use provided by either Karl's work at the University of Connecticut or by the reports coming from Cornell. Along the same lines many Extension faculty indicated that they are now recommending soil tests more frequently as they are now able to do the analysis in their labs. Many respondents said that this inclusion is because of the new research that has been coming out that previously did not exist.
- Considerations are now made to tailor content to the targeted audience. As one respondent from Extension said, "Our work is not much more targeted and we are no longer just throwing useless information at the public." Most respondents who said that this change had occurred also said that this change was driven by the presentation and/or workshops they attended presenting the findings from the social science portion of this project.
- It should be noted that it was mentioned by more than one educator that no changes had occurred in their content during this timeframe.

It is encouraging to hear from several respondents that the content of their education has shifted either because of the social and/or natural science research that was conducted as part of this project. It seems that almost every educator who was exposed to the findings of the project utilized them and adjusted their content accordingly. On the other hand, shifts in content are occurring with educators who did not get exposed to the project as well as situations were no shifts are occurring.

What were some of the most important impacts/outcomes that came of this project?

- *Social science component?*
- *Natural science component?*
- *Outreach/education component?*
- *Products?*

There were many outcomes that resulted as part of this project including social and natural science results from the research, outreach and education recommendations/presentations, and educational outreach products. Of the outcomes that the respondents were exposed to, this question sought to

discovery what about them was the most useful for them and their work with homeowners regarding lawn care. This will also highlight what outcomes should be utilized in the future for additional works. The key points generated from the responses from those who had knowledge about the outcomes of the project are bulleted below:

- Every respondent who was exposed to Karl's research said that it was very useful and that it has influenced either the content of their education or their own personal use of lawn chemicals. This was often mentioned as the most beneficial outcome of the project. Extension professionals in particular are very happy to have his recommendations as they are "evidence based" (meaning grounded in sound scientific research) and therefore permitted to be used in their recommendation by their respective universities.
- The respondents who were exposed to the outcomes of the social science outcomes generally found the information very useful. The most common response concerning these outcomes was that they now have a new found appreciation of the complexity of the issue of changing lawn care behavior. The second most common response was that respondents now recognize the importance of tailoring messages and considering/researching the audience. Also many respondents were fascinated by many of the findings from this research, such as the importance of fitting in with the community's standard of lawn care and how time spent on lawn care is not a barrier to adopting alternatives.
- Respondents who had been exposed to the products created as part of the project all found them to be intriguing and good models to use for their efforts.
- Many respondents also saw that the regional and trans-institutional partnership were incredible beneficial and absolutely necessary for a project such as this involving widespread behavior and NPS pollution.

By far Dr. Guillard's research was the most common mentioned beneficial outcome from this project. However, those who had been exposed to the social science results found them not only enlightening, as with the newfound appreciation for considering audiences, but also found them beneficial to their work and/or their perspectives on the issue. The products were only seen by a few respondents but those who had seen them found them useful and wanted more.

What were some of the biggest setbacks or limitations of this project? What could have been done differently to enhance this project?

As is always the case with projects of this size and scope with an audience as broad as ours, every aspect could not be covered. This question seeks to discover what the limitations or setbacks were for the project and also to highlight what could be done to fill this need.

- The most commonly mentioned short-coming of this project was inadequacy of outcome dissemination. Many respondents were aware of the project and its goals but did not feel that they received the depth or breadth of information they had expected. Many respondents desired to see tangible reports or examples that they could use to guide their own projects. Also mentioned frequently was a need for information about social science methodology for both exploratory research and for project evaluation.
- Another short-coming that was stressed by many respondents, particularly those from Connecticut, was how Massachusetts was not included in this project. Many felt that this absence was detrimental to the regional project and that the resources provided by this state would have been very useful. As was mentioned by most of the respondents from Connecticut,

research stemming from the University of Massachusetts was somewhat contradictory from the research conducted by Karl and on more than one instance this issues was brought forth.

- A couple respondents indicated that more scientific research on the benefits of using alternative lawn care practices was needed. Also was mentioned was the need for research on the use of organics as there is a growing interest in their use.
- Several project team members mentioned that the time frame for this project was too short and that this resulted in problems for the project.
- Many respondents also expressed concern that the outcomes and the campaigns (proposed and active) will fizzle out after the grant is over and the money runs out. These respondents are very concerned that the hard work and research that came of the project will not be adequately used.

It is apparent that a lot of good research and outcomes have come of this project and there is a great desire by the opinion leaders interviewed for broader dissemination of material and for continued efforts. Partnerships are considered to be very important by respondents and therefore when a partner perceived by some as a key player (MA) is missing, it can have detrimental effects on the work of the rest of the region. There is a lot of concern regarding the longevity of this project and its outcomes, therefore efforts should be made to continue this work and the spread of the useful information and product examples developed.

What will be done in the future to continue these efforts? What, if any, resources would you need to help these efforts?

As the project is expected to continue into the future, not only to capitalize on the research results and outreach and education recommendations produced, but also to continue to make meaningful changes in lawn care for the protection of regional water resources. This question is meant to describe what future projects respondents are going to be involved with and to see what could be done as part of this project to aid in these efforts.

- Many of the project team members are planning to continue their current works, particularly with the Bangor Area of Maine where their current behavior change campaign will be implemented throughout the region for the next two years.
- Point of sale products are to be developed and/or implemented in many regions including Maine and New Hampshire this summer and further on. However there is a concern for funding that was noted by more than one project member.
- There is a growing demand from MS-4 communities to get information about reducing lawn chemical use as a result of a law from the Environmental Protection Agency that requires MS-4 communities to adopt an outreach and education project. Many respondents conveyed the interest these communities have in developing projects similar to that of this one, and in particular many communities are choosing to focus on fertilizer use. These communities express a great need for lawn practice information, research methods, and product examples.
- Many respondents indicated that no new projects were underway and they are more concerned with maintaining their current programs.

While many respondents did not indicate that future projects were underway those that did expressed a desire for more information, much of which could be provided by the outcomes of this project. In particular the interest expressed by MS-4 communities to use reduction in fertilizer use as their target

behavior for their EPA required outreach project suggests a great need for the outcomes of the changing lawn care project.

Additional comments

Respondent were given the opportunity to add an additional comments or thoughts to this study in this section. This provides a means for the respondents to share any information that choose, and may result in useful insights or ideas. However, most of the responses offered for this section were compliments to the hard work and success of the project and the project team. One respondent suggested that this project be used as framework which could be used to address other environmental concerns such private well testing. Also it was mentioned by several respondents that the regional approach was essential to this project and that they would like to see continuation and growth of this approach.

Conclusions and Recommendations

Overall the respondents who were exposed to the project's outcomes, such as the research results, outreach and education products, and/or professional presentations spoke very favorable towards them and felt they were useful to their work and/or their perspectives on the issue of lawn care behavior and the environment. Many respondents found both the findings from the natural science and the social science research to be very beneficial and would like to see the information in more usable forms and be more broadly distributed. To address this concern, efforts should be made to provide useful reports summarizing the findings and presenting examples that are easy to recreate for both the social science research methods and campaign products. Also efforts should be made to broadly distribute these documents/reports to Extension professional and other practitioners who could benefit from these outcomes. There exists a great need for this information it just needs to be out there in a digestible form, particularly for Extension and MS-4 communities.

Most respondents commented on the critical role of regional partnership when dealing with NPS pollution and lawn care behavior. In fact, several respondents listed regional partnerships as the most beneficial aspect of the entire lawn care project. It is recommended that the partnerships that were established as part of this project be maintained and that new partnerships, particular with the state of Massachusetts, be sought out. All parties can benefit from these partnerships in shared resources, research, messages, and campaign strategies. Also, due to the diffuse nature of the source of NPS pollution, regional partnerships are vital to the success of nutrient reduction in the region's waterways. While the natural science research results were the most mentioned beneficial outcome of the project the outcomes of the social science research were mentioned as enlightening and useful almost as often. Clearly the results from both of these research endeavors were very useful to practitioners. The results from the natural and social science research were also complimentary, as can be seen in the educational outreach products developed that included both regional fertilizer recommendations and messaging guided by the information gathered from the social science. This is also indicative of the benefit of including both the natural and social aspects in environmental communications, particular with an issue such as lawn care which involves widespread and long lasting social behavior.

Many respondents feel that their outreach and education efforts are helping to encourage changes in attitudes and behavior in their communities. While this is most certainly the case, there are also national trends to be "green" and go "organic" and as expressed by many respondents these trends are also affecting the concerns homeowners have towards the environmental impacts of their lawns. Which

influence is the strongest cannot be determined, but these new attitudes and interests resulting from this trend can be utilized and fostered by educators and practitioners and help to achieve meaningful changes. Therefore continued efforts to educate and encourage environmentally responsible lawn care behavior is needed.

Overall Evaluation Conclusions

NPS pollution is a major threat to water quality, and the Changing Homeowner's Lawn Care Behavior to Reduce Nutrient Losses in New England's Urbanizing Watersheds project was designed to merge turf science, social science, and Extension knowledge and efforts into a concerted effort to change DIYers turf care behavior to protect water quality. The ambitious transdisciplinary effort produced a great deal of new and needed information on turf care and social dynamics that can inform efforts to change turf care behaviors, however this alone does not mean the project is a success. Evaluation research is an essential part of any effort to understand if a project achieved the intended results. In addition to judging if a project was successful, evaluations can also include a formative component that analyzes project processes to inform the design of future projects to improve their effectiveness. The evaluation of this project to protect water quality was designed to achieve three goals.

The first evaluation goal was to determine if behavior change occurred among members of targeted audiences by conducting post-project surveys in four of the study communities. Data from all communities (n= 103) indicated that some DIYers' turf care behaviors had changed, and had changed in the ways that the project had intended. Residents of the communities who encountered Extension programs asserted that they encouraged them to use less lawn chemicals, and about 17% reported doing so. As with many education efforts a major challenge is reaching audiences. Fifty-five percent of respondents experiencing Extension programs stated they used less lawn chemicals as a result, but only 25% of respondents had encountered turf care information from Extension in the last 3 years. Overall results indicate the project achieved desired goals, but perhaps not at the magnitude desired. Continued efforts to apply the information generated by the turf science and social science research in this project are warranted to protect water quality impacted by turf care practices.

The second evaluation goal was to examine the results from the project and also to evaluate the effectiveness of various message framing approaches using an experimental research design model to identify the most effective ones for instigating behavioral change. These efforts required not only a more sophisticated research design, but also a larger sample size (n=139). The study site in Maine was able to leverage the research from this project into a larger campaign than in other study communities, and the data indicate that their efforts were successful. A relatively large number of residents had encountered the campaign, and those who had were statistically significantly more likely to have reduced their use of lawn chemicals than those not seeing any campaign materials. Perhaps even more importantly, the normative framing of messages was the most effective at stimulating behavior change, an important finding for framing messages in future endeavors.

The third evaluation goal was to conduct a formative evaluation to assess the workings of the project itself, as well as its outcomes. Responses from in-depth interviews (n=22) with key stakeholders indicate that project results reached some desired educator audiences, but that there were variances in how much the project information was applied in each state. Some respondents felt a more uniform and heavily funded application part of the project would have improved its results, an opinion echoed by some members of the project team. In short, more funding for outreach and education efforts may enhance effectiveness in future efforts of this kind. Respondents had mixed feeling about whether behavior change had occurred among DIYers, but acknowledge a lack of formal information about this conclusion was frequently noted. The majority of educators exposed to project information are using it, and they found the turf and social science valuable for providing usable information. However, the greatest concerns expressed were over the need for more dissemination of the information from the project, among both professional educators and audiences. Respondents knowledgeable about the

workings of the project consistently commented on the quality of the project team and how well the endeavor was coordinated by the principle investigator, Julia Peterson (UNH SeaGrant Extension). As a whole the interview data indicate that the project was effective at producing and using cutting edge scientific research in Extension efforts to address NPS issues related to turf care, but that more dissemination of both scientific findings and educational materials produced would have improved results.

In combination these three evaluation components elucidate that the *Changing Homeowner's Lawn Care Behavior to Reduce Nutrient Losses in New England's Urbanizing Watersheds* project was successful in achieving many of its goals, but that improvements could be made in future efforts of this kind. The transdisciplinary approach used in the work represents the cutting edge of efforts to address NPS issues, and findings from the work should continue to be of use in endeavors to protect water quality from the impacts of residential turf care.

Appendices: Questionnaires Used In Evaluation Research Surveys

Questionnaire Used to Evaluate The Effectiveness of the Outreach Campaigns:
The Survey of Residents in Four States
(Highlighted portions are customized to each community)

TOWN NAME Neighborhood Lawn Care Questionnaire



Instructions

The _____ (State University Extension) and Plymouth State University's Center for the Environment are collaborating to conduct research concerning neighborhood lawn care practices. Please take some of your time to fill out this important questionnaire.

This questionnaire is designed for all residents of your neighborhood, so even if you don't have a lawn or are not familiar with some of the issues, please feel free to answer all appropriate questions and remember there are no wrong answers. If you encounter a question for which you do not know the answer, please indicate this by writing "DK" (for "don't know") in the margin next to that question.

The information you provide is completely confidential and will only be presented in summaries where individual answers cannot be identified. Nothing you share can be traced back to you or your household, so please respond freely and honestly by returning the completed questionnaire in the envelope provided.

Once we receive the completed questionnaire we will remove you from our list and we will not have to contact you again, and we thank you in advance!

Throughout this questionnaire we use the term "lawn chemicals". To ensure that everyone understands this term please read the following definition.

Lawn chemicals are chemicals that are applied to lawns such as fertilizers, pesticides and combination weed and feed products.

How do you maintain your lawn?

The following section asks about your lawn care practices. Please check the box of the best answer for each of the following questions. All of the following questions refer to lawn care practices performed during the growing season.

1. Do you have a lawn at your current residence in this neighborhood?

- Yes
 No (Please skip to the **Campaign Exposure** section, which begins with question number 7)

2. Please indicate how many times during last season the following lawn chemicals were applied to your lawn:

A. Fertilizers (either organic or synthetic)	Not applied	1 time	2 times	3 times	4 or more
B. Pesticides (e.g. fungicides, insecticides, and herbicides)	Not applied	1 time	2 times	3 times	4 or more
C. Combination Weed and Feed products (e.g. Scott LawnPro)	Not applied	1 time	2 times	3 times	4 or more

3. For each application of lawn chemicals, which of the following best describes your method of determining how much to apply?

- I follow the instructions on the bag I just use the entire bag
 I hire someone else to apply for me I apply how much feels right
 I calculate the amount needed based on my lawn's size
 Lawn chemicals are not applied to my lawn
 Other (Please specify): _____

Recent Changes in Your Lawn Care

The following questions ask if you have changed your lawn care practices in the last 3 years. Please choose the one best answer for each of the following questions.

4. How has the amount of fertilizer you use on your lawn changed over the last three years?

- There has been no change I use more than before
 I use less than before I do not use fertilizer for lawn care

5. How has the amount of pesticides you use on your lawn changed over the last three years?

- There has been no change I use more than before
 I use less than before I do not use pesticides for lawn care

6. If you made any changes in fertilizer or pesticide use please use the box below to share with us why you changed the amount of fertilizer or pesticide used as indicated in questions #4 and #5 (if you need more space use the back of this questionnaire).

Campaign Exposure

7. Have you seen or heard anything concerning lawn care from STATE UNIVERSITY EXTENSION in any of the following sources in the last 4 years? (Please mark all that apply)

- Newspaper Television Radio
 Internet Printed handout/guide Workshop

- Other (Please specify): _____

- I have not seen any materials from UNIVERSITY about lawn care in the last 4 years (Please skip to the **Demographics: A Bit About Who You Are** section, which begins with question number 10)

8. If you saw or heard anything concerning lawn care from **STATE UNIVERSITY EXTENSION** in the last 4 years please use the box below to share a brief summary of what you learned.

9. How did the information you saw or heard affect your use of lawn chemicals?

- Encouraged me to use less
- Encouraged me to use more
- The information had no effect on my use of lawn chemicals
- Other (Please specify): _____

Demographics: A Bit About Who You Are

The following questions will help us compare responses from people with differing background characteristics to identify important trends across different groups. Please remember that all responses are completely confidential and cannot be linked with you as an individual.

10. Do you rent or own your current residence?

- Rent Own
- Other (Please specify): _____

11. Which category best describes your annual household income before taxes?

- | | |
|---|--|
| <input type="checkbox"/> Less than \$20,000 | <input type="checkbox"/> \$80,000-\$99,999 |
| <input type="checkbox"/> \$20,000-\$39,999 | <input type="checkbox"/> \$100,000-\$119,999 |
| <input type="checkbox"/> \$40,000-\$59,999 | <input type="checkbox"/> \$120,000-\$139,999 |
| <input type="checkbox"/> \$60,000-\$79,999 | <input type="checkbox"/> \$140,000 or over |

12. In what year were you born? _____

13. What is your gender?

- Female
- Male

14. Which of the following best describes the highest level of education you have completed?

- | | |
|---|---|
| <input type="checkbox"/> Less than 12 years, no high school diploma | <input type="checkbox"/> Vocational/Trade Certificate |
| <input type="checkbox"/> High School/GED | <input type="checkbox"/> Bachelor's Degree |
| <input type="checkbox"/> Some college | <input type="checkbox"/> Master's Degree or higher |

Thank you for your time! Please fold this questionnaire in half and return it in the self addressed envelope provided.

Questionnaire Used To Determine The Effectiveness of Various Approaches to Framing and
Delivering Specific Messages: The Evaluation in Maine

Neighborhood Lawn Care Questionnaire



Questionnaire pick-up date: _____

Instructions

Your town, the Bangor Area Stormwater Group (BASWG), University of Maine Cooperative Extension, and Plymouth State University's Center for the Environment are collaborating to conduct research concerning neighborhood lawn care practices. Please take some of your time to fill out this important questionnaire.

This questionnaire is designed for all residents of your neighborhood, so even if you don't have a lawn or are not familiar with some of the issues, please feel free to answer all appropriate questions and remember there are no wrong answers. If you encounter a question for which you do not know the answer, please indicate this by writing "DK" (for "don't know") in the margin next to that question.

The information you provide is completely confidential and will only be presented in summaries where individual answers cannot be identified. Nothing you share can be traced back to you or your household, so please respond freely and honestly.

Our research team will come by your home to collect this questionnaire. Once this questionnaire is completed please place it in the provided door hanger bag and place it on your front door knob. The researchers will come by on the date and time indicated on the cover page of this questionnaire. Once we receive the completed questionnaire we will remove you from our list and we will not have to contact you again, and we thank you in advance!

Throughout this questionnaire we use the term "lawn chemicals". To ensure that everyone understands this term please read the following definition.

Lawn chemicals are chemicals that are applied to lawns such as fertilizers, pesticides and combination weed and feed products.

Neighborhood Perceptions

1. Using a scale of SD (Strongly Disagree) to SA (Strongly Agree), please indicate your level of agreement with the following statements:

	<u>Strongly Disagree</u>	<u>Disagree</u>	<u>Neutral</u>	<u>Agree</u>	<u>Strongly Agree</u>
A. People in my neighborhood think protecting water quality is important.	SD	D	N	A	SA
B. People in my neighborhood choose not to use fertilizers on their lawns.	SD	D	N	A	SA
C. People in my neighborhood choose not to use pesticides on their lawns.	SD	D	N	A	SA
D. Most of my neighbors use lawn chemicals on their lawns.	SD	D	N	A	SA
E. My neighbors believe it is important to maintain a suitable lawn.	SD	D	N	A	SA

How do you maintain your lawn?

The following section asks about your lawn care practices. Please check the box of the best answer for each of the following questions. Please remember the information you share is completely confidential and will not be recorded or presented in any way that could link responses to the individuals who make them. All of the following questions refer to lawn care practices performed during the growing season.

2. Do you have a lawn at your current residence in this neighborhood?

- Yes (Go to question 3, which is on page 4)
- No (skip to the **Campaign Exposure** section, which is on page 5, and begins with question number 8)

3. Please indicate how many times during last season the following lawn chemicals were applied to your lawn:

D. Fertilizers (either organic or synthetic)	1 time	2 times	3 times	4 or more	Not applied	Not applicable
E. Pesticides (e.g. fungicides, insecticides, and herbicides)	1 time	2 times	3 times	4 or more	Not applied	Not applicable
F. Combination Weed and Feed products (e.g. Scott LawnPro)	1 time	2 times	3 times	4 or more	Not applied	Not applicable

4. For each application of lawn chemicals, which of the following best describes how you determine how much to apply?

- I follow the instructions on the bag
- I just use the entire bag
- I hire someone else to apply for me
- I apply how much feels right
- I calculate the amount needed based on my lawn's size
- Lawn chemicals are not applied to my lawn
- Other (Please specify): _____

Lawn Care Intentions for Next Season

The following questions ask how you intend to maintain your lawn next season as compared to how you maintained your lawn this last season. Please choose the one best answer for each of the following questions.

5. How much fertilizer do you intend on using on your lawn next season?

- Less than last season
- About the same as last season
- More than last season
- I do not use fertilizer
- Not applicable

6. How much pesticide do you intend on using on your lawn next season?

- Less than last season
- About the same as last season
- More than last season
- I do not use pesticide
- Not applicable

7. In the box below, please share with us why you intend to use the amount of fertilizer or pesticide indicated in questions #6 and #7 (if you need more space use the back of this questionnaire).

Campaign Exposure

The University of Maine Cooperative Extension program and the Bangor Area Storm Water Group (BASWG) have been conducting an outreach and education campaign attempting to inform community members in your town about lawn care and water quality. Please check the box of the best answer for each of the following questions to let us know about your exposure to these efforts.

8. Have you seen any BASWG storm drain stencils around your neighborhood?

Yes No

9. Have you received a BASWG doorhanger at your home?

Yes No

10. Have you visited the BASWG webpage?

Yes No (skip to question 11)

a. What directed you to this webpage? (Please mark all that apply)

BASWG doorhanger BASWG stencil Newspaper article
 Television news story Friend Internet search engine
 Other (Please specify): _____

11. Have you seen or heard anything concerning BASWG activities on any of the following media sources? (Please mark all that apply)

Newspaper Television Radio Internet
 Other (Please specify): _____

My Beliefs

- 12. Using a scale of SD (Strongly Disagree) to SA (Strongly Agree), please indicate your level of agreement with the following statements:**

	<u>Strongly Disagree</u>	<u>Disagree</u>	<u>Neutral</u>	<u>Agree</u>	<u>Strongly Agree</u>
A. Lawn chemicals can be harmful to children.	SD	D	N	A	SA
B. Lawn chemicals can be harmful to pets.	SD	D	N	A	SA
C. I want my lawn to look good enough to fit in with the community.	SD	D	N	A	SA
D. Lawn chemicals <u>do not</u> negatively affect water quality.	SD	D	N	A	SA
E. I believe it is important to maintain a suitable lawn.	SD	D	N	A	SA
F. I believe people are too concerned about the appearance of their lawns.	SD	D	N	A	SA
G. Lawn chemicals can runoff into local waterways.	SD	D	N	A	SA

Demographics: A Bit About Who You Are

The following questions will help us compare responses from people with differing background characteristics to identify important trends across different groups. Please remember that all responses are completely confidential and cannot be linked with you as an individual.

- 13. How long have you lived in your community?**

- Less than 1 year 11-15 years
 1-5 years 16-20 years
 6-10 years over 20 years

14. Do you rent or own your current residence?

- Rent
- Own
- Other (Please specify): _____

15. Which category best describes your annual household income before taxes?

- | | |
|---|--|
| <input type="checkbox"/> Less than \$20,000 | <input type="checkbox"/> \$80,000-\$99,999 |
| <input type="checkbox"/> \$20,000-\$39,999 | <input type="checkbox"/> \$100,000-\$119,999 |
| <input type="checkbox"/> \$40,000-\$59,999 | <input type="checkbox"/> \$120,000-\$139,999 |
| <input type="checkbox"/> \$60,000-\$79,999 | <input type="checkbox"/> \$140,000 or over |

16. Do you feel your work or business is in some way economically dependent upon water quality?

- Yes
- No

17. Which of the following categories best describes your political orientation?

- | | | | | |
|--|---|-----------------------------------|--|---------------------------------------|
| <input type="checkbox"/> Liberal | <input type="checkbox"/> Moderately liberal | <input type="checkbox"/> Moderate | <input type="checkbox"/> Moderately conservative | <input type="checkbox"/> Conservative |
| <input type="checkbox"/> Not Sure | | | | |
| <input type="checkbox"/> Other (Please specify): _____ | | | | |

18. In what year were you born? _____

19. What is your gender?

- Female
- Male

20. Which of the following best describes the highest level of education you have completed?

- | | |
|---|---|
| <input type="checkbox"/> Less than 12 years, no high school diploma | <input type="checkbox"/> High School/GED |
| <input type="checkbox"/> Some college | <input type="checkbox"/> Vocational/Trade Certificate |
| <input type="checkbox"/> Bachelor's Degree | <input type="checkbox"/> Master's Degree or higher |

Thank you for your time! Please place this completed questionnaire in the pickup bag provided and hang it on your doorknob on or before the date and time indicated on the cover page of this questionnaire. Our researchers will stop by to pick it up.

References

- Adler, R.W., J.C. Landman, et al. (1993). *The Clean Water Act: 20 Years Later*. Washington D.C.: Island Press.
- Ajzen, I. & Fishbein, M. (1980). *Understanding attitudes and predicting social behavior*. Engelcliffs, NJ: Prentice Hall.
- Berg, Bruce L. 2007. Qualitative Research Methods for the Social Sciences. 6th ed. Boston, MA: Allyn & Bacon.
- Bormann, F.H., Balmori, D. and G.T. Geballe. (2001). *Redesigning the American Lawn: A search for environmental harmony*. New Haven, CT: Yale University Press.
- Cialdini, R., Reno, R., & Kallgren, C. (1990). *A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places*. Journal of Personality and Psychology, 58, 1015-1026.
- Dennis, J. 1986. Phosphorus Export from a Low Density Residential Watershed and an Adjacent Forested Watershed. *Lake and Reservoir Management*, 2: 401-407.
- Dillman, D., Smyth, J., and Christian, L. (2009). Internet, Mail, and Mixed-mode Surveys: The Tailored Design Method. John Wiley and Sons Inc., New Jersey.
- Glaser, B. and Strauss, A. (1969). *The Discovery of Grounded Theory: Strategies for Qualitative Research*. London: Weidenfeld and Nicolson.
- Goldstein, N., Cialdini, R., and Griskevicius, V. (2008). *A room with a viewpoint: Using social norms to motivate environmental conservation in hotel rooms*. Journal of Consumer Research, 35.
- Gotschi, E., Vogel, S., Lindenthal, T., and Larcher, M. (2010). *The role of knowledge, social norms, and attitudes toward organic products and shopping behavior: Survey results from high school kids in Vienna*. The Journal of Environmental Education, 41(2), 88-100.
- Griskevicius, V., Cialdini R.B., Goldstien N.J. (2008). Social norms: An underestimated and underemployed lever for managing climate change. *International Journal of Sustainability Communication* 5-13.
- Guillard, K., and W.M. Dest. 2003. Extractable soil phosphorus concentrations and creeping bentgrass response on sand greens. *Crop Sci.* 43:272–281.
- Hopper, J., and Nielsen, J. (1991). *Recycling as altruistic behavior: Normative and behavioral strategies to expand recycling participation in a community recycling program*. Environment and Behavior, 23:2, 195-219.
- Jenkins, V. S. (1994). *The Lawn: A History of an American Obsession*. Smithsonian Institute Press 1994.
- Kallgren, C., Reno, R., and Cialdini, R. (2000). *A focus theory of normative conduct: When norms do and do not affect behavior*. *Personality and Social Psychology Bulletin*.

- Kort, Y., McCalley, T., and Midden, C. (2008). *Persuasive trash cans: Activation of littering norms by design*. Environment and Behavior, 40, 870-891.
- Maguire, R.O., and J.T. Sims. 2002. Measuring agronomic and environmental soil phosphorus saturation and predicting phosphorus leaching with Mehlich 3. Soil Sci. Soc. Am. J. 66:2033–2039.
- Mckenzie-Mohr, D. and Smith, W. (1999). Fostering Sustainable Behavior: An Introduction to Community-Based Social Marketing. New Society Publishers, Canada.
- Milesi C., Elvidge C. D., Dietz J.B., Tuttle B. T., Nemani R. R., and S. W. Running (2005). *A Strategy for Mapping and Modeling the Ecological Effects of US Lawns*. NASA Ames Research Center, Moffett Field, CA.
- Morris, T.F., E.M. Szigeti, and J.L. Ping. 2006. Runoff phosphorus estimation as related to soil sampling depth, extractants, and soil properties in conventionally-tilled cornfields. (under review).
- Neuman, W. (2007). Basics of Social Research: Quantitative and Qualitative Approaches. Pearson Education, Inc.
- Robbins P., Polderman A., Birkenholtz. (2001) Lawns and Toxins: An Ecology of the City. *Cities*, 18(6): 369-380.
- Robbins P. and T. Birkenholtz (2003). *Turfgrass revolution: measuring the expanse of the American lawn*. Land Use Policy 2003, pp. 181-194.
- Robbins P. (2007). Lawn People: How Grasses, Weeds, and Chemicals Make Us Who We Are. Temple University, Philadelphia PA.
- Schultz, P.W., Nolan J.M., Cialdini R.B., Goldstien N.J., Griskevicius V. (2007). The constructive, destructive, and reconstructive power of social norms. *Psychological Science*, 18(5), 429-434.
- Scott, J. and Marshal, G. (2005). Oxford Dictionary of Sociology. Oxford University Press, Oxford.
- Shern, L.C. (1994). *Suburban Lawns: Dimensions of meaning, activities, and environmental concerns reported by homeownership couples in Georgia and Michigan*. Dissertation Abstracts. Michigan State University.
- Sims, J.T., R.O. Maguire, A.B. Leytem, K.L. Gartley, and M.C. Pautler. 2002. Evaluation of Mehlich 3 as a agri-environmental soil phosphorus test for the mid-Atlantic United States of America. Soil Sci. Soc. Am. J. 66:2016–2032.
- Steele, J., Bourke, L., Luloff, A., Liao, P., Theodori, G., and Richard, S. (2001). *The drop-off/pick-up method for household survey research*. In press.
- Steinberg T. (2006). American Green. W. W. Norton Company Inc. New York, NY.
- Thogersen, J. (2006). Norms for environmentally responsible behavior: An extended taxonomy. *Journal of Environmental Psychology*, 26, 247-261.

United States Environmental Protection Agency (1996) “*Managing Nonpoint Source Pollution from Households*” Office of Water EPA 841-F-96-004J, Retrieved January 2010.
(<http://www.epa.gov/owow/nps/facts/point10.htm>).

This material is based upon work supported in part by the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture, under Agreement Nos. 2008-51130-19504 and 2006-51130-03656. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.