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Assessing LakeSmart: The Development and Effectiveness of a Lake Protection Program

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EXECUTIVE SUMMARY

Maine's nearly 6,000 lakes are a vital resource for the state, generating $6 billion in annual economic activity and sustaining 52,000 jobs. Over the course of the last several decades, this resource has increasingly been threatened by development and related problems, especially nutrient runoff. LakeSmart is a lake protection program designed to stem the flow of nutrient runoff by promoting and rewarding the use lake-friendly landscaping practices.

For this project, I traced the history of LakeSmart from its roots in the Maine Department of Environmental Protection and, through stakeholder interviews and surveys, chronicled its development into the flagship program of the Maine Lakes Society. To assess the program's effectiveness, I examined the drivers of and barriers to conservation behavior and how they have been addressed in the design and implementation of the program.

Through the use of surveys and stakeholder interviews, I identified potential areas of improvement in the structural design of LakeSmart as well as in the way it presents itself to potential participants. Specifically, the program can improve its mentoring process for property owners who do not receive LakeSmart certification, it can develop partnerships with member-rich groups to increase exposure of the program to new potential participants, and it can foster a strong sense of place in lake communities by becoming involved in local events. In addition, LakeSmart can improve the training for the evaluators and screeners by increasing "job-shadowing" opportunities with experienced LakeSmart inspectors, and it can reduce redundancy, subjectivity, and unclear wording in its evaluation form. If LakeSmart implements these changes, along with other already in the process of being implemented, there is real potential for expansion within and beyond the state of Maine.

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I. INTRODUCTION

In a state so defined by its status as a tourist destination that it carries the nickname "Vacationland", the quality of the environment is of inestimable value. Maine's nearly 6,000 lakes alone generate an estimated $3.5 to $6 billion in annual economic activity and support 52,000 jobs, while also providing 400,000 Mainers with clean drinking water (Boyle et al. 1997, Natural Resources Council of Maine 2013). In the last few decades, however, it has become increasingly apparent that this natural resource is under threat. Mirroring a worldwide decline in water quality (Baron et al. 2013, Nasir Khan and Mohammad 2014), the water quality of Maine's lakes has decreased measurably in the past twenty years due to increased developmental pressure and earlier spring ice-out, a combination that leads to increased nutrient availability in the lakes (Boyle et al. 1999, McCullough et al. 2013, Beyene and Jain 2015). While the Mandatory Shoreland Zoning Act (38 MRSA §435-449) of 1971 has done much to help manage shoreland development for the sake of lake health by establishing protected zones and minimum setback rules (Maine Department of Environmental Protection 2008), developmental pressure is still increasing in many parts of the state (Pavri et al. 2012).

The constant human presence in, on, and around Maine's lakes has brought with it many environmental impacts. Among them are: the destruction of wildlife habitat, the introduction of invasive species, (such as Eurasian milfoil, *Myriophyllum spicatum,* and its lesser-known relative Variable-leaf milfoil, *Myriophyllum heterophyllum*), and increased nutrient runoff from lush, suburban-style lawns, which promotes eutrophication (Bailey and Calhoun 2008, Baron et al. 2013, Nasir Khan and Mohammad 2014). Laws such as the Shoreland Zoning Act (38 MRSA §435-449) or the Natural Resource Protection Act (38 MRSA §480) and programs such as the Volunteer Lake Monitoring Program (Maine Volunteer Lake Monitoring Program 2016) have been created to help protect and restore the health of Maine lakes by mitigating human impacts. Among these lake protection programs is LakeSmart, a government-created but now nonprofit-administered effort to promote and reward the use of landscaping best management practices (BMPs) to buffer shoreline properties against erosion and nutrient runoff (Maine Lakes Society 2015). Property owners can apply for the LakeSmart award, a

distinctive white and blue sign that proclaims its owner as a friend of the lake (Maine Lakes Society 2015). Operating on 43 lakes and three rivers in 13 of Maine's 16 counties (excluding Somerset, Piscataquis and Sagadahoc counties) as of 2016, LakeSmart is among the largest and most well-known lake protection programs in the state (see Appendix A). However, while the program appears to be successful at raising awareness of threats to lake health from shoreline development and promoting lake-friendly landscaping practices, its effectiveness has yet to be formally evaluated.

Because LakeSmart is a comprehensive program that encompasses many aspects of lake protection, a full assessment of the program is difficult to achieve. Instead, this report focuses on four different aspects of the program: the background conditions under which the LakeSmart developed, a historical overview of the program's development, an investigation of the motivations that drive conservation behavior among lakeshore residents, and an exploration of the assessment criteria used for the LakeSmart award. The report ends with a synthesis of the findings and their implications for the future of the LakeSmart program.

In the Background section, I explore the importance of lakes to Maine's economy and the state's recreation culture as well as provide an overview of the problems facing many of Maine's lakes. By fostering an understanding of the science behind water quality decline, this section explains how legislation, lake protection programs, and especially LakeSmart, attempt to mitigate the damage done by decades of shoreline development.

In the Historical Overview, I chronicle LakeSmart's development from a Maine Department of Environmental Protection pilot project in 2003 to the Maine Lakes Society flagship program in 2016 (Maine Lakes Society 2016). Through a combination of a literature review and stakeholder interviews, I chronicle the evolution of the LakeSmart program and its transition from a government- to a non-profit-administered program. In this section, I also explore past program changes and stakeholder visions for the future of LakeSmart.

The Motivation for Conservation section focuses on what drives people to engage in pro-environmental behavior in general by reviewing literature on participation in activities as disparate as bird-feeding, recycling, and water conservation. I then draw comparisons between these literature findings and survey data from the Belgrade Lakes

watershed, exploring differences in demographic characteristics, environmental attitudes, concern about declining water quality, community engagement, and implementation of best management practices between participants in the LakeSmart program and shoreline residents who have not participated in the program. In this section, I also explore the influence of reference persons on the adoption of LakeSmart standards as well as stated motivations for participation among the LakeSmart participants. I then use these findings to make recommendations for increasing participation in the LakeSmart program.

The LakeSmart Criteria and Suggestions for Improvement section draws on surveys administered to the individuals who carry out the daily work of evaluating nutrient runoff management strategies on lakeshore properties throughout the state. These people, collectively referred to as LakeSmart inspectors, were asked to give their opinions on the criteria and processes that lead to a LakeSmart award. From an analysis of their responses, I develop recommendations for future changes to the program.

Finally, I summarize the recommendations for improvement of the LakeSmart program identified throughout the report, and compare them to changes to the program that have already been implemented since work on this report began in September 2015. In doing so, I identify improvements that still have the potential to be implemented.

My goal in conducting this research project is to deliver a thorough yet accessible assessment of the strengths and weaknesses of the LakeSmart program. I will make suggestions for future improvement that will be both useful to those administering the program and of sound scientific value. By carrying out this assessment, I hope to make a contribution that will help take this innovative program to the next level.

II. BACKGROUND

Lakes in Maine

With an abundance of clear lakes and vast forests, Maine is an ideal destination for tourists, attracting close to 34 million visitors in 2014 (Maine Office of Tourism 2015a). These visitors from Southern New England, Eastern Canada and beyond generated more than $5.6 billion in direct expenditures and supported close to 100,000 tourism-related jobs in 2015 (Maine Office of Tourism 2015b). According to studies by the Maine Department of Environmental Protection, 54% of this money is spent in communities directly bordering the lakes (Bouchard 2000). The money spent by lake users pays residents' wages and is re-spent within the community, generating an estimated $3.5 to $6 billion dollars in annual lake-related economic activity and sustaining 52,000 lake-related jobs (Boyle et al. 1997, Bouchard 2000, Natural Resources Council of Maine 2013). Overall economic activity from the Great Ponds (those lakes with a surface area larger than ten acres) alone represented 5% of Maine's gross regional product in 1997, illustrating the importance this natural resource to the economy of the state even 20 years ago (Boyle et al. 1997).

In addition to money spent by out-of-state visitors, the lakes generate $87 to $290 per acre, suggesting that lake recreation presents a powerful draw to Maine residents. In fact, Mainers spend 80% of all money spent pursuing lake-related recreation activities (Boyle et al. 1997). According to a 2015 survey from the Maine Office of Tourism, 95% of Mainers had taken a vacation in Maine more than 50 miles away from their home within their lifetime, and 71% had done so within the past year, suggesting a strong connection to the recreation resources of their home state (Maine Office of Tourism 2015a). This strong sense of place, coupled with the revenue generated by tourists and summer residents, can begin to explain the importance that lakes hold for Maine.

Causes of Declining Water Quality

Although Maine is almost synonymous with its deep lakes and dense forests, water quality issues are of great concern. All 5,780 lakes and ponds that are monitored by the Maine Department of Environmental Protection (DEP) are considered impaired due to high levels of mercury bioaccumulation (Maine Department of Environmental

Protection 2012). While factors such as mercury bioaccumulation, nonnative fish introductions, and acidification are putting stress on Maine's lakes, nutrient enrichment (called eutrophication) is considered the most severe threat to lakes in this region (Whittier et al. 2002). In total, 117 lakes are considered "impaired" or "threatened" due to their total phosphorus loads, and 24 lakes do not meet minimum standards for water clarity (Maine Department of Environmental Protection 2012, 2016). These impaired lakes are located primarily along the I-95 corridor (Maine Department of Environmental Protection 2013a). Eutrophication is a severe enough threat that as early as 1996, 260 lakes and ponds in Maine did not meet federal standards for swimming and aquatic life support (Michael et al. 1996). Today, 2.4% out of 986,952 lake-acres in Maine are not considered suitable for swimming, and 8.6% are not suitable for supporting aquatic life (Maine Department of Environmental Protection 2012).

Eutrophication in its own right is a natural process, which occurs as part of the natural aging of lakes. After their formation, lakes are initially oligotrophic (nutrient poor) (Nasir Khan and Mohammad 2014). Oligotrophic lakes are clear and deep, supporting little plant and animal life. Over time, the limiting nutrients phosphorus (P) and nitrogen (N) present in eroding soil and decomposing animal matter are carried into the lake by storm water runoff, causing a change in the trophic state to a mesotrophic (nutrient enriched) and finally to a eutrophic (nutrient rich) or even hypertrophic state plagued by serious water quality problems (Nasir Khan and Mohammad 2014). While this process happens naturally over geological time, formerly oligotrophic and mesotrophic lake ecosystems are becoming eutrophied at an increasing rate due to human alterations of natural nutrient fluxes resulting primarily from development along shorelines and in the watershed (Smith 2003, Nasir Khan and Mohammad 2014). This acceleration of the natural aging process, termed cultural eutrophication, has become one of the world's most pressing water quality issues (Nasir Khan and Mohammad 2014), and it has progressed to a point where most freshwater resources in the United States are degraded in some way (Baron et al. 2013).

Eutrophication occurs because in many freshwater ecosystems, productivity is limited by the availability of the essential nutrients phosphorus (P) and nitrogen (N) (Schindler 1977, Glibert et al. 2014). P is frequently a limiting nutrient because all living

organisms require it to build nucleic acids and phospholipid membranes. Similarly, N can be a limiting nutrient due to its prevalence in nucleic acids and amino acids. Human alterations of the natural nutrient cycles, especially the industrial production and application of N- and P- rich fertilizers, have led to large increases in the amounts of reactive N and P that are cycled through aquatic ecosystems (Nasir Khan and Mohammad 2014). Unless the excess nutrients are flushed out of the ecosystem before they can be taken up and used biologically, affected ecosystems often display algal blooms, which limit light availability for other species. As these algae die and are broken down, they support large populations of decomposers. These decomposers use up large amounts of dissolved oxygen, sometimes creating hypoxic (low-oxygen) conditions that can result in fish kills (Baron et al. 2013, Faridmarandi and Naja 2014, Nasir Khan and Mohammad 2014).

Nutrient inputs into a lake can be external or internal in origin. External nutrient inputs generally enter the lake through direct runoff, groundwater flow, or tributary flow, whereas internal nutrient inputs occur when anoxic conditions result in the release of P from lake sediments (Lijklema 1986, Kõiv et al. 2011). Phosphorus that is not used up by the organisms present in a lake ecosystem or flushed out of the system sinks to the bottom of the lake, where it becomes bound to iron, making it biologically unavailable (Søndergaard et al. 2003). In anoxic conditions, however, whether caused by the organisms decomposing algal matter or by summer stratification (which prevents oxygen from reaching the deeper parts of a lake), the P is released from its bond with iron. This makes it biologically available again, able to fuel primary production (Søndergaard et al. 2003). External nutrient inputs, on the other hand, originate from either point or non-point sources (Nasir Khan and Mohammad 2014). Point source pollution enters the lake or its tributary streams from one defined outlet, such as a pipe releasing sewage effluent or a leaking septic system (Harvey 2015). Non-point source pollution, on the other hand, is washed into streams and lakes with rainwater runoff carrying pollutants and phosphorus-rich eroding soil from the entire watershed (Baron et al. 2013, Nasir Khan and Mohammad 2014, Harvey 2015, Rissman and Carpenter 2015). Because, at least in developed countries, eutrophication control measures have succeeded in removing most point sources, the focus has turned to mitigating non-point sources, whose impacts are

much more difficult to quantify and prevent (Nasir Khan and Mohammad 2014, Rissman and Carpenter 2015).

Impacts of Eutrophication

Regardless of its cause, cultural eutrophication can impact lakes, their organisms, and their surrounding human populations. Common impacts on human lake uses include restricted industrial and recreational use due to the spread of invasive macrophytes and algae, reduced drinking water quality, and human health effects due to high nutrient loading and toxic cyanobacteria blooms (Nasir Khan and Mohammad 2014). These restrictions often seriously harm local economies by decreasing tourism and recreation revenue and by necessitating costly macrophyte removal efforts (Paterson 1989). Ecosystem impacts include fish kills resulting from hypoxia or cyanotoxin-poisoning as well as increased release of greenhouse gases from lake sediments (Smith 2003, Baron et al. 2013, Nasir Khan and Mohammad 2014). Because climate change is projected to intensify summer droughts, reducing flushing rates and lengthening the residence time of nutrients in aquatic ecosystems, and to increase the severity of rain storms, increasing the amount of runoff entering these ecosystems, cultural eutrophication is likely to intensify during the coming decades (Whitehead et al. 2009).

Storm water runoff continues to be an area of significant concern for Maine lakes (Pavri et al. 2012). While runoff is likely to contain pollutants and nutrients from the entire watershed, shoreline properties are generally considered the last line of defense against lake degradation (Jennings et al. 2003). Numerous studies have shown that shoreline development, which tends to weaken this line of defense and introduce nutrient sources in proximity of the shoreline, is associated with a host of environmental problems beyond eutrophication, including destruction of fish nursery grounds, introduction of invasive species, and loss of littoral biodiversity (Soediono 1989, Elias and Meyer 2003, Jennings et al. 2003, Brauns et al. 2007, 2011, Carpenter et al. 2007, Cheruvelil and Soranno 2008, De Sousa et al. 2008, Merrell et al. 2009, Christensen et al. 2012, Steinman et al. 2015).

While eutrophication should be an area of concern in most parts of the world, it is especially threatening in a place like Maine, where large parts of the state economy rely heavily on the lakes (Peckenham and Hart 2012). On a smaller scale, high water quality

buoys the economies of entire communities by providing access to high quality, low cost drinking water, high lakeshore property values (resulting in high tax revenue for lake communities), recreation revenue, and aesthetic qualities (Boyle and Bouchard 2003). Because degraded lakes are significantly less valuable to the surrounding communities (in terms of recreation, drinking water, transportation, fishing and other uses) than healthy lakes, potential economic gains should be an incentive for lake protection and restoration (Carpenter and Cottingham 1997, Keeler et al. 2012). In fact, Boyle et al. (1997) conclude that tolerating the continued degradation of Maine's lakes would be akin to killing "the goose that laid the golden egg."

Hierarchy of Lake Protection in Maine

To protect this "golden goose", a multi-tiered hierarchy of lake protection efforts has developed in Maine (Boyle et al. 1997). At the state level, Maine has created a suite of laws designed to combat nutrient runoff and promote sound environmental practices around the lakes. Arguably the most influential and far-reaching law is the Mandatory Shoreland Zoning Act (38 MRSA §435-449). Enacted in 1971 in response to increasing developmental pressure, the act prescribes statewide minimum standards for protecting aquatic habitat (Maine Department of Environmental Protection 2008). The law establishes a minimum setback of 100 feet from the lakeshore for all newly-built structures (older structures are "grandfathered in" under previous regulations), prohibits large openings in the tree canopy, mandates an intact, multi-level buffer zone and narrow, meandering paths. All of these features are designed to prevent or reduce erosion carrying phosphorus and to slow the flow of water across the property, allowing it to infiltrate into the ground before reaching the lakeshore and reducing the amount of soil and other runoff entering the lake (Merrell 2013). How effectively this law has minimized negative effects from shoreline development becomes clear when comparing the state of Maine's lakes to those in Vermont. Maine's Shoreland Zoning Act was actually modeled after Vermont's Zoning of Shorelands Law (24 VSA §4410a) of 1970, which included many of the same features. However, the Vermont law was repealed only five years later, in 1975, leaving the protection of lakeshores in the hands of individual towns and private landowners (Vermont Department of Environmental Conservation 2003, Merrell et al. 2013). Most Vermont towns did not enact sufficiently stringent ordinances, allowing the

lakeshores to become some of the most heavily developed areas in the state (Merrell et al. 2013). Recognizing the harm that was being done to Vermont's lakes, the state legislature passed the Vermont Shoreland Protection Act (10 VSA §1441) that took effect in July 2014, reestablishing regulations to guide development within 250 feet of lakes greater than ten acres (Watershed Management Division 2015).

In addition to the Shoreland Zoning Act, Maine has passed several other protective laws, including the Erosion and Sedimentation Control Act (38 MRSA §420-C), which mandates erosion control measures to be put in place for any earth disturbances (e.g., camproads, parking areas) in the watersheds of at-risk bodies of water; the Natural Resource Protection Act (38 MRSA §480), which regulates earth disturbances within 100 feet of water resources; the Site Location of Development Act (38 MRSA §481-490), which regulates major development proposals; and a law discouraging the use of phosphorus-based fertilizers (38 MRSA §419) (Nonpoint Source Training & Resource Center 2000, Monagle 2002).

While Maine state laws set the minimum standards for lake protection, municipalities can introduce their own, more stringent regulations. The Town of Belgrade in Central Maine, for example, has its own Shoreland Zoning Ordinance (approved by referendum in 1991 and amended in 1997), a Minimum Lot Size Ordinance (1993) and a Floodplain Management Ordinance (1999), all of which aim to reduce human impacts on the adjacent Belgrade Lakes (Town of Belgrade 1991, 1993, 1999). Many municipalities also use direct management strategies that focus on combatting the symptoms of eutrophication, such as overproduction of macrophytes (Belgrade Regional Conservation Alliance 2015a). The Town of Belgrade, for example, funds a Courtesy Boat Inspection program at boat launch sites intended to prevent the spread of invasive aquatic plants such as Variable milfoil, *Myriophyllum heterophyllum* (Belgrade Regional Conservation Alliance 2015a).

Maine lakes receive protection not only from various levels of government, but also from many non-profit organizations such as lake associations and lake trusts. Lake associations are membership organizations in which individuals and businesses come together with the common goal of protecting a given lake or watershed. The Belgrade Lakes Watershed, for example, a roughly 180 square mile area comprising seven lakes

and various smaller ponds, has six all-volunteer lake associations with the goal to protect the water quality of their respective lakes: the East Pond Association, the North Pond Association, the McGrath Pond – Salmon Lake Association, the Belgrade Lakes Association (for Great Pond and Long Pond), the Friends of Messalonskee (for Messalonskee Lake), and the Watson Pond Landowners Association (Kallin 2015). These individual lake associations are members of the Belgrade Regional Conservation Alliance (BRCA), a combined lake and land trust that protects land in the Belgrade Lakes watershed through purchases and conservation easements (Belgrade Regional Conservation Alliance 2015b, Kallin 2015). Together as well as individually, the six lake associations and the lake trust sponsor programs like the BRCA youth conservation corps, which carries out erosion and nonpoint source pollution control work throughout the watershed, or milfoil removal programs. In addition to being members of the BRCA, the lake associations are also members of the Maine Lakes Society (MLS) (Maine Lakes Society 2016). Although the MLS happens to be based in Belgrade Lakes Village, in the same building as the BRCA and the Belgrade Lakes Association (BLA), it operates throughout the state (Kallin 2015, Maine Lakes Society 2016). Formerly known as the Maine Congress of Lake Associations, the MLS is a membership organization comprised of 144 lake associations, businesses and individuals (Maine Lakes Society 2016). The organization provides lake education for children and adults alike through its Lakes Alive! program and teaches lake friendly landscaping practices through its LakeSmart program. The MLS also holds the annual Maine Lakes Conference to share lake science developments and to provide networking opportunities for lake stewards and stakeholders, and lobbies the state legislature in Augusta for lake friendly laws (Maine Lakes Society 2016).

Another important element of Maine lake protection is the Maine Volunteer Lake Monitoring Program (VLMP), which integrates the efforts of several tiers in the state's lake protection hierarchy. Formed in 1971 in response to the Clean Water Act that was passed a few months later, the VLMP is a non-profit citizen science organization supported through funding from the Maine Department of Environmental Protection (DEP) and the US Environmental Protection Agency (EPA) as well as through private donations from individuals, organizations, and businesses who recognize the value of the

work done by VLMP volunteers (Williams and Hill 2013). More than 1,200 volunteers, trained and certified by the VLMP and based in more than 500 watersheds throughout the state, monitor a wide range of water quality indicators, regularly assess general watershed health, and screen the lakes for invasive species (Maine Volunteer Lake Monitoring Program 2016). The information gathered by VLMP volunteers, many of whom have continuously monitored their lakes for several decades, informs essential lake management decisions at every level of lake stewardship: from individuals to towns, lake associations and land trusts, to the state, and even to the federal level.

Potential Solutions for Eutrophication

Organizations in the lake protection hierarchy, especially lake associations, land trusts, and towns, often sponsor programs to increase the water quality in local lakes. Aquatic macrophyte removal programs are especially popular because, by removing the excess growth of invasive species fueled by increased nutrient availability, one of the most visible symptoms of eutrophication can be eliminated. However, because aquatic macrophyte removal is often carried out either manually (through labor-intensive hand-removal programs) or chemically (through herbicide applications) it is most often used to contain the spread of invasive species such as Variable milfoil, *Myriophyllum heterophyllum* (Bailey and Calhoun 2008, Maine Department of Environmental Protection 2013b, Matson 2015).

Food web manipulation efforts that favor predators of phytoplankton to improve water clarity are more easily managed (Shahady et al. 1994, Jeppesen et al. 2005, Olin et al. 2006, Halliwell and Evers 2008). These food web manipulations, also known as biomanipulations, involve either the removal of planktivorous fish or the stocking of piscivorous fish, with the goal of reducing the feeding pressure on herbivorous zooplankton populations, allowing their populations to increase. This increase in zooplankton populations increases the feeding pressure on phytoplankton, hopefully resulting in an increase in water clarity (Halliwell and Evers 2008). Food web manipulations have been effective in Maine lakes (Halliwell and Evers 2008) as well as in lakes and reservoirs in other regions (Shahady et al. 1994, Jeppesen et al. 2005, Olin et al. 2006).

Other strategies focus on the chemical inactivation of nutrients present in the water, especially phosphorus (Welch and Cooke 1999). Such efforts can involve the addition of aluminum sulfate, a substance that binds with phosphorus in the lake sediment, preventing it from being released during events of hypolimnetic anoxia (eutrophication-induced lack of oxygen in the deeper parts of a lake). Alum application, as the process is commonly called, has been shown to be able to immobilize phosphorus for a period of more than ten years (Welch and Cooke 1999) in many different lake environments (Kennedy and Cooke 1982, Steinman et al. 2004, Reitzel et al. 2005), and is currently being evaluated as a possible treatment for algal bloom-plagued East Pond of the Belgrade Lakes (Maggie Shannon, pers. comm.). However, because alum, if dosed incorrectly, can lead to pH changes, which can severely harm fish and plankton communities (Schumaker et al. 1993, Tanada et al. 2003), it remains a controversial and expensive response to eutrophication.

Hypolimnetic oxygenation, the injection of oxygen into the deep part of a lake to satisfy the biological oxygen demand of flora, fauna, and sediment and to prevent the release of phosphorus caused by anoxic conditions, is a less controversial option that has been widely used and shown to be effective in alleviating the signs of eutrophication (Beutel and Horne 1999, Müller and Stadelmann 2004, Gantzer et al. 2009, Liboriussen et al. 2009).

LakeSmart

If used correctly, aquatic macrophyte removal, biomanipulation, alum application or hypolimnetic oxygenation can be effective in combatting the aesthetic symptoms of eutrophication. They do not, however, address the problem of nutrient loading and thus the ultimate cause of eutrophication. Laws such as the Mandatory Shoreland Zoning Act do address this problem, but more can always be done to reduce the stress nutrient runoff exerts on Maine's lakes. One such additional initiative is the Maine Lakes Society (MLS)'s flagship program, LakeSmart (Maine Lakes Society 2015). LakeSmart is a largely volunteer-run lake protection program targeted towards lakeshore residents, the last line of defense against nutrient runoff into the lakes (Jennings et al. 2003). From humble beginnings as a Maine Department of Environmental Protection (DEP) pilot program in 2003 (Welch and Smith 2008), the program has grown to be "one of the most

Table 1. Selected Best Management Practices promoted by the LakeSmart Program to mitigate erosion and nutrient runoff into lakes.

Best Management Practice	Description
Driveway and Parking Areas	
Rubber Razors[1]	Rubber blade that intercepts water and diverts it off gravel driveways and camproads into stable vegetated areas
Turnouts[1]	Extension to a roadside ditch that diverts water into adjacent vegetated areas
Open-Top Culverts[1,2]	Fortified narrow gaps in the road that collect water and divert it into nearby vegetation
Structures and Septic System	
Permitting[1]	Comply with laws and ordinances regulating activities in proximity of waterways
Rain Gardens[1]	Landscaped areas designed to capture rainwater from impermeable surfaces and allow it to infiltrate
Rain Barrels[1]	Barrel placed beneath the downspout of gutters to capture and store water running off the roof
Drywells[2]	Gravel-filled pit beneath a gutter downspout to capture and infiltrate water running off the roof
Dripline Trenches[1,2]	Gravel-filled trench along foundation to capture and infiltrate water running off the roof
Septic System Pumped Regularly[3]	Every three years in considered ideal to prevent overflowing and leakage
Leach Field Free of Woody Vegetation[4]	Roots can destroy the leach field pipes and create leaks
Yard, Recreation Area, and Footpaths	
Minimize Lawn Area[4]	Large lawns allow for uncontrolled runoff
Waterbars[1]	Log or piece of timber that intercepts water travelling down a footpath and directs it into stable vegetated areas

[11] Portland Water District and Maine Department of Environmental Protection 2006

[2] Portland Water District 2015a

[3] Maine Lakes Society 2015

[4] Portland Water District 2015b

Table 1 Continued.

Best Management Practice	Description
Pervious Pathways[2]	Path made up of mulch, gravel, or grass pavers that allow water to infiltrate
Infiltration Steps[1 2]	Steps filled with gravel to slow water flow and allow for infiltration in steep sections of a path
Meandering Paths and Walkways[1]	Meandering paths direct water into nearby vegetation instead of allowing gullies to form
Erosion Control Mix[1 2] or Superhumus[2]	Heavy types of mulch that lock in place and protect the underlying bare soil
Infiltration Trenches[1]	Gravel-filled trench to collect and infiltrate runoff
Limit/Eliminate Use of Fertilizer[5]	Apply fertilizer sparingly and only after testing the soil for nutrient levels
Limit/Eliminate Use of Pesticides/Herbicides[3]	Pesticides and herbicides get washed into waterways, where they can seriously harm aquatic flora and fauna
Leave Lawn Clippings[1 2 4]	Leaving lawn clippings and leaves builds up a layer of duff that slows water flow and limits runoff
Plant Native Species[4]	Native species are best adapted to Maine's climate and can prevent erosion and runoff
Collect Pet Waste[3]	Pet waste contains nitrogen as well as bacteria and parasites that can contaminate waterways and infect humans
Buffer and Water Access	
Multi-level Vegetative Buffers[1]	Vegetation along shoreline at least ten feet deep, containing duff layer, ground cover, understory, shrub, and trees
Shoreline Riprap[1 2]	Heavy, irregular-shaped rocks placed along the shoreline to stabilize it
Live Staking[1]	Planting cuttings of fast-growing native species such as dogwood or willow on bare shoreline slopes to stabilize the soil

[5] Cumberland County SWCD and Portland Water District 2015a

effective lake protection programs available today" (Maine Lakes Society 2015). Through the distribution of informational material, educational efforts and mentorship, as well as an award plaque in recognition for stewardship efforts, LakeSmart encourages residents to implement best management practices (BMPs) (Table 1) that limit erosion and reduce nutrient runoff from shoreline properties, mitigating their impact on the lake (Maine Lakes Society 2015).

Property owners who wish to be considered for the LakeSmart award, which identifies them as friends of the lake, contact the LakeSmart coordinator of their lake association to schedule a review of their property. After an initial screening to determine whether the property has the potential to satisfy the LakeSmart standards, the property is judged by a trained LakeSmart evaluator on its use of BMPs in four areas: (1) the driveway and parking area, (2) structures and septic system, (3) yard, recreation areas and footpaths, and (4) buffer and water access (Table 1).

In the program design of LakeSmart, the property evaluation was divided into these four sections to emphasize the potential for nutrient runoff from each of these sources, and therefore their importance to runoff mitigation efforts through the implementation of best management practices (Table 1). Unless they are properly designed and maintained, driveways and parking areas are prone to erosion during rain events, causing P-rich soil to be washed into the lake (Portland Water District and Maine Department of Environmental Protection 2006, Maine Lakes Society 2015). Similarly, roof-runoff from buildings can cause erosion unless it is captured and allowed to infiltrate into the ground (Portland Water District and Maine Department of Environmental Protection 2006, Maine Lakes Society 2015). Septic systems, especially ones that are more than twenty years old, can leak nutrients into the groundwater, which carries them into the lake (Maine Lakes Society 2015). The yard, especially the lawn, is often treated with fertilizers, pesticides, or herbicides, which can be swept into the lake during rain events (Cumberland County Soil & Water Conservation District and Portland Water District 2015) and footpaths leading to the shoreline can channel nutrient runoff into the lake unless they are designed to direct the water into infiltration areas (Portland Water District 2015a). Finally, vegetated buffers slow the flow of water across the property,

particularly in the riparian area, and allow it to infiltrate before it reaches the lake, while also capturing eroded soil (Maine Lakes Society 2015).

Only residents whose properties score well in all four of these runoff mitigation categories during the LakeSmart evaluation receive the distinctive blue-and-white award sign. Those that score well in at least one but not all four sections receive a commendation recognizing their effort, and are encouraged to keep improving their properties (Maine Lakes Society 2015). By educating residents about best management practices and making the 'LakeSmart style' of landscaping the new norm for Maine lakeshore properties, the Maine Lakes Society hopes to save the lakes from dying a 'death by a thousand cuts' through nutrient runoff from countless poorly-buffered properties (Maine Lakes Society 2015).

III. HISTORICAL OVERVIEW – THE DEVELOPMENT OF LAKESMART

The Early Years: LakeSmart at the Department of Environmental Protection

Like any other successful resource protection program, LakeSmart started as an idea. Worried about the increase in development around the Maine lakes and the related water quality problems, the Maine Department of Environmental Protection (DEP) began designing a new lake protection program in 2001. DEP staff members, notably among them Aquatic Biologist Barbara Welch and Lakes Education Coordinator Christine Smith, met with leaders in the lake protection community from around the state to gauge the need for and potential success of a program that would, once fully implemented, help mitigate the runoff from shoreline properties by making lake-friendly landscaping practices the norm (Welch and Smith 2008).

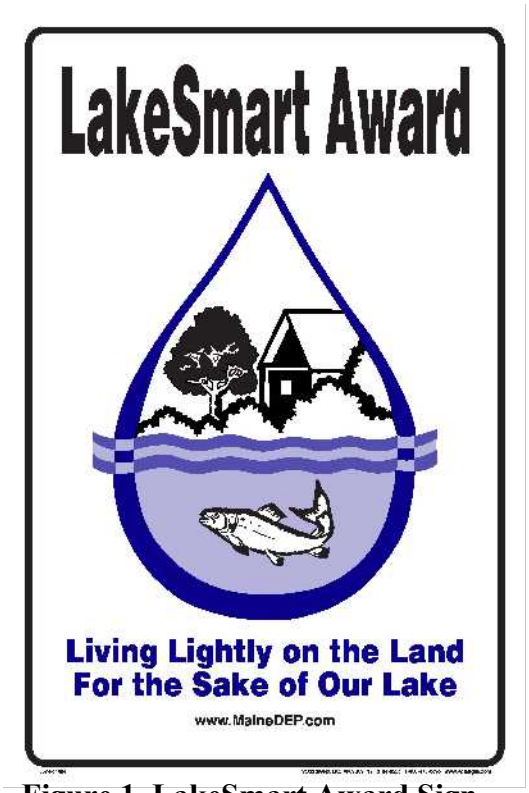

Figure 1. LakeSmart Award Sign

This paradigm shift was to be accomplished by encouraging the use of landscaping best management practices (BMPs) through education efforts combined with incentives, recognition, and social pressure (Welch and Smith 2008). After two years of fine-tuning, the Department of Environmental Protection (DEP) had developed LakeSmart, a comprehensive program that would offer workshops to train lakeshore residents in best practices, conduct property visits to evaluate current runoff management strategies and recommend steps for further improvement, and issue an award sign for exemplary land management that could be displayed on the property. To avoid the impression of an "undercover" code enforcement program, trained Soil & Water Conservation District (a special-purpose district formed in the 1930s in response to dust-bowl era soil loss, and more recently focused on preventing nutrient runoff into waterways - Maine Association of Conservation Districts 2016) staff would carry out the

site visits rather than DEP staff. To maximize both the positive effect on the lake and stakeholder participation, the DEP decided to promote a variety of BMPs, including some with a large potential impact on the lake, no matter how difficult they might be to achieve (e.g., reducing lawn area, improving buffers, replacing leaking septic systems), and some quick fixes (e.g., reducing/eliminating fertilizer use, regularly pumping septic systems, erosion prevention measures) that showed that lake protection did not have to be difficult or expensive (Table 1).

After designing and field-testing an evaluation tool (see Appendix B for latest version), the DEP selected four distinct categories in which the implementation of BMPs would be evaluated: (1) driveway and parking areas, (2) structures and septic system, (3) lawn, recreation areas, and footpaths, and (4) buffer and water access. A shoreline property was required to score highly in all four categories to receive the distinctive blue-and-white LakeSmart award sign (Figure 1). The owners of those properties that scored well in at least one category, but not all four, were sent a commendation certificate along with recommendations for runoff management improvements and were encouraged to apply for the LakeSmart award again in the future.

A Sound Footing: Concepts behind LakeSmart

The Department of Environmental Protection (DEP) designed its LakeSmart program using social marketing principles, based in part on the McKenzie-Mohr (2006) book *Fostering Sustainable Behavior: An Introduction to Community-based Social Marketing.*

McKenzie-Mohr (2006) introduces the concept of community-based social marketing as a strategy to encourage and maintain sustainable behavior. Social psychology research indicates that behavior change can be promoted most effectively at the community level and through direct inter-personal contact. For this reason, programs that rely heavily or solely on media advertising can be quite effective in raising awareness for social, environmental or health issues, but rarely bring about actual changes in behavior (McKenzie-Mohr 2006). Programs that make use of traditional marketing tools and view the promoted behavior as a product to be sold can be equally ineffective. Because encouraging people to adopt a new behavior is much more complex

than simply altering their preferences for one product over another, it cannot be accomplished using the same tools (McKenzie-Mohr 2006).

An effective community-based social marketing program must be developed in several steps (McKenzie-Mohr 2006). First, barriers to engaging in the promoted behavior, as well as benefits resulting from the behavior change, must be uncovered empirically. While most program designers have a sense of these barriers and benefits, empirical research can uncover barriers that were previously unknown as well as correct misconceptions (McKenzie-Mohr 2006).

After identifying lakeshore residents as their target audience, as opposed to municipal code enforcement officers, lawn care companies, or building contractors, the Department of Environmental Protection (DEP) staff members used data from the existing 2000 Maine Lake Users Survey (a statewide quantitative phone survey) to characterize their audience as "concerned but lacking knowledge on cause and effect, looking for easy fixes, [and] retired" (Welch and Smith 2008). Using this information, and keeping in mind the goal of reducing nutrient runoff from shoreline properties, the DEP created the LakeSmart program with its focus on changing landscaping, yard care, and property maintenance practices to benefit lake health (Welch and Smith 2008).

By creating a resource protection program that offered educational workshops, site visits, and an attractive award sign to be displayed as recognition for positive actions, the Department of Environmental Protection (DEP) incorporated several of the tools proposed by McKenzie-Mohr (2006). The workshops, which served a dual function of spreading knowledge about lake-friendly practices as well as soliciting participants for the LakeSmart program, are an example of the *commitment* tool described by McKenzie-Mohr (2006). According to McKenzie-Mohr (2006), getting your target audience to commit to a small favor (e.g., participation in a workshop) often makes it easier to get them to agree to a larger favor later (e.g., changing their landscaping practices to comply with LakeSmart criteria). The incorporation of easy-to-implement best management practices (BMPs) along with ones requiring more extensive changes is another example of the *commitment* tool (McKenzie-Mohr 2006). The LakeSmart award signs, posted on both the road- and the lake-side of LakeSmart properties, embody several social marketing tools at once. They serve as *prompts* to remind LakeSmart awardees to engage

in the sustainable behaviors for which the sign was awarded (McKenzie-Mohr 2006). The award signs also increase the visibility of the program to neighbors and visitors and help establish LakeSmart practices as the apparent *norm* in the community, exerting social pressure on neighbors to become a part of the program (McKenzie-Mohr 2006). The signs, and the concern for the lake they represent, may serve as *incentives* to participate in the program. Lastly, the site visits by trained Soil & Water Conservation District evaluators increase *convenience* for the participating property owners because they take place at their homes and are arranged to accommodate their schedules (McKenzie-Mohr 2006).

The only tool proposed in McKenzie-Mohr (2006) that was perhaps addressed incompletely in the LakeSmart program design is the *communication* tool. While it seems that the Department of Environmental Protection (DEP) presented information tailored to both the issue and the audience, as suggested by McKenzie-Mohr (2006), it did so in long six-hour workshops, which were likely to draw a limited audience that already cared about the lakes more than the typical shoreline resident (Welch and Smith 2008). It also appears that while the DEP cooperated with lake associations to spread the LakeSmart message, it could have more fully engaged with local lake protection leaders to seek their endorsement of the program and allow them to serve as local catalysts of change (Welch and Smith 2008).

Gathering Momentum: Moving Past the Pilot Phase

In the summer of 2003, the Department of Environmental Protection (DEP) began to offer educational workshops on best management practices (BMPs) for shoreline LakeSmart property landscaping and maintenance and to carry out property evaluations. After a pilot phase of two years (during which the program was operational, but the message and evaluation process were still being adjusted), LakeSmart had spread to 32 different lakes in half of Maine's 16 counties (see Appendix A). These lakes were located primarily in the southern and eastern parts of the state (Welch and Smith 2008). In 2005, after the pilot phase had ended, the DEP decided to evaluate the effectiveness of its new program using phone and mail surveys, interviews, and focus groups (Welch and Smith 2008). Consistent with the theories of McKenzie-Mohr (2006), who suggested that information-based campaigns succeed at raising awareness, but not adoption of

conservation behaviors, the LakeSmart workshops were found to be relatively ineffective tools for moving residents to action. Although 72% of the workshop attendees could describe something they had learned at the workshop up to a year later, no direct link between workshop attendance and implementation of best management practices (BMPs) was found (Welch and Smith 2008). For this reason, the DEP decided to shorten the workshop from six to two hours, and to transform it from a dry classroom experience into an active "Walk 'n Talk" session (Welch and Smith 2008). This new format consisted of a tour of two properties to familiarize attendees with the LakeSmart evaluation process and the appearance and function of BMPs (Welch and Smith 2008).

The assessment carried out by the Department of Environmental Protection also revealed the importance of so-called "sparkplugs", local residents who, through their enthusiasm for lake protection, were able to spur their communities into action (Welch and Smith 2008). These "sparkplugs" are examples of a key element of McKenzie-Mohr (2006)'s *communication* tool: using a credible source to disseminate your information. In the minor adjustments to the LakeSmart program that resulted from the post-pilot assessment, the Department of Environmental Protection (DEP) emphasized the role of these "sparkplugs" as local catalysts for the program (Welch and Smith 2008). The DEP also decided to place greater emphasis on changing resident behavior through establishing lake-friendly practices as a new norm by adopting the 15% rule proposed by Everett M. Rogers in his 1983 book *Diffusion of Innovations* (Rogers 1983). After studying the adoption of new behaviors in various eras and locations, Rogers (1983) observed that once 15% of a community has visibly adopted a new behavior, this behavior tends to become the norm. The DEP incorporated this concept into the LakeSmart program by shifting the focus on big lakes from lake associations to individual road associations, where this participation threshold could be overcome more quickly. Because LakeSmart-certified properties would be concentrated in a smaller area (the road served by a participating road association), the visibility of the program to residents and visitors of that area would be increased. According to Welch and Smith (2008), at least one (unspecified) lake overcame this threshold prior to 2008.

After the pilot phase, as a direct result of the program assessment, new lake associations wishing to join the LakeSmart program had to fulfill certain criteria to

ensure that Department of Environmental Protection (DEP) time and money would not be spent on lakes that were not actively promoting LakeSmart. Only active lake associations with a high membership among shoreline residents were considered as LakeSmart candidates. These lake associations were asked to make a three-year commitment to the LakeSmart program, during which they agreed to actively promote the program and pursue the goal of reaching 15% LakeSmart certification among shoreline properties. A local leader to act as a "sparkplug", as well as a non-DEP person to handle scheduling of property evaluations for the lake also became requirements (Welch and Smith 2008).

The End of LakeSmart at the Department of Environmental Protection

On January 5, 2011, as the Department of Environmental Protection (DEP) was preparing for its ninth LakeSmart season, Paul LePage was elected Governor of Maine. In keeping with the new governor's "open for business" attitude (The Associated Press 2011), the LePage administration quickly began dismantling state environmental regulations and programs considered anti-business. These actions included preventing the construction of an offshore wind park that would have made Maine the national leader in offshore wind energy, vetoing a bill that would have funded climate change research in Maine (Cutler 2013), proposing to open three million acres of the North Woods to development (Kaufman 2011), and proposing to relax anti-smog protections (Grant 2013). Lake protection efforts suffered as well. Governor LePage vetoed a bill that would have prohibited fertilizer use within 25 feet of lake shores (Ohm 2014, Scardina 2014) and enacted sweeping changes within the DEP (Natural Resources Council of Maine 2013). Within two years of LePage taking office in early 2011, the DEP's lake protection staff had been reduced from the equivalent of 6.5 full-time positions to the equivalent of 2.5 full-time positions, 80% of documents previously available on the DEP website were removed in a website redesign, and lake education efforts were all but eliminated (Natural Resources Council of Maine 2013). Other impacts included the removal of the DEP logo from a report showing the effectiveness of Maine's Shoreland Zoning Act (38 MRSA §435-449), the removal from the DEP website of an award-winning marketing video showing the danger of lawn chemicals, and the failure to enforce a 2007 law (38 MRSA §419) requiring stores selling phosphorus-based fertilizer to post signs informing customers about the dangers of nutrient pollution to lake health (Natural Resources

Council of Maine 2013). Furthermore, DEP scientists were discouraged from attending professional conferences and meetings, and a new policy requiring prior approval from the DEP leadership for all staff presentations and speeches given to citizen groups was instituted (Natural Resources Council of Maine 2013).

One of the programs caught up in the sweeping funding cuts and staff reductions within the Department of Environmental Protection (DEP) was LakeSmart. After a record season with 89 awards granted in 2011, the program was abruptly terminated (Figure 2).

A New Dawn: LakeSmart at the Maine Lakes Society

After a season of inactivity in 2012, the management of the LakeSmart program was transferred from the Department of Environmental Protection (DEP) to the Maine Lakes Society (MLS), then operating under the name Maine Congress of Lake Associations (Maine COLA). Maggie Shannon, the executive director of Maine COLA at the time, had taken an interest in the LakeSmart program several years earlier after being approached by lakeshore residents who wanted to participate in LakeSmart and mistakenly believed it to be a Maine COLA initiative (Shannon, pers. comm.). Shannon began promoting the program among the lake associations she worked with in her position at Maine COLA because, as a former lake association president, she knew that it could be very frustrating to try to protect the lakes without the right tools. Believing that LakeSmart, with its focus on preventing nutrient runoff through education and the use of best management practices (BMPs), could be such a tool, Shannon referred both lake associations and individuals to the DEP, but was disheartened to see some of them turned away.

After determining that the main reason the Department of Environmental Protection (DEP) was turning people away was the lack of flexibility in scheduling and funding that resulted from employing Soil & Water Conservation District (S&WCD) staff as LakeSmart evaluators, Shannon began talking with the DEP about training volunteers to conduct pre-evaluation “screenings” of applicant’s properties (Shannon, pers. comm.). Using the same criteria as the S&WCD evaluators, the volunteer screeners would determine whether a property had the potential to receive the LakeSmart. This enabled the DEP to direct the S&WCD evaluators to properties with a high likelihood of

receiving the award, greatly streamlining the process. From 2008 to 2011, Maine COLA and the DEP co-trained volunteers for a pilot program running in two watersheds, including the Belgrade Lakes region, where Shannon's organization is headquartered. After seeing that the volunteer screeners were able to operate much more flexibly and cheaply than the Soil & Water Conservation district evaluators, as well as reach more lakeshore residents in the two pilot watersheds, Shannon was excited about expanding Maine COLA's relationship with the DEP.

In early 2011, while Shannon was making plans for further collaboration with the Department of Environmental Protection (DEP), the LePage administration defunded LakeSmart, along with all other conservation programs not specifically authorized by law (Natural Resources Council of Maine 2013). Maine COLA, then in the process of changing its name to Maine Lakes Society (MLS), volunteered to assume the management of the lake protection program. However, because DEP staff members were discouraged from communicating with citizens and lake associations (a policy sometimes referred to as a gag order - Natural Resource Council of Maine 2013), little information apart from publicly available promotional material and a basic database of past participants was transferred to the MLS (Shannon, pers. comm.).

Once LakeSmart had officially been transferred to its new home at the Maine Lakes Society (MLS), Shannon began to transform and reinvigorate the program. Building on her positive experience with volunteer evaluators during the DEP-Maine COLA pilot project, Shannon expanded her volunteer network to incorporate all 14 lakes still actively pursuing LakeSmart after its season of inactivity in 2012 (Figure 3).

In the three full years that the Maine Lakes Society (MLS) has managed LakeSmart (2013–2015), Shannon has aggressively expanded the program, both in terms of awards granted each year, from 52 to 117 (Figure 2), and in the number of participating lakes, from 14 to 39 (Figure 3), while actively reforming the way the program is run. These changes included relying more heavily on the lake associations to administer the LakeSmart program than the Department of Environmental Protection (DEP) had (e.g., for distribution of information, scheduling, volunteers, and data collection). Because of its function as an umbrella organization for lake associations in Maine, Shannon believes that the MLS has an intimate understanding of how lake

associations function, and how effective (or ineffective) they can be at distributing information and spurring their members into action (Shannon, pers. comm.). According to Shannon, the MLS now functions as a sort of service provider for LakeSmart, helping the lake associations of participating lakes implement the program by providing promotional material and training workshops for local screeners, but leaving the micromanagement of scheduling screenings and evaluations to the individual lake associations.

As a result of the successful DEP-Maine COLA pilot project, the Maine Lakes Society (MLS) relies heavily on volunteer screeners to administer the LakeSmart program throughout the state (Shannon, pers. comm.). Unlike the evaluators, a group of ten individuals that includes paid employees of lake or watershed associations as well as some trained volunteers, all 67 screeners are volunteers (Beck, pers. comm.). Screeners serve to shelter the evaluators from properties that have no chance of achieving LakeSmart status by carrying out a preliminary screening using the same evaluation tool as the evaluators. The more experienced evaluators subsequently assess those properties

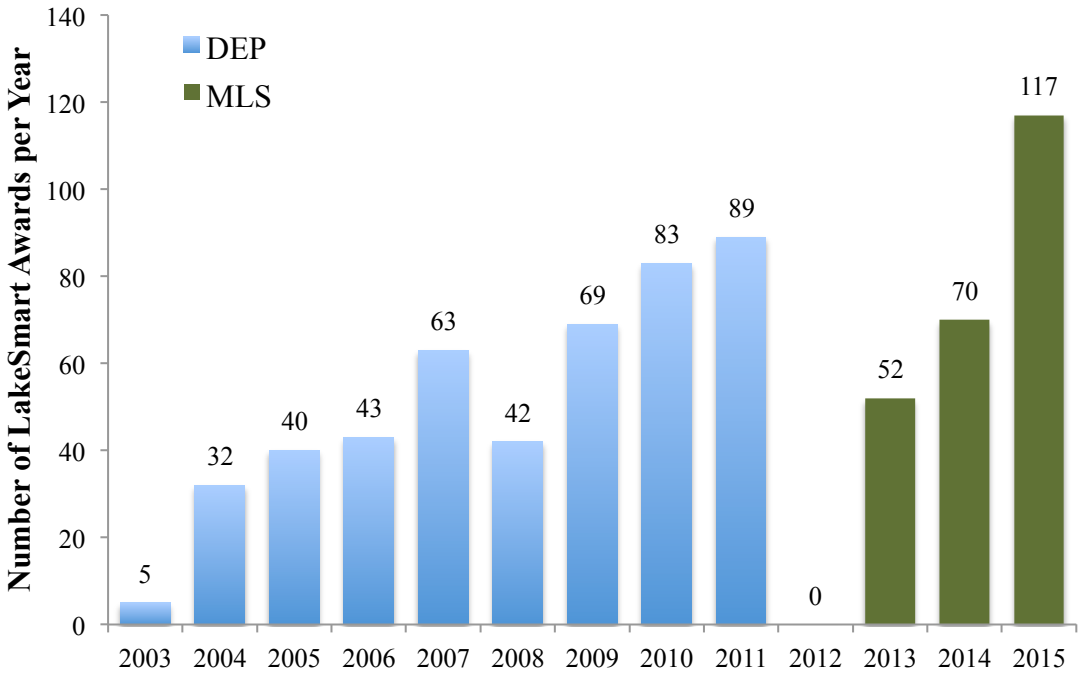

Figure 2. The number of LakeSmart Awards by year from 2003 until 2015 under Department of Environmental Protection (DEP) and Maine Lakes Society (MLS) leadership. The program was inactive during the change in leadership in 2012. Data from the Maine Lakes Society.

that passed the initial screening and make a decision on whether the property fulfills the criteria for the LakeSmart award. Both screeners and evaluators educate the property owners about best management practices and make recommendations for improving the property's runoff mitigation. In addition, they serve as the "sparkplugs" (whose importance was initially recognized by the DEP) who spread enthusiasm about lake protection in their communities.

The training for LakeSmart screeners and evaluators now consists of two parts. The first part is an all-day introduction to lake science, the LakeSmart program, best management practices, available resources, and two or three site visits to practice using the evaluation tool. The second part of the training is a half-day follow up where screeners- or evaluators-in-training conduct real site evaluations supervised by Shannon. Shannon believes that this revised training procedure has led to greater scientific knowledge and more consistent evaluations (Shannon, pers. comm.)

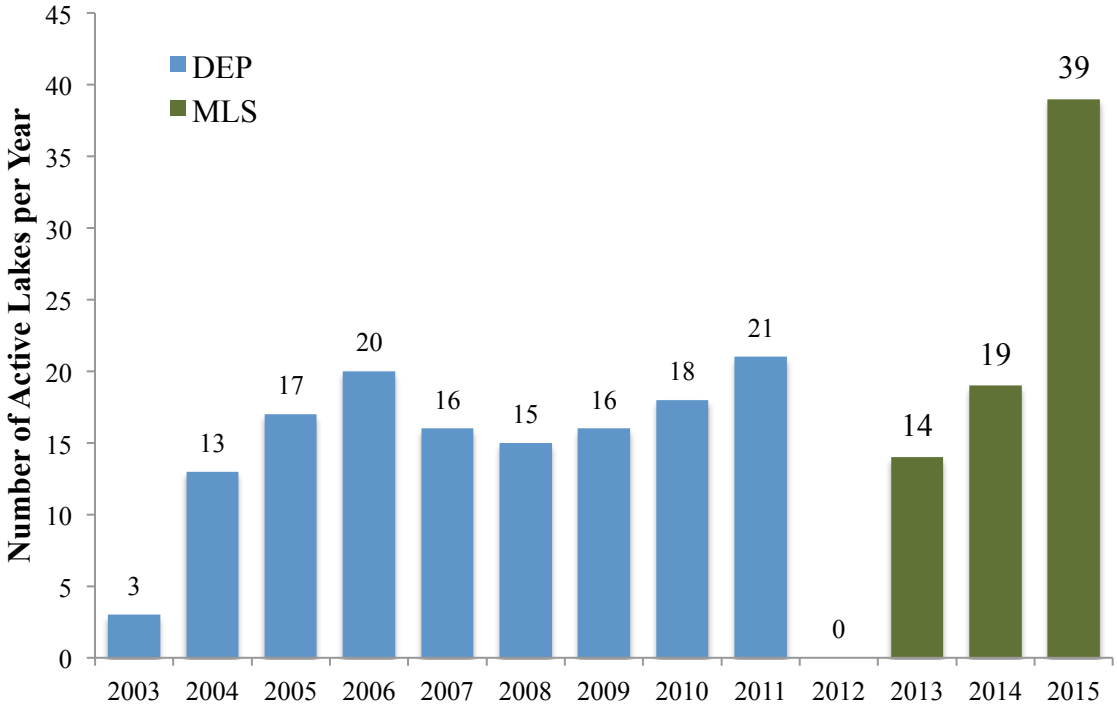

Figure 3. The number of Lakes active in the LakeSmart program in the years 2003 to 2015 under Department of Environmental Protection (DEP) and Maine Lakes Society (MLS) leadership. A lake is defined as "active" if at least one shoreline property received an award in a given year. Lakes where properties only received commendations (certificates of recognition) but no full awards were not considered "active" for the purpose of this figure. Data obtained from the Maine Lakes Society.

The Future of LakeSmart

Even though Shannon is satisfied with the state of the LakeSmart program in general, she plans to institute several changes in future seasons. Due to the accelerating growth rate of the program (Figures 2 and 3), Shannon, who stepped down from her position as Maine Lakes Society (MLS) executive director in June 2015 to devote all of her energy to LakeSmart, spends most of her time on the road, be it for training, supervising new volunteers, or working with lake associations to bring LakeSmart to more lakes. To ease her workload and to allow her to focus on the big picture, Shannon hopes to turn some of her most experienced evaluators into paid local LakeSmart representatives. Instead of offering LakeSmart training workshops on an as-needed basis for small groups, Shannon plans to offer one full-day training workshop in Central, Southern, and Northern Maine starting in the 2016 season (Shannon, pers. comm.).

Along with this more streamlined training program, Shannon is setting goals to channel LakeSmart's future expansion in ways that most benefit lake health. By the year 2020, she hopes to have a robust LakeSmart presence on all 172 Maine lakes that are classified as "impaired" or "threatened" on the Department of Environmental Protection's Nonpoint Source Priority Watersheds List (Maine Department of Environmental Protection 2016). This ambitious goal might be achievable because there is at least one LakeSmart award on 53 (9 impaired and 44 threatened) of these lakes already (Shannon, pers. comm., Maine Department of Environmental Protection 2016). Since the program has been spreading to new lakes at an accelerating pace, it may well be possible to build a LakeSmart presence, if not necessarily a large one, on the other 119 lakes in the next four years. Shannon also hopes to re-emphasize the importance of the 15% threshold from social diffusion theory to help change the norm for landscaping practices on all participating lakes (Rogers 1983). Shannon believes that only three lakes have managed to clear this hurdle to date, leaving ample room for expansion on other lakes in the program. However, no consistent effort has been made to collect data on the number of LakeSmart properties relative to the total number of shoreline properties on most participating lakes, making it difficult to judge when the 15% threshold is crossed and LakeSmart landscaping has the potential to become the new norm.

By making lake-friendly landscaping practices the accepted norm, Shannon hopes that the LakeSmart program will expand beyond the "low-hanging fruit" of properties that only need small improvements to comply with LakeSmart to reach those properties with substantial runoff problems and a disproportionate impact on lake health (Shannon, pers. comm.). The experiences of Melvin Croft, LakeSmart evaluator for the East Pond Association, suggest that reaching past these "low-hanging fruit" is important. On East Pond, where the program started in 2009 and where 26 shoreline properties have received the LakeSmart award, not a single property owner applied for LakeSmart certification in the 2015 season, suggesting to Croft that a threshold of harder-to-reach properties has been reached (Croft, pers. comm.)

To cross this threshold, Shannon plans to improve the follow-up with homeowners to turn the program from a one-off interaction into a mentoring relationship. Currently, lakeshore residents receive the result of their property evaluation in a report praising the best management practices already employed and recommending others to address specific problem areas, along with information on the appropriate mitigation strategies. In the future, Shannon would like to include a follow-up visit or conversation with property owners, regardless of whether they received the award or not. From this follow-up, Shannon hopes to determine whether the program has made a lasting impression on the property owner, and whether changes in behavior and runoff management have been made, for the worse or the better, in the time that has passed since the initial evaluation. Several LakeSmart stakeholders expressed similar ideas (Beck, pers. comm., Matson, pers. comm.).

Figure 4. Vermont's Lake Wise Award

Once LakeSmart expands its footprint in Maine, Shannon hopes to eventually turn it into a national program, with a presence in all states that have a significant number of lakes. Several LakeSmart evaluators believe that

this can be accomplished through slow but steady growth (D. Gay, pers. comm., S. Gay, pers. comm.). Garrison Beck, a paid LakeSmart evaluator and employee of the Damariscotta Lake Watershed Association, believes that for the program to be expanded successfully, there needs to be more centralized control at the Maine Lakes Society to standardize evaluation procedures and the training of volunteers (Beck, pers. comm.), something that Shannon is actively trying to avoid by planning to train local LakeSmart representatives. However, these two goals are not as mutually exclusive as they might seem. It may be possible for the Maine Lakes Society to centrally dictate training and evaluation procedures, and the portrayal of LakeSmart to potential participants, while outsourcing the day-to-day management of the program to regional representatives.

However the expansion of the LakeSmart program is accomplished, Shannon believes that it is a good sign that the design of the LakeSmart program design has already been copied several times, including by the creatively named Lake Wise program in Vermont operated by the Watershed Management Division of the Vermont Department of Environmental Conservation (2016). Shannon believes that in this case, imitation really is the sincerest form of flattery.

IV. MOTIVATION FOR CONSERVATION

Factors Influencing Conservation Participation

When examining the effectiveness of a specific resource protection program such as LakeSmart at mobilizing people for its cause, it is important to first examine what motivates people to participate in such programs in general. While little research appears to have been carried out on participation in lake protection programs specifically, factors affecting participation in conservation efforts more generally have been examined widely (Fransson and Gärling 1999, Story and Forsyth 2008, Welsch and Kühling 2009, Kreutzwiser et al. 2011, Davies et al. 2012, Dolnicar et al. 2012, Dai et al. 2015, Harvey et al. 2015).

Conservation efforts can range from recycling in a Chinese apartment block (Dai et al. 2015), bird feeding in British gardens (Davies et al. 2012), and water conservation in Australian homes (Dolnicar et al. 2012) to participation in Burmese python hunts in Florida (Harvey et al. 2015). Many studies of citizen participation in conservation efforts focus on demographic characteristics, such as age, income, gender, and education level. Older age is frequently found to be associated with increased participation in conservation efforts (Davies et al. 2012, Harvey et al. 2015), as is female gender (Harvey et al. 2015). Households comprising more than one individual have also been found to be more likely to participate in such activities (Welsch and Kühling 2009, Davies et al. 2012), as have households with a higher annual income (Davies et al. 2012).

Pro-environmental attitudes have been identified as drivers of conservation behavior (Dolnicar et al. 2012), as has awareness of the environmental problem (Fransson and Gärling 1999, Story and Forsyth 2008, Kreutzwiser et al. 2011). However, awareness of the problem alone is often not sufficient to spur people into action (McKenzie-Mohr 2006). Instead, environmental awareness must be accompanied by an understanding of cause and effect (Fransson and Gärling 1999, Kreutzwiser et al. 2011), a sense of the gravity of the problem (Story and Forsyth 2008, Harvey et al. 2015) and knowledge of how to perform the appropriate stewardship behavior (Kreutzwiser et al. 2011). Studies have further identified people who actively seek information about an environmental issue (Dolnicar et al. 2012) and those who have personally experienced negative

consequences from the issue (Welsch and Kühling 2009, Dolnicar et al. 2012, Harvey et al. 2015) as more likely to be actively involved in mitigation efforts. Similarly, a perceived personal health threat may have positive impacts on such involvement (Fransson and Gärling 1999). Active involvement, however, may temper the level of concern about the problem through constant exposure (Harvey et al. 2015). Furthermore, participation in conservation efforts has been found to be associated with a sense of personal responsibility for the issue, and the guilty conscience that goes along with this perceived responsibility (Fransson and Gärling 1999, Story and Forsyth 2008, Rees et al. 2015).

People have been found to be significantly more likely to adopt conservation practices if their neighbors, friends and relatives have done so (Welsch and Kühling 2009). This imitation of reference persons is strongest when the behavior in question is highly visible, such as installing solar panels on a roof (Welsch and Kühling 2009). This observation is consistent with the community-based social marketing principles introduced by McKenzie-Mohr (2006), who suggested that establishing a conservation behavior as the apparent norm in a community is an important tool for increasing adoption of the behavior.

While demographic factors, environmental knowledge, and the behavior of reference people can be important predictors of participation in conservation efforts, whether or not the residents of a place feel a deep connection to it (i.e. a shared sense of place) can be even more important (Williams and Stewart 1998, Fleming and Love 2012, Chapin and Knapp 2015). While this sense of place is often rooted in a common history and common values, it can be fostered through community-building activities such as community gardens, restoration projects, and place-based community celebrations (Chapin and Knapp 2015). A strong sense of place can be an especially important motivator for participation in conservation efforts at the local scale. However, the possibility of extending this connection to types of places (i.e. from a specific lake to all lakes) has been discussed (Chapin and Knapp 2015). Maggie Shannon, former executive director of the Maine Congress of Lake Associations (now the Maine Lakes Society) and current director of the LakeSmart program, has been quoted as saying: " I can't do very much about the polar bears, but I can try to do something about this corner [of the

world]" (Fleming and Love 2012). This view illustrates the importance of focusing on the local scale to retain the benefits created by sense of place.

Exploring LakeSmart Participation

To assess how effective LakeSmart has been at motivating lakeshore residents to participate in its runoff mitigation program, it makes sense to compare the characteristics of shoreline residents who participate in LakeSmart to those who tend to participate in conservation efforts in general as well as to those who do not participate in LakeSmart. By identifying factors that distinguish LakeSmart participants from non-participants, and comparing these findings to those of similar studies, the effectiveness of the LakeSmart program can be investigated.

Methods: Shoreline Resident Surveys

To this end, I examined a survey of 150 Belgrade Lakes shoreline residents (see Appendix C) conducted the summer of 2011, which was designed and carried out by Sophie Sarkar, a Colby Environmental Policy major working with Professor Philip Nyhus. Although this survey focused on the residents' willingness to pay for improved water clarity (or to prevent a decline in water clarity), it also included a number of questions regarding residents' perceptions about water quality and their participation in different aspects of community life, coupled with demographic questions. To create a dataset comprised solely of respondents who had not participated in the LakeSmart program, 13 LakeSmart award recipients were identified and eliminated from the 2011 survey responses.

To compare the 137 survey respondents who had not participated in the LakeSmart program to people who had, I designed a similar survey for Belgrade Lakes shoreline residents who had received either a LakeSmart award or a commendation (given when the property receives a passing score in at least one but not all four LakeSmart evaluation categories (see Appendix B)). To facilitate the comparison between LakeSmart participants and non-participants, this survey (see Appendix D) contained many of the same questions regarding perceptions about water quality, participation in community life, and demographics as Sarkar's 2011 survey. In addition, the survey contained several questions specifically about the experience of respondents

with the LakeSmart program. Although LakeSmart award holders were removed from the pool of respondents to Sarkar's 2011 survey, the possibility that some respondents may have participated in both surveys exists. Thus, the two samples may not be entirely independent.

After I designed the survey questions using Qualtrics software (Qualtrics 2016, Freeman, pers. comm.), Maggie Shannon, the LakeSmart program director, emailed survey links to 245 LakeSmart participants in the Belgrade Lakes region. Of these 245 survey recipients, 106 were LakeSmart award holders and the other 139 had received a commendation. In total, there are 363 LakeSmart participants (188 commendation holders and 175 award holders) in the Belgrade Lakes region (Figures 5 and 6), but Shannon only had the contact information for a subset of them. By using Shannon, a known figure to all of the survey recipients, to distribute my survey, I hoped to maximize the response rate. Over the course of the next four weeks, 95 of these LakeSmart participants completed at least part of the online survey, a response rate of 38.8%.

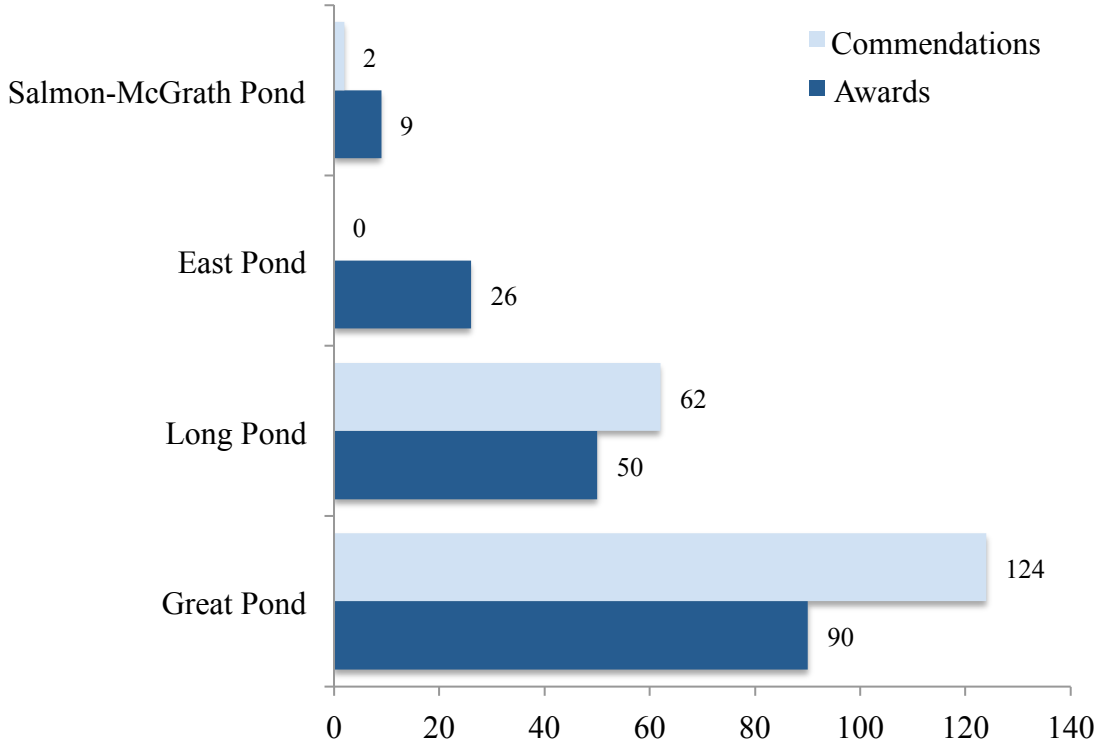

Figure 5. The number of LakeSmart Awards and commendations in the Belgrade Lakes Region, organized by lake. Data obtained from the Maine Lakes Society and the Belgrade Lakes Association.

Of these 95 respondents, 76 (80.0%) completed all questions. The survey did not distinguish between respondents who had received the LakeSmart award and those who had received a commendation. I then compared the responses to my survey and the responses of non-LakeSmart-participants to Sarkar's 2011 survey using unpaired two sample t-tests for numerical questions and Fisher's exact tests for categorical questions. The purpose of both statistical tests was to identify any significant differences between the two groups (5% significance threshold).

Demographics

When the demographic information of the two populations was compared, no statistical difference between LakeSmart participants and non-participants was found in education level (89.3% vs. 82.6% college graduates), mean age (65.9 vs. 64.1 years old), presence of children in the household (15.1% vs. 13.4%), length of shoreline owned (280 ft vs. 234 ft) or proportion of seasonal to year-round residents (83.2% vs. 81.8%). Among the seasonal residents of both groups, there was no significant difference in the number of days the respondents spent at their lake residence (79.5 vs. 73.6 days per year).

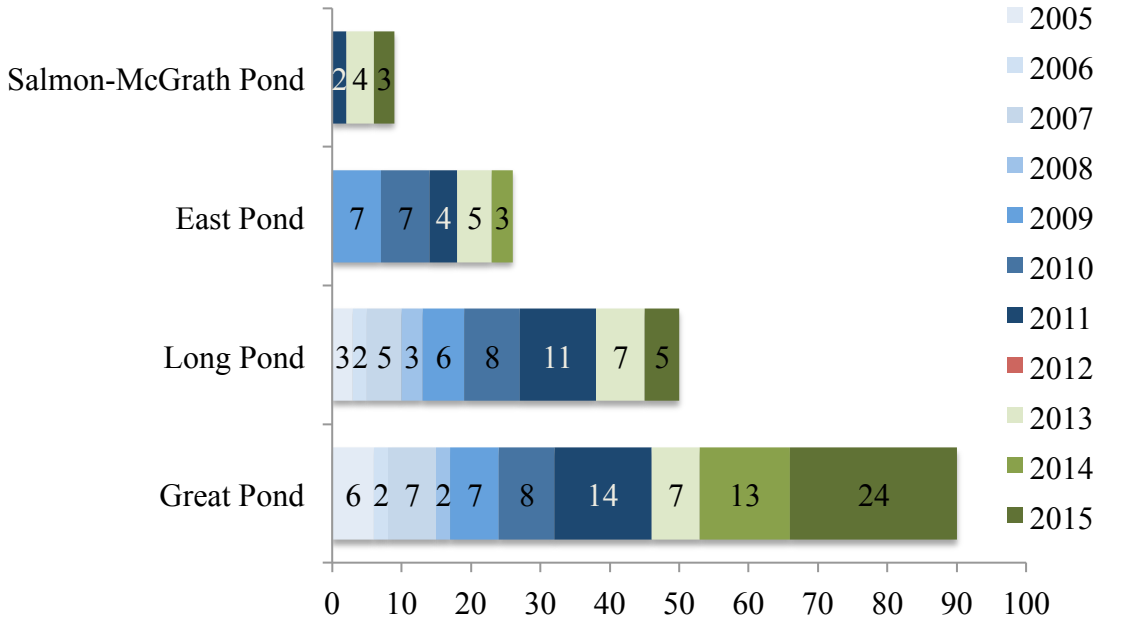

Figure 6. The number of LakeSmart awards per year in the Belgrade Lakes Region, organized by lake. Similar data for the number of commendations per year was not available. The LakeSmart program was administered by the Maine Department of Environmental Protection until 2011 (pictured in blue), and by the Maine Lakes Society starting in 2013 (pictured in green). The program was inactive in 2012. Data obtained from the Maine Lakes Society and the Belgrade Lakes Association.

LakeSmart participants were found to be significantly more likely to be male (65.8% vs. 50.8%) (Fisher's exact, p=0.041; n_{LS}= 73, n_{nLS}=132), politically liberal (50.7% vs. 31.6%) (Fisher's exact, p=0.015; n_{LS}= 73, n_{nLS}=114), retired (45.8% vs. 9.1%) (Fisher's exact, $p < 0.001$; n_{LS}= 72, n_{nLS}=132), and in a higher income category (42.4% vs. 19.1% earning more than $200,000 per year) (Fisher's exact; p=0.015, n_{LS}= 66, n_{nLS}=105) than non-participants. In addition, LakeSmart participants on average purchased their lake residences significantly more recently than non-participants (1993 vs. 1985) (t-test, t=3.6687, p=0.0003; n_{LS}= 93, n_{nLS}=136).

These findings run contrary to findings in other studies focused on demographic factors, which categorized participants in conservation efforts as older (Davies et al. 2012, Harvey et al. 2015) and more likely to be female (Harvey et al. 2015) than non-participants. This difference between my findings and literature findings could arise because the surveys only asked for the demographic information of the respondent, excluding the information of any spouse or other member of the household who might have influenced the decision to participate in LakeSmart. In addition, higher income was found to have a positive effect on LakeSmart participation, just like it does on wildlife gardening (read: providing food for wild birds) (Davies et al. 2012).

Although no quantitative information has been gathered on how much money LakeSmart participants tend to spend on best management practice (BMP) implementation to meet LakeSmart criteria, anecdotal observations suggest that some property owners spend tens of thousands of dollars (Kallin, pers. comm.). Nathan Durant, Director of the Youth Conservation Corps at the Belgrade Regional Conservation Alliance, has developed a "ruler" to estimate the cost of certain common BMPs (Table 2). This information, coupled with the fact that participants tend to earn more income than non-participants, suggests that expense might be a barrier to participation.

Pro-Environmental Attitudes

While no direct questions about respondents' environmental beliefs and attitudes were asked in either survey, the responses to several questions can be used as possible indicators of pro-environmental attitudes. LakeSmart participants were found to be at least twice as likely than non-participants to be members of environmental organizations (38.8% vs. 17.6%) (Fisher's exact, p=0.002; n_{LS}= 95, n_{nLS}=136) and volunteer lake

monitoring groups (14.7% vs. 6.6%) (Fisher's exact, p=0.047; n_{LS}= 95, n_{nLS}=136). The LakeSmart participants were also significantly more likely to be members of their lake associations 95.2% vs. 81.0%) (Fisher's exact, p=0.002; n_{LS}= 83, n_{nLS}=137), which is to be expected since LakeSmart efforts are coordinated and promoted by the local lake associations (Maine Lakes Society 2015). There was, however, no difference in the proportion of respondents rating their lake association as active, which was high in both groups (95.2% vs. 91.2%).

The higher membership of LakeSmart participants in conservation-focused organizations such as lake associations, volunteer lake monitoring groups, and other environmental groups can be taken as a possible indicator of more pronounced pro-environmental attitudes in this group than in the pool of non-LakeSmart-participants. These findings are consistent with the findings of Dolnicar et al. (2012), who studied the adoption of water conservation behavior in Australia.

Concern about Declining Water Clarity

When Belgrade Lakes shoreline residents were asked whether they believed that their lake was at risk of declining water clarity, 95.2% of LakeSmart participants and 86.3% of non-participants indicated that they did. At this high level of concern, there was no significant difference between the two groups. LakeSmart participants were, however,

Table 2. "Ruler" for estimating the cost of common best management practices developed by Nathan Durant in 2015. Estimates are based on 2014 prices. Estimate totals include material costs, permit applications, delivery, and administrative costs. Chart made available by Logan Parker.

Length	Infiltration Trench (1.5' x 1.5')	Rip Rap	Rubber Razor	Mulch (3' x 0.25')
10ft	$75.00	$173.00	$158.00	$60.00
30ft	$123.00	$294.00	$476.00	$76.00
50ft	$172.00	$428.00	$819.00	$97.00
70ft	$237.00	$558.00	$1,238.00	$117.00
100ft	$303.00	$729.05	$1,561.00	$145.00

more likely to believe that the water clarity of their lake had declined in the past five (66.7% vs. 15.5%) (Fisher's exact, $p < 0.001$; $n_{LS}= 72$, $n_{nLS}=103$), ten (78.5% vs. 57.3%) (Fisher's exact, $p=0.009$; $n_{LS}= 65$, $n_{nLS}=110$) and 20 years (79.2% vs. 58.5) (Fisher's exact, $p=0.027$; $n_{LS}= 53$, $n_{nLS}=94$) than the non-participants. When asked about the water clarity of their own lake in comparison to other Belgrade Lakes, LakeSmart participants were more likely than non-participants to rate the clarity of their own lake as the same as or better (91.0% vs. 73.1%) (Fisher's exact, $p=0.001$; $n_{LS}= 67$, $n_{nLS}=93$) and less likely to perceive the water quality as worse (9.0% vs. 26.9%). When asked to compare their lake to other Maine lakes beyond the Belgrade Lakes watershed, roughly one third of each group rated the water quality of their lake as worse, the same, or better, and there was no significant difference between the groups. In comparison to lakes in the rest of the United States, however, LakeSmart participants were significantly more likely than non-participants to rate the clarity of their own lake as average or better (88.9% vs. 81.2%) (Fisher's exact, $p=0.002$; $n_{LS}= 54$, $n_{nLS}=69$). At the same time, LakeSmart participants were less likely than non-participants to believe that the water clarity of their lake had caused a decrease in their property value (23.0% vs. 51.2%) (Fisher's exact, $p < 0.001$; $n_{LS}= 74$, $n_{nLS}=127$).

Although both groups strongly believed that their lakes were at risk of declining water quality, LakeSmart participants were more likely to report a decrease in water clarity from past conditions, suggesting a greater awareness of the problem of water quality, which has been associated with higher participation in conservation efforts in other studies (Fransson and Gärling 1999, Story and Forsyth 2008, Kreutzwiser et al. 2011). In contrast to other studies, however, LakeSmart participants did not attribute a greater gravity to the problem, as illustrated by their unlikelihood to believe that the water clarity of the lake had impacted their property value (Story and Forsyth 2008, Harvey et al. 2015). The strong awareness of the risk of water quality decline in both populations may be due to the presence of the Maine Lakes Resource Center in the Belgrade Lakes area, whose mission is to promote conservation through education about potential impacts on lake health (Maine Lakes Resource Center 2014).

Community Engagement and Sense of Place

As found above, LakeSmart participants are significantly more likely than non-participants to be members of conservation focused groups like lake associations (Fisher's exact, p=0.002; n_{LS}= 83, n_{nLS}=137), volunteer lake monitoring groups (Fisher's exact, p=0.047; n_{LS}= 95, n_{nLS}=136) and general environmental groups (Fisher's exact, p=0.002; n_{LS}= 95, n_{nLS}=136). This trend did not extend to membership in other, non-conservation-focused groups such as hunting and fishing groups (5.3% vs. 1.5%) and country clubs (3.2% vs. 4.4%), where there was no significant difference in membership between the two groups. LakeSmart participants were, however, more likely than non-participants to be members of road associations (58.9% vs. 36.5%) (Fisher's exact, p=0.001; n_{LS}= 95, n_{nLS}=137), which, just like the higher lake association membership, might be attributed to LakeSmart's partnership with road associations for local efforts (Shannon, pers. comm.). When respondents in both groups were asked how they would rate the sense of community around their lake, LakeSmart participants were much more likely than non-participants to rate it as strong (67.8% vs. 40.1%) (Fisher's exact, $p < 0.001$; n_{LS}= 87, n_{nLS}=133), indicating that they felt a stronger sense of place (Williams and Stewart 1998, Fleming and Love 2012, Chapin and Knapp 2015).

Implementation of Best Management Practices

Several questions in common to both surveys addressed the implementation of best management practices, specifically minimizing lawn area and fertilizer use and maintaining a well-buffered shoreline (see Appendices B and C). When comparing the two groups of respondents, LakeSmart participants were significantly less likely to have a lawn on their lake property (46.7% vs. 67.2%) (Fisher's exact, p=0.005; n_{LS}= 75, n_{nLS}=137), and among those respondents who did have a lawn, LakeSmart participants reported having a significantly lower percentage of their property covered in lawn (21.9% vs. 31.8% lawn coverage) (t-test, t= -2.2607, p=0.0276; n_{LS}= 32, n_{nLS}=88). There was no significant difference between the two groups in types of fertilizer (standard, phosphorus free, organic), and the majority of respondents in both groups used no fertilizer at all (93.7% of LakeSmart participants and 80.0% of non-participants).

When presented with a choice between a photo of a well-buffered shoreline and an unbuffered shoreline, 84.7% of LakeSmart participants and 73.3% of non-participants

preferred the well-buffered shoreline. However, this difference was not significant, suggesting that acceptance and preference of buffered shorelines is high whether residents participate in LakeSmart or not. When asked about the state of the buffer along the entire shoreline of their property, there was no difference in the percentage of shoreline that the two groups described as vegetated. On average, LakeSmart participants reported 78.5% of their entire shoreline as vegetated, and non-participants described 75.5% of their shoreline as vegetated, suggesting that the prevalence of buffers is high. When asked just about the shoreline directly in front of their house, however, LakeSmart participants reported a significantly higher percentage of the shoreline as vegetated than the non-participants (71.8% vs. 60.4%) (t-test, $t=2.2911$, $p=0.0233$; $n_{LS}= 67$, $n_{nLS}=133$).

While these findings indicate that certain best management practices, such as small or nonexistent lawns and effective shoreline buffers in front of the house, are more prevalent on properties of LakeSmart participants, as might be expected, it cannot be concluded that these best management practices were implemented as a result of participation in the LakeSmart program. On the contrary, these best management practices

may have already been in place and may have induced the residents to apply for the LakeSmart award because meeting the criteria did not require much additional work.

Imitation of Reference Persons

To examine the effectiveness of the LakeSmart award sign as a community-based social marketing tool, I asked the LakeSmart participants whether, to their knowledge, any of their neighbors within 0.5 miles had already received a LakeSmart award when they themselves applied for it (McKenzie-Mohr 2006, Welch and Smith 2008). Of the 77 respondents who answered this question, 53.3% (41) knew of LakeSmart awards in their proximity, while 24.6% (19) did not and 22.1% (17) were not sure. When asked whether the proximity of a LakeSmart awardee influenced their decision to apply for the award, respondents, on average, indicated that the influence had been moderate (4.6 on a Likert scale from 0 = no influence to 10 = significant influence). When asked whether they knew of any neighbors within 0.5 miles who had received the LakeSmart award after the respondent, 23.7% (18) of the 76 respondents who answered this question indicated yes, 17.1% (13) no, while 59.2% (45) were unsure. Again, LakeSmart participants, on

average, believed their influence on their neighbors' decisions to be moderate (4.9 on the above scale).

Even though the respondents only attributed a moderate influence to the proximity of LakeSmart awardees, the fact that a majority of respondents had been aware of the LakeSmart award signs in the neighborhood suggests that the signs are effective at increasing the visibility of the program and allow for the imitation of reference people, as intended in the program design (McKenzie-Mohr 2006, Welch and Smith 2008, Welsch and Kühling 2009). The imitation of reference persons in the immediate neighborhood appears to lead to the formation of clusters of awards in certain areas (Figures 7 and 8). However, a quantitative analysis of this pattern has yet to be completed.

In a similar survey, which I administered to LakeSmart screeners and evaluators statewide (see Appendices E and F), respondents indicated that, based on their experience, they thought that people near LakeSmart awardees were more likely to apply for the award. In close agreement with each other, the screeners and evaluators agreed quite strongly (6.92 and 7.00, respectively, on a Likert scale from 0 = strongly disagree to 10 = strongly agree). Although the questions posed to the screeners and evaluators differed from the question to the LakeSmart participants in that it asked about strength of agreement rather than strength of influence, the higher score on the Likert scale might suggest that the screeners and evaluators perceive the imitation of reference persons more strongly than the LakeSmart participants.

Stated Motivations for Participation

When examining the characteristics and interests of people who participate in the LakeSmart program, it is important to consider their stated motivations. In the 2015 survey, LakeSmart participants were asked to rank their motivations for seeking the LakeSmart award from 1 to 6, with 1 being the most important and 6 being the least important motivation. On average, respondents ranked "desire to protect the lake" highest (mean rank: 1.18), followed by "desire to achieve LakeSmart appearance on the property" (mean rank: 2.89), "property already fulfilled LakeSmart criteria" (mean rank: 2.99), "prestige of the award" (mean rank: 4.08), "social pressure" (mean rank: 4.66), and "other motivations" (mean rank: 5.20). "Other motivations" included considerations of property value, interest in the LakeSmart program, and a desire to set a positive example

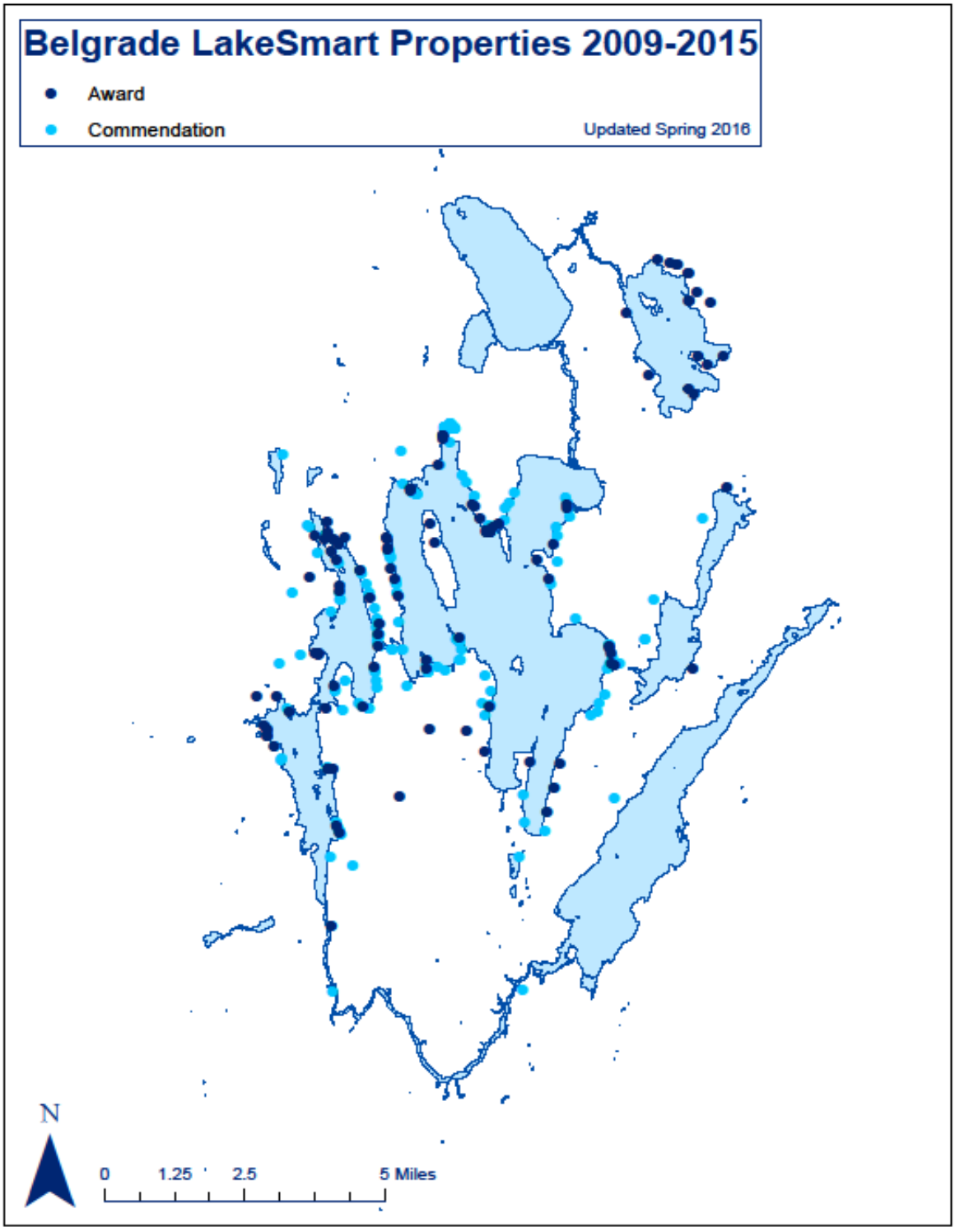

Figure 7. Map of the Belgrade Lakes Watershed showing the locations of LakeSmart award properties in dark blue and commendation (received when some but not all criteria for the award are met) properties in light blue for the years 2009 to 2015. Data from the Belgrade Lakes Association.

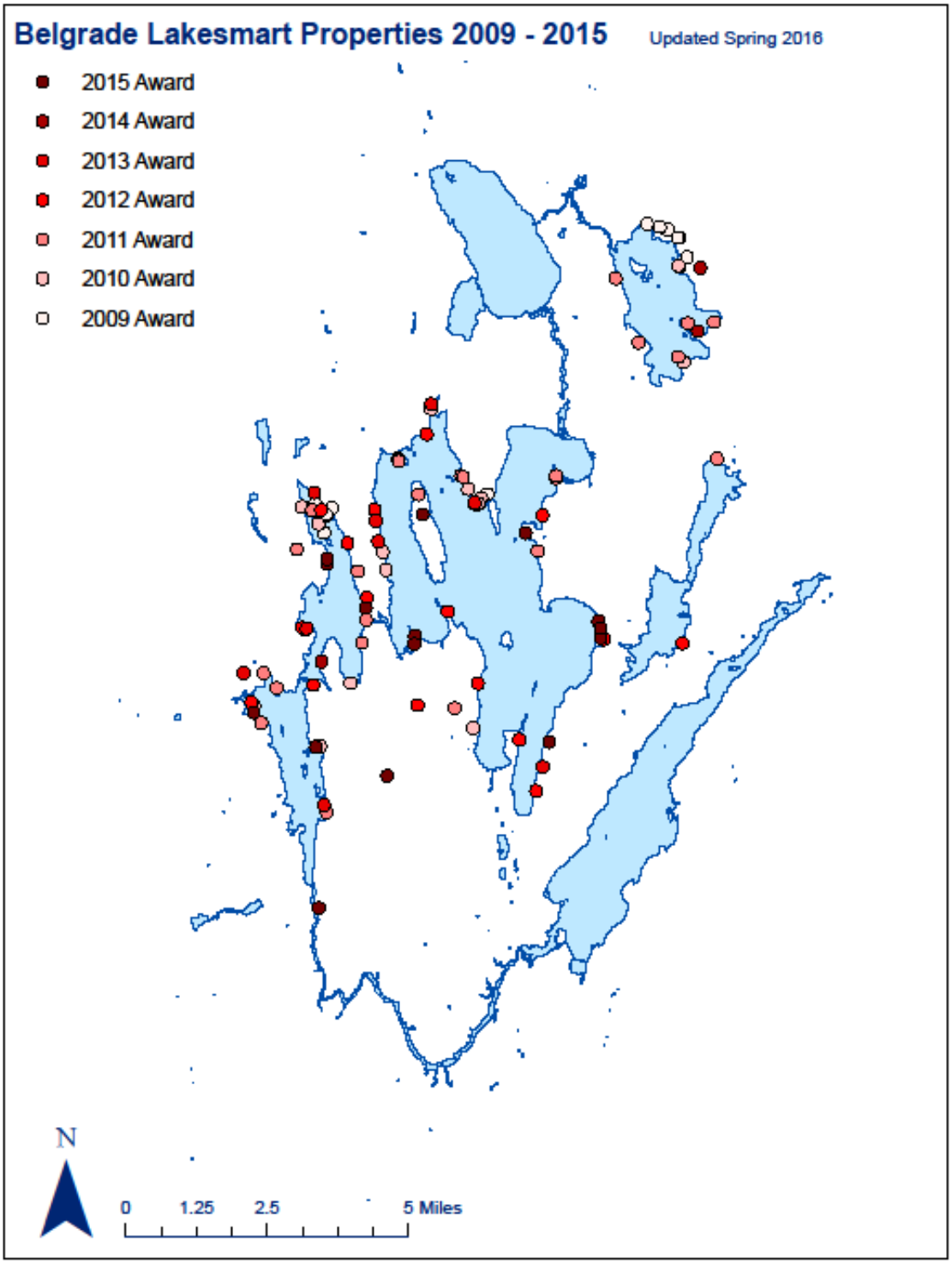

Figure 8. Map of the Belgrade Lakes Watershed showing the locations of LakeSmart award properties for the years 2009 to 2015. The more recent awards are shown in a darker red. Data from the Belgrade Lakes Association.

for neighbors (Table 3). When LakeSmart screeners and evaluators were asked a similar question, they, too, identified desire to protect the lake both as their main reason for being involved in the program and as what they thought the participants' main motivation was. This finding supports the impression (from higher membership in conservation-focused groups among LakeSmart participants) that general pro-environmental attitudes have been strong drivers of participation in the LakeSmart program and that the buffered shoreline "aesthetic" promoted by LakeSmart is accepted and actively sought by the pool of participants.

Summary of Findings and Their Implications

While the distinguishing factors between LakeSmart participants and non-participants were generally consistent with literature findings in that participants displayed more pronounced pro-environmental attitudes and were more likely to participate in conservation-related activities such as lake associations, volunteer lake monitoring groups and other environmental groups, they differed from literature findings in other ways. Because concern about declining water quality was very high in both

Table 3. Responses of LakeSmart participants to the survey question: "What motivated you to seek LakeSmart certification for your property." The respondents were asked to rank 6 given motivations by order of importance. "Other" motivations included considerations of property value, interest in the LakeSmart program, and the desire to set a positive example for neighbors. Other N=83.

Motivation	Ranked First	Ranked Second	Ranked Third	Ranked Fourth	Ranked Fifth	Ranked Sixth
Desire to Protect the Lake	86.8%	10.8%	0.0%	2.4%	0.0%	0.0%
Property Already Fulfilled LakeSmart Criteria	4.8%	36.1%	25.3%	24.1%	8.4%	1.2%
Other	3.6%	8.4%	6.0%	2.4%	4.8%	74.7%
Social Pressure	2.4%	3.6%	4.8%	18.1%	56.6%	14.5%
Prestige of Award	1.2%	2.4%	25.3%	37.4%	25.3%	8.4%
Desire to Achieve LakeSmart Appearance	1.2%	38.6%	38.6%	15.7%	4.8%	1.2%

groups, there was no significant difference between the two groups on this issue. This result, along with the higher concern among non-participants about adverse effects on property values from declining water clarity, suggests that LakeSmart is not attracting some people who, according to other studies, should be receptive to participating in conservation efforts such as LakeSmart (Dolnicar et al. 2012, Harvey et al. 2015). By emphasizing the connection between nutrient runoff from shoreline properties and declining water quality, and the resulting decline in property values even more than it already does, LakeSmart may well be able to increase program participation in the future.

Although there was no difference in membership in non-conservation-focused groups (apart from road associations) between the LakeSmart participants and the non-participants, fostering partnerships with hunting and fishing groups or country clubs might not be worthwhile for LakeSmart, since membership in these groups was very low for both pools of respondents. The significantly higher membership among LakeSmart participants in road association (with whom LakeSmart already works to solicit participants), however, illustrates that conservation-focused groups are not the only relevant partners for LakeSmart. By partnering with other organizations such as homeowners' or condo associations, LakeSmart could increase participation within a given community.

Lastly, the significantly lower perceived sense of community reported by non-participants suggests a potentially important tool for increasing LakeSmart participation: fostering a strong sense of community. According to Chapin and Knapp (2015), this goal can be achieved through community-building activities such as community gardens, restoration projects focused on local history, and place-based community celebrations.

V. LAKESMART CRITERIA AND SUGGESTIONS FOR IMPROVEMENT

For a comprehensive evaluation of the LakeSmart program, it is important to not only investigate the characteristics of the people who have or have not participated in the program, but also to investigate specific aspects of the program. In the online survey that I administered to 245 Belgrade Lakes Area LakeSmart participants (106 award holders and 139 commendation recipients), I asked specific questions about the respondents' experiences with LakeSmart as well as questions about demographic characteristics, perceptions of water quality, and participation in different aspects of community life.

Methods: LakeSmart Inspector Surveys

In addition to the survey of LakeSmart participants, I administered similar surveys to LakeSmart screeners and evaluators (which I will call LakeSmart inspectors when referring to both groups). Like the survey of the LakeSmart participants, these surveys were created in Qualtrics (Qualtrics 2016, Freeman, pers. comm.) and distributed by Maggie Shannon, the director of the LakeSmart program, in November of 2015 (see Appendices E and F). Within the next four weeks, four out of ten evaluators responded to the survey (a response rate of 40.0%), and 41 out of 67 screeners responded (a response rate of 61.2%). Since not all respondents answered all survey questions, the total number of respondents may differ between questions and will be indicated in parentheses (i.e. n = total sample size). Unlike the LakeSmart participants, all of whom were located in the Belgrade Lakes Region (see Figures 5 and 6 for survey recipient locations), the LakeSmart inspectors work throughout the state. The LakeSmart inspectors all received exactly the same survey except for the words "evaluator", "evaluation", "screener", and "screening", which were matched to the survey recipient's position.

Background Information about LakeSmart Inspectors

The 41 screeners reported working on 35 different lakes, while the evaluators worked in entire watersheds, regions or even counties. On average, the evaluator started evaluating properties in 2010 (n=4), while the screeners, who serve to reduce the workload of the evaluators, started screening properties on average in 2011 (n=39). In a typical season, 14.3% of screeners assess more than ten properties, while the other 85.7% assess a mean of 4.6 properties (n=35). Among the evaluators, one carries out more than ten evaluations in a typical season, while two others evaluate a mean of six properties.

When asked about their reasons for becoming a LakeSmart inspector, 87.8% of screeners reported wanting to help protect lake health, 4.9% wanted to publicize the LakeSmart program, and 7.3% became screeners for other reasons, including wanting to educate others about the negative impact shoreline properties can have on lake health (n=41). Among the four evaluators, three became involved with LakeSmart to help protect the lakes, while one became an evaluator as part of his job responsibilities (working for a lake association). Most screeners (90.0%) own shoreline properties, and of these, 72.2% are LakeSmart certified (n=40). On average, the screeners' properties received the LakeSmart award in late 2012. Of the ten screeners whose shoreline properties are not LakeSmart certified, two reported that necessary best management practices (BMPs) would be too expensive, while seven cited other problems preventing certification, including the size of the dock and objections from neighbors.. Only one of the four evaluators who responded to my survey owns a shoreline property, and it is not LakeSmart certified due to a reluctance to changing the property function (e.g., wanted to keep the lawn as a play area for children) and because the deck by the water is too large to meet LakeSmart standards.

In addition to these background questions, the LakeSmart inspectors were also asked specific questions about their experiences with LakeSmart. These responses were combined with LakeSmart participants' responses to similar questions and used to investigate two general issues: people's experiences with the LakeSmart process and their general opinions about the program. LakeSmart inspectors were also asked about the training they received, and any changes they would make to the training as well as to the program in general.

Experiences of Participants and Inspectors with the LakeSmart Process

In part of the 2015 LakeSmart participant survey (see Appendix D), shoreline property owners were asked about their experiences while they were going through the process that would eventually result in a LakeSmart award or commendation (a certificate of recognition that is received when the property scores highly in at least one, but not all four, of the LakeSmart evaluation sections. See Appendix B). Although 95 respondents submitted the survey, not every respondent answered every question, resulting in sample

sizes that differed among questions. All percentages reported are relative to the sample size of the specific question.

When asked about the result of their initial LakeSmart evaluation, 40 (48.8%) respondents indicated that they had received the LakeSmart award on their first try. Of the 42 respondents who did not initially receive the award, 35 (83.3%) received a commendation, while 7 (16.7%) did not score highly enough in any evaluation category to receive either level of LakeSmart certification. While the survey did not ask respondents whether they had made changes to their property prior to applying for the LakeSmart award, the high percentage of properties that satisfied LakeSmart standards in their first evaluation coupled with the prevalence of some best management practices in the population of non-LakeSmart participants (see Chapter IV) suggests that these properties might be the "low-hanging fruit", properties that never had substantial nutrient runoff problems or had problems that were easily mitigated.

The respondents who indicated receiving a commendation or no LakeSmart certification at all as a result of their initial evaluation were asked which types of best management practices (BMPs, see Table 1) were recommended to them in their post-evaluation write-up (n=42) (Table 4). Planting a new buffer (47.6%) was the most frequently cited recommendation, followed by controlling driveway runoff (33.3%), letting leaf accumulate and controlling roof runoff (19.1% each), minimizing or avoiding fertilizer use (11.9%), and decreasing lawn area (7.1%). The remaining 28.6% of

Table 4. Best management practices recommended for improving the nutrient runoff management of a property if the initial LakeSmart evaluation did not result in an award. Other recommendations included pumping the septic system, installing shoreline rip rap, and decreasing the size of decks. N=42.

Best Management Practice	Percentage of Respondents
Plant a New Buffer	47.6%
Control Driveway Runoff	33.3%
Other Recommendations	28.6%
Leave Leaf Litter on the Ground	19.1%
Control Roof Runoff	19.1%
Minimize/Avoid Fertilizer Use	11.9%
Decrease Lawn Area	7.1%
Install Rain Garden	7.1%

respondents cited other recommendations, including reducing deck size, installing rip rap, minimizing the parking area, pumping the septic system more frequently, and making the path to the water more curved (Table 4) (n=42). The frequency with which BMPs were recommended to property owners suggests that problems with the buffer zone were encountered most frequently.

This impression regarding the importance of the buffer zone is supported by respondents' answers to two other questions about the four LakeSmart evaluation categories. First, all respondents were asked to rank the four evaluation categories (see Appendix B) in order of difficulty for their property to score highly (on a scale from 1 = most difficult to 4 = least difficult). On average, respondents cited the buffer and water access category as most difficult (mean rank: 2.30), followed closely by the yard, recreation area, and footpath category (mean rank: 2.35), the driveway and parking area category (mean rank: 2.44), and finally the structures and septic system category (mean rank: 2.92) (Table 5). Then, the respondents who had initially not achieved the full LakeSmart award were asked which area of their property needed the most improvements. In response, the respondents ranked the areas in the same order as above (mean ranks: 2.11, 2.33, 2.52 and 3.03, respectively).

Taken together, the responses to these questions suggest that the buffer area is the part of the property that is most influential in determining whether a property receives the LakeSmart award. To test this theory, Manny Gimond (pers. comm.) developed a multivariable regression that quantifies the impact of individual evaluation questions on the final LakeSmart evaluation score using evaluation scores for residents of the Belgrade Lakes Region provided by the Belgrade Lakes Association (Logan Parker, pers. comm.).

Table 5. LakeSmart participants were asked to rank the areas of their properties corresponding to the four LakeSmart evaluation sections by order of difficulty of receiving a high score. First = most difficult and fourth = least difficult. N=61.

Property Area	Ranked First	Ranked Second	Ranked Third	Ranked Fourth
Buffer & Water Access	44.3%	23.0%	7.23%	23.0%
Yard, Recreation & Footpaths	26.2%	29.5%	29.5%	14.8%
Structures & Septic	16.4%	8.2%	31.2%	44.3%
Driveway & Parking	13.1%	39.3%	29.5%	18.0%

Gimond started by including all of the questions on the evaluation form (see Appendix B) in the regression, and subsequently removed questions until only those with the most significant impact on the final score remained (Table 6) (Gimond, pers. comm.). The regression analysis identified question 11 in section 3 (yard, recreation, and footpath) as the question with the highest impact (15.0%) on the final LakeSmart evaluation score. This question refers to path characteristics (such as limited and defined path width and meandering shape) that help prevent runoff from travelling along the path into the lake.

Table 6. Impact of individual evaluation questions on the final score of a LakeSmart evaluation as determined by a multivariable regression carried out by Manny Gimond. Data obtained from the Belgrade Lakes Association.

Evaluation Section	Question Number	Variable Weight	Significance Level	Question Content
Yard, Recreation Area & Footpath	11	0.1502	$p < 0.001$	Path characteristics are not conducive to runoff
Buffer & Water Access	6	0.1350	$p < 0.001$	Duff layer is maintained wherever possible
Yard, Recreation Area & Footpath	1	0.1326	$p < 0.001$	Soil erosion is not occurring on site
Buffer & Water Access	10	0.1199	$p < 0.01$	Path and dock approach do not compromise buffer effectiveness
Yard, Recreation Area & Footpath	5	0.1180	$p < 0.001$	Lawn area is minimized
Driveway & Parking Area	1	0.0958	$p < 0.01$	Driveway and parking area are defined and minimized
Structures & Septic System	3	0.0693	$p < 0.05$	No evidence of leach field or septic system malfunction
Buffer & Water Access	2	0.0659	$p < 0.01$	Buffer contains five tiers of vegetation
Structures & Septic System	1	0.0659	$p < 0.05$	Roof runoff is infiltrated or directed to rain barrel
Buffer & Water Access	5	0.0474	$p < 0.01$	Buffer is more than ten feet wide

In total, one of the most influential questions was located in section 1 (driveway and parking area), two in section 2 (structures and septic system), three in section 3 (yard, recreation area, and footpath), and four in section 4 (buffer and water access) (see Appendix B). The section where the most influential question was located, section 3, also carried the most weight overall, determining 40.1% of the final score. Section 4 followed closely, with 36.8%, while sections 2 and 1 only determined 13.5% and 9.6%, respectively. These findings are not entirely consistent with the opinions of the LakeSmart participants, who reversed the order of the two most important sections in their ranking, putting section 4 first, followed closely by section 3. When LakeSmart inspectors were asked which evaluation section has been most difficult for LakeSmart applicants in their experience, they agreed with the LakeSmart participants, ranking section 4 as most difficult.

In addition to questions about the different LakeSmart evaluation sections, LakeSmart participants were also asked to identify the greatest barriers to improving their property to meet LakeSmart standards. Out of 70 respondents, 14.3% cited a lack of time, 11.4% were reluctant to change the function of the property (e.g., by minimizing lawn that is used for relaxation or as the children's play area). Another 7.1% identified improvements as too expensive, while 1.4% was reluctant to change the appearance of the property. The remaining 65.7% of respondents cited other reasons, including age and location of structures and the difficulty of coordinating proposed changes with multiple owners. Others were simply waiting for the buffer they had planted to meet LakeSmart standards to mature.

When the LakeSmart inspectors were asked a similar question, however, 51.2% of screeners (n=41) and three out of four of evaluators identified the cost of improvements as the main reason people struggled to attain LakeSmart standards on their properties. Lack of time was identified as the second most important reason, with 26.8% of screeners (n=41) and two out of four of evaluators selecting it. This disconnect between what LakeSmart inspectors and participants identified as barriers to making recommended runoff mitigation improvements probably stems from the fact that LakeSmart inspectors interact not only with award or commendation recipients (like the respondents to my survey), but also with those people whose properties do not pass the screenings or

evaluations. Although no such information was collected during this study, it is possible that, just like non-participants (see chapter IV), failed LakeSmart applicants are in a lower income category, making the implementation of best management practices to attain LakeSmart standards a more significant expense.

When LakeSmart inspectors were asked if they thought that the owners of properties that had neither received a commendation nor an award were willing to make the recommended improvements, both screeners and evaluators disagreed rather strongly (7.18 and 7.25, respectively, on a Likert scale from 0 = strongly agree to 10 = strongly disagree). Screeners (n=41) believed that owners were unwilling to make the recommended improvements primarily due to reluctance to changing the property function (48.8%) and appearance (46.3%), followed by cost of materials (43.9%), cost of labor (31.7%), lack of time (29.3%), and a lack of interest (14.6%). Among the evaluators, on the other hand, all four believed that the residents' unwillingness to make improvement was primarily due to the cost of labor, while three evaluators each believed that the cost of materials and reluctance to changing the property function were important factors. One evaluator each believed that lack of time, lack of interest, and reluctance to changing the property appearance were important. Despite the perceived unwillingness of failed applicants to make improvements, the screeners had rescreened on average at least one (1.14) property (that had previously failed) that was then recommended for evaluation, while evaluators had re-evaluated on average 3.25 properties that then received the LakeSmart award, suggesting that some property owners very much are motivated to implement the recommended changes to receive the LakeSmart award.

Despite all of the difficulties identified, LakeSmart participants, on average, found the process quite easy to navigate (8.05 on a Likert scale from 0 = not easy at all to 10 = extremely easy) (n=42). This result suggests that, while some people might have difficulty making the recommended improvements due to lack of time or money, the LakeSmart process itself is not a deterrent from participation in the program.

When asked to identify changes they would like to see implemented in the program, 23.2% of LakeSmart participants reported that they would like a follow-up beyond the written recommendations for improving nutrient runoff management, 10.5% would like to see the quality of recommendations for best management practices (BMPs)

improve (for example by including price estimates of BMP implementation), 7.4% would like to see improvements in the scheduling of property visits, 6.3% would like improved informational material, and 3.2% would like shorter property visits (n=95). By implementing these changes, LakeSmart could potentially increase the number of property owners who implement recommended improvements and reapply for the LakeSmart award.

LakeSmart Inspector Training

As part of the LakeSmart inspector surveys, the screeners and evaluators were asked about the training they had received to carry out their duties. 80.5% of screeners (n=41) and all four of the evaluators participated in a professional-led workshop introducing them to the concepts of the LakeSmart program and their duties as LakeSmart inspectors, 15.6% and one, respectively, participated in stakeholder-led workshops. In addition, 80.5% of screeners and three evaluators participated in site visits with trained screeners, 63.4% and three, respectively, read instructional material, and 61.0% and two, respectively, attended follow-up practice sessions. On average, screeners (n=41) agreed relatively strongly that the training they received made them feel adequately prepared to carry out their duties as screeners (3.64 on a Likert scale from 0 = strongly agree to 10 = strongly disagree). Evaluators, on the other hand, slightly disagreed that their training had been adequate (6.5 on the same scale).

When asked about difficulties they experienced during their first few site visits, 29.3% of screeners cited unfamiliarity with the screening process, 26.8% felt they lacked knowledge about best management practices, 22.0% felt insecure when interacting with property owners, and 9.8% had difficulty answering questions asked by the property owners (n=41). Among the four evaluators, two reported unfamiliarity with the evaluation process, and one lacked knowledge about best management practices (BMPs). However, the evaluators reported no problems interacting with property owners or answering their questions.

In addition, the LakeSmart inspectors were asked about ideas for improving their training. 58.5% of screeners and three out of four evaluators cited job shadowing with more experienced evaluators, 22.0% and two, respectively, would like more training

workshops, 22.0% and one, respectively, would like to see more frequent follow-up sessions, and 19.5% and two, respectively would like more scientific background information about lake health and the purpose and function of BMPs. Additional ideas included having screeners visit properties in pairs comprised of one experienced and one new screener.

Inspectors' Opinions on LakeSmart Evaluation Criteria

To evaluate the effectiveness of the LakeSmart evaluation criteria, LakeSmart inspectors were asked several specific questions about the evaluation form (see Appendix B). First, LakeSmart inspectors were asked whether they found the form intuitive and easy to use. Screeners (n=41), on average, found the form relatively easy to use (7 on a Likert scale from 0 = not easy at all to 10 = extremely easy), while the evaluators found the form somewhat less intuitive (5.75 on the same scale). It is important to note, however, that this mean was heavily skewed by one evaluator who selected "1", while the three others selected "7" or "8". Those LakeSmart inspectors who rated the ease of use of the form as a "6" or lower were invited to share their concerns. Among the screeners (n=13), 17.1% found the point system confusing, 14.6% found the wording of questions unclear or confusing, 12.2% thought that some questions require subjective assessments, and 7.3% said that the form was too long. Other complaints targeted the version of the evaluation form that must be completed online after site visits, and specifically that the document is not a fillable pdf and that entered scores do not add up automatically. The one evaluator who found the form difficult to use cited unclear wording, and subjective assessments.

While both screeners (n=37) and evaluators (n=4) believe that the evaluation form reinforces and rewards the use of best management practices rather well (7.70 and 7.25 on a Likert scale from 0 = not very well to 10 = extremely well), they had several suggestions for how the form could be improved. Among the screeners (n=41), 51.2% would like to see one or more questions clarified, specifically the questions about natural topography. Another 14.6% would like to eliminate questions, specifically those that seem to duplicate each other. Examples of this were two questions about minimized lawn area and a layer of duff, where one is dependent on the other because lawn and duff are mutually exclusive. According to the screener who submitted this response, the property

owner is penalized twice for the same offense. 12.2% of screeners would like to give one section more weight than the others, but did not indicate which ones. 7.3% would like to add a question, specifically concerning roof runoff and the use of native species in landscaping. A further 2.4% would like to add an evaluation section, and suggested separating section 2 into a section concerning structures and a section about the septic system, as opposed to a combination of the two. Other ideas included building more flexibility for individual situations into the evaluation form. Among the four evaluators, two would like to clarify a question, but did not indicate which one, while three would eliminate questions, specifically those not directly related to runoff (e.g., about natural topography). Additional criticism focused on section 3 (yard, recreation area, and footpaths). Specifically, evaluators suggested eliminating questions 3f (because turf height is highly variable and less important than turf health) and 3j (due to the need for subjective assessments), to combine questions 3g and 3i (about duff and mulch, respectively) and questions 3h and 4g (about natural topography) due to redundancy.

After analyzing these responses, there appears to be the potential to streamline the evaluation process by reducing redundancies, subjectivity, and confusion in the questions identified above. In addition to simplifying the evaluation or screening process for the LakeSmart inspectors, these changes have the potential to make the process more transparent and comprehensible for LakeSmart participants.

Promoting LakeSmart and Countering Misconceptions

To judge how information about LakeSmart is disseminated in the communities, LakeSmart participants as well as inspectors were asked about ways in which they promote the LakeSmart program in their community. 82.9% of screeners (n=41), three out of four evaluators, and 65.3% of participants (n=95) talk to their friends and neighbors about LakeSmart, 63.4% of screeners, three out of four evaluators, and 7.4% of participants give presentations about LakeSmart, either in a formal or an informal setting, 14.6% of screeners, two evaluators, and 2.1% of participants lead workshops for interested parties, and 78.0% of screeners, all four evaluators, and 10.5% of participants distribute informational material. Other ways in which inspectors or participants promote the program include visiting farmers markets, contributing to local newspapers and newsletters, and working with schools. Several participants and screeners also cited their

LakeSmart award signs as ways they promote the program, showing that they understand the value of the LakeSmart sign as a social marketing tool (McKenzie-Mohr 2006). On the other hand, 9.5% of LakeSmart participants said that they do not promote LakeSmart, with several reporting that they view LakeSmart as a failure without citing specific reasons.

Furthermore, the LakeSmart inspectors were asked to identify any misconceptions about LakeSmart that they had encountered. Responses included fear of being reported for zoning violations, the assumption that recommended changes would always be expensive, and that recommended changes would be mandatory. Especially the fear about zoning violations shows that LakeSmart may need to do more to distance itself from its Department of Environmental Protection past and emphasize its position as a non-regulatory Maine Lakes Society program.

Recommended Changes to the Program

The findings of this study suggest several areas for improvements to the LakeSmart program present themselves:

- Allaying LakeSmart participants' concern about lack of time and money for improvements by promoting ways to save both, including but not limited to employing Youth Conservation Corps members for best management practice implementation and negotiating discounts with contractors and plant nurseries
- Fostering a continued relationship with shoreline residents whose properties initially do not meet LakeSmart standards by sending them new information about discounts and partnerships as it becomes available and by reminding them about the program whenever possible, albeit in a non-intrusive manner
- Incorporating increased "job-shadowing" with experienced LakeSmart inspectors into the training of both evaluators and screeners
- Teaching screeners how to anticipate and correctly answer questions they may receive when interacting with property owners, perhaps through role-play during the training sessions
- Incorporating follow-up training workshops after a certain period of time to ensure consistency among the LakeSmart inspectors

- Reducing redundancy and confusion in the evaluation form, especially related to questions about natural topography
- Creating a fillable, self-summing pdf version of the evaluation form to make it more accessible and reduce errors in score reporting
- Continuing to emphasize the non-regulatory nature of the LakeSmart program to assuage fears of a punishment for zoning violations.

I believe that making these changes in future years will enhance the effectiveness of the LakeSmart program and allow it to attract more participants.

VI. SYNTHESIS AND FINAL RECOMMENDATIONS

The recommendations for improvements to the LakeSmart program identified in this report can be divided into two general categories: structural changes to the program, in terms of the training and the evaluation procedure, and changes to how the program presents itself to potential participants. While this report was in progress, Maggie Shannon, the director of the LakeSmart program, has introduced several changes to the program that will take effect in the coming evaluation seasons (Shannon, pers. comm.). These changes will be discussed wherever they relate to recommended improvements discovered during this report.

Recommended Structural Changes

In her conversations with me for this report, Maggie Shannon identified a continuing relationship with shoreline residents who apply for the LakeSmart award, whether they receive it or not, as a goal for the future of LakeSmart. Conversations with several LakeSmart stakeholders revealed a similar desire (Beck, pers. comm., Matson, pers. comm.).

Since our conversation in October of 2015, Shannon has instituted a new policy that limits the life of a LakeSmart award to five years (Shannon, pers. comm.). Once the five-year period expires, the lake association will contact the shoreline property owner for LakeSmart recertification. The re-evaluations will start in 2017, five years after the Maine Lakes Society took over the LakeSmart program. This guaranteed and ongoing contact with LakeSmart mediated by the lake association will hopefully serve as an incentive to property owners to maintain their property according to LakeSmart standards even after receiving the award, providing long-term benefits to the lake.

While the five-year time limitation for the award will almost certainly increase the profile of the LakeSmart program in lake communities by increasing the number of properties that are involved in the certification process at any given time, the recommendation of improving the continuing mentoring relationship with shoreline residents whose properties do not initially qualify for the award remains valid. By contacting property owners who did not receive the LakeSmart award with recommendations for improvements and possibly informing them about discounts for

materials and labor alongside other benefits through continued communication, it should be possible for LakeSmart to increase the proportion of these initially-rejected properties that eventually attain LakeSmart status.

Other recommendations for structural changes to increase participation in the LakeSmart program include expanding relationships with member-rich groups, conservation-focused or not, in addition to the lake associations and road associations that already promote LakeSmart. Shannon has already embarked on a partnership with the conservation organization Maine Audubon, creating the Loon Smart merit badge (Shannon, pers. comm.). This sticker (Figure 9), which can be added to the slightly redesigned LakeSmart award sign (Figure 10), can be earned by LakeSmart awardees who make additional efforts to provide nesting habitat for waterfowl, especially the iconic loon. By partnering with Maine Audubon, a 150 year-old conservation agency with a large membership base, Shannon has done exactly what my findings recommend.

Figure 9. Loon Smart Merit Badge Created by LakeSmart and Maine Audubon

Recommendations for structural changes also included changes to the training that LakeSmart evaluators and screeners receive. I found that LakeSmart inspectors would like to see training that incorporates increased "job-shadowing" with experienced inspectors, more practice anticipating and answering questions posed by property owners, as well as periodic follow-up training workshops. While the former two, to my knowledge, have not yet been implemented, Shannon has instituted a policy of requiring volunteer screeners to attend re-training workshops every three years to ensure consistency in their assessments. Workshops will be held in the summer of 2016 for volunteers certified as screeners in 2012 and 2013.

The survey responses of the LakeSmart inspectors also revealed a great desire for reduced redundancy, subjectivity, and unclear wording in certain parts of the LakeSmart evaluation form. The responses also revealed a need for more a more intuitive electronic evaluation form. To my knowledge, these changes have not yet been implemented.

Recommended Presentation Changes

In addition to recommendations for structural changes, my study also revealed the potential for improvement in how the LakeSmart program presents itself to potential participants, including the message it disseminates to potential participants. Survey responses of LakeSmart participants revealed a potential for attracting new participants by emphasizing the adverse effect of poor lake water quality on property values. Shannon has independently started to implement this strategy by appearing as a panelist at a Maine Real Estate & Development Association (MEREDA) conference in February 2016. However, this message can still be incorporated to a greater extent in the informational material provided by the LakeSmart program (Shannon, pers. comm.).

Figure 10. Redesigned LakeSmart Award Sign

By examining the survey responses of LakeSmart inspectors, I discovered that common misconceptions about LakeSmart include the impression that it is still a Department of Environmental Protection (DEP) program, and that it is a code enforcement program. These findings led me to recommend that LakeSmart continue to emphasize its voluntary, non-regulatory nature as well as its status as a Maine Lakes Society (MLS) program to assuage potential fears of punishment for zoning violation. A step towards this end is the redesign of the LakeSmart award sign. Although the design changes are not very substantial and the award sign still retains the same general layout and color scheme as the original DEP design, the redesign may help distinguish LakeSmart-the-DEP-program from LakeSmart-the-MLS-program. In addition, the sign now features green trees, which may be meant to reference the partially green MLS logo.

The last major possibility for improvement identified in my report is the utilization of shoreline residents' sense of place, or sense of community, to increase LakeSmart participation. Because I found that LakeSmart participants perceive a significantly stronger sense of community than non-participants, and because strong sense of community has been identified as a driver of participation in conservation efforts, I believe that LakeSmart participation can be increased by fostering a stronger sense of community among shoreline residents. This goal can be accomplished in a number of ways, but the most important is perhaps the organization of community-building activities such as place-based celebrations.

Conclusion

While it appears that many recommendations identified in this report have already been incorporated, or will be incorporated soon, into the LakeSmart program, opportunities for further improvement remain. Specifically, the program can improve its mentoring process for property owners who fail to receive LakeSmart certification, it can develop partnerships with member-rich groups to increase exposure of the program to new potential participants, and it can foster a strong sense of place in lake communities by participating in or sponsoring local events. In addition, LakeSmart can improve the training for the evaluators and screeners by increasing "job-shadowing" opportunities with experienced LakeSmart inspectors, and it can reduce redundancy, subjectivity, and unclear wording in its evaluation form. If LakeSmart implements these changes, along with those that are already in the process of being implemented, there is real potential for expansion within and beyond the state of Maine.

VII. PERSONAL COMMUNICATION

Garrison Beck, Midcoast Conservancy Watershed Protection Specialist and Damariscotta Lake Watershed Association LakeSmart Evaluator

Melvin Croft, Belgrade Regional Conservation Alliance and East Pond Association Board Member, East Pond Association LakeSmart Evaluator

Ellen Freeman, Colby College, Teaching and Learning Applications Coordinator

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Peter Kallin, President of the Maine Lakes Society

Lynn Matson, Belgrade Lakes Association Board Member and Volunteer LakeSmart Screener

Logan Parker, Maine Lakes Resource Center Community Engagement Coordinator and Belgrade Lakes Association LakeSmart Coordinator

Maggie Shannon, Maine Lakes Society, LakeSmart Program Director

VIII. LITERATURE CITED

Bailey, J. E., and A. J. K. Calhoun. 2008. Comparison of three physical management techniques for controlling Variable-leaf milfoil in Maine lakes. Journal of Aquatic Plant Management 46:163–167.

Baron, J. S., E. K. Hall, B. T. Nolan, J. C. Finlay, E. S. Bernhardt, J. A. Harrison, F. Chan, and E. W. Boyer. 2013. The interactive effects of excess reactive nitrogen and climate change on aquatic ecosystems and water resources of the United States. Biogeochemistry 114:71–92.

Belgrade Regional Conservation Alliance. 2015a. Belgrade Newsletter: Update from the Belgrade Regional Conservation Alliance. http://belgradelakes.com. April 29, 2016.

Belgrade Regional Conservation Alliance. 2015b. About the Belgrade Regional Conservation Alliance. http://belgradelakes.com. May1, 2016.

Beutel, M. W., and A. J. Horne. 1999. A review of the effects of hypolimnetic oxygenation on lake and reservoir water quality. Lake and Reservoir Management 15:285–297.

Beyene, M. T., and S. Jain. 2015. Wintertime weather-climate variability and its links to early spring ice-out in Maine Lakes. Limnology and Oceanography 60:1890–1905.

Bouchard, R. 2000. The Economics of Lakes: More on dollars and $ense. Maine Department of Environmental Protection. Augusta, Maine.

Boyle, K., and R. Bouchard. 2003. Water quality effects on property prices in northern New England. LakeLine Magazine 23:24–27.

Boyle, K. J., P. J. Poor, and L. O. Taylor. 1999. Estimating the demand for protecting freshwater lakes from eutrophication. American Journal of Agricultural Economics 81:1118–1122.

Boyle, K., J. Schuetz, and S. Kahl. 1997. Great ponds play an integral role in Maine's economy. Department of Resource Economics & Policy Staff Paper REP April:1–5.

Brauns, M., X. F. Garcia, N. Walz, and M. T. Pusch. 2007. Effects of human shoreline development on littoral macroinvertebrates in lowland lakes. Journal of Applied Ecology 44:1138–1144.

Brauns, M., B. Guecker, C. Wagner, X.-F. Garcia, N. Walz, and M. T. Pusch. 2011. Human lakeshore development alters the structure and trophic basis of littoral food webs. Journal of Applied Ecology 48:916–925.

Carpenter, S. R., B. J. Benson, R. Biggs, J. W. Chipman, J. A. Foley, S. A. Golding, R. B. Hammer, P. C. Hanson, P. T. J. Johnson, A. M. Kamarainen, T. K. Kratz, R. C.

Lathrop, K. D. McMahon, B. Provencher, J. A. Rusak, C. T. Solomon, E. H. Stanley, M. G. Tuner, M. J. Vander Zanden, C.-H. Wu, and H. Yuan. 2007. Understanding regional change: A comparison of two lake districts. BioScience 57:323–335.

Carpenter, S. R., and K. L. Cottingham. 1997. Resilience and restoration of lakes. Conservation Ecology 1:2–18.

Chapin, F. S., and C. N. Knapp. 2015. Sense of place: A process for identifying and negotiating potentially contested visions of sustainability. Environmental Science and Policy 53:38–46.

Cheruvelil, K. S., and P. A. Soranno. 2008. Relationships between lake macrophyte cover and lake and landscape features. Aquatic Botany 88:219–227.

Christensen, D. L., B. R. Herwig, D. E. Schindler, and S. R. Carpenter. 2012. Impacts of lakeshore residential development on coarse woody debris in north temperate lakes. Ecological Aplications 6:1143–1149.

Cumberland County Soil & Water Conservation District, and Portland Water District. 2015. Fertilizer Basics - Are you feeding your plants, or the lake? Standish, Maine.

Cutler, E. 2013, November 4. Threatened environment, weaker economy the enduring legacy of Paul LePage. Opinion Piece. Central Maine News. March 15, 2016.

Dai, Y. C., M. P. R. Gordon, J. Y. Ye, D. Y. Xu, Z. Y. Lin, N. K. L. Robinson, R. Woodard, and M. K. Harder. 2015. Why doorstepping can increase household waste recycling. Resources, Conservation and Recycling:9–19.

Davies, Z. G., R. A. Fuller, M. Dallimer, A. Loram, and K. J. Gaston. 2012. Household factors influencing participation in bird feeding activity: A national scale analysis. PloS one 7:e39692.

Dolnicar, S., A. Hurlimann, and B. Grün. 2012. Water conservation behavior in Australia. Journal of Environmental Management 105:44–52.

Elias, J. E., and M. W. Meyer. 2003. Comparisons of undeveloped and developed shorelands, northern Wisconsin, and recommendations for restoration. Wetlands 23:800–816.

Faridmarandi, S., and G. M. Naja. 2014. Phosphorus and water budgets in an agricultural basin. Environmental Science & Technology 48:8481–8490.

Fleming, J. R., and E. A. Love. 2012. Healthy lakes and vibrant economies: Linking history, sense of place, and watershed protection in the Belgrade Lakes region. Maine Policy Review 21:90–95.

Fransson, N., and T. Gärling. 1999. Environmental concern: Conceptual definitions, measurement methods, and research findings. Journal of Environmental Psychology 19:369–382.

Gantzer, P. A., L. D. Bryant, and J. C. Little. 2009. Effect of hypolimnetic oxygenation on oxygen depletion rates in two water-supply reservoirs. Water Research 43:1700–1710.

Glibert, P. M., R. Maranger, D. J. Sobota, and L. Bouwman. 2014. The Haber Bosch–harmful algal bloom (HB–HAB) link. Environmental Research Letters 9:105001–10513.

Grant, G. 2013, October 15. From the State House: Protecting Maine's environment requires oversight, transparency. Opinion Piece. Central Maine News. April 2, 2016.

Halliwell, D., and M. Evers. 2008. A Maine success story. LakeLine Magazine 2:37–43.

Harvey, R. G., L. Perez, and F. J. Mazzotti. 2015. Not seeing is not believing: volunteer beliefs about Burmese pythons in Florida and implications for public participation in invasive species removal. Journal of Environmental Planning and Management:1–19.

Harvey, T. S. 2015. Muddying the waters: Protection, public participation, and ambiguity in the language of pollution in the Great Lakes. The Journal of Culture & Agriculture 37:107–115.

Jennings, M. J., E. E. Emmons, G. R. Hatzenbeler, C. Edwards, and M. A. Bozek. 2003. Is littoral habitat affected by residential development and land use in watersheds of Wisconsin lakes? Lake and Reservoir Management 19:272–279.

Jeppesen, E., M. Søndergaard, N. Mazzeo, M. Meerhoff, C. C. Branco, V. Huszar, and F. Scasso. 2005. Lake restoration and biomanipulation in temperate lakes: relevance for subtropical and tropical lakes by eutrophication of lakes. Pages 341–359 *in* M. V. Reddy, editor. Tropical eutrophic lakes: their restoration and management. Science Publishers, Enfield, New Hampshire.

Kallin, P. 2015. Alphabet Soup of Conservation in the Belgrades. Summertime in the Belgrades 17:1–2.

Kaufman, L. 2011, April 15. G.O.P. Push in States to Deregulate Environment. The New York Times:4. New York.

Keeler, B. L., S. Polasky, K. A. Brauman, K. A. Johnson, J. C. Finlay, A. O'Neill, K. Kovacs, and B. Dalzell. 2012. Linking water quality and well-being for improved assessment and valuation of ecosystem services. Proceedings of the National

Academy of Sciences 109:18619–18624.

Kennedy, R. H., and G. D. Cooke. 1982. Control of lake phosphorus with aluminum sulfate: dose determination and application techniques. Water Resources Bulletin 18:389–395.

Kõiv, T., T. Nõges, and A. Laas. 2011. Phosphorus retention as a function of external loading, hydraulic turnover time, area and relative depth in 54 lakes and reservoirs. Hydrobiologia 660:105–115.

Kreutzwiser, R., R. De Loë, K. Imgrund, M. J. Conboy, H. Simpson, and R. Plummer. 2011. Understanding stewardship behaviour: Factors facilitating and constraining private water well stewardship. Journal of Environmental Management 92:1104–1114.

Liboriussen, L., M. Søndergaard, E. Jeppesen, I. Thorsgaard, S. Grünfeld, T. S. Jakobsen, and K. Hansen. 2009. Effects of hypolimnetic oxygenation on water quality: Results from five Danish lakes. Hydrobiologia 625:157–172.

Lijklema, L. 1986. Phosphorus accumulation in sediments and internal loading. Hydrobiological Bullentin 20:213–224.

Maine Association of Conservation Districts. 2016. What are conservation districts? https://maineconservationdistricts.com/about/. March 8, 2016.

Maine Department of Environmental Protection. 2008. Maine shoreland zoning: A handbook for shoreland owners. Maine Department of Environmental Protection, Gardiner, Maine.

Maine Department of Environmental Protection. 2012. State of Maine 2012 Integrated Water Quality Monitoring and Assessment Report. Maine DEP 2010 305(b) Report and 303(d) list. Augusta, Maine.

Maine Department of Environmental Protection. 2013a. Maine 303(d) Phosphorus-Based TMDL Lakes. Augusta, Maine.

Maine Department of Environmental Protection. 2013b. Use of Aquatic Herbicides. http://www.maine.gov/dep/water/invasives/invherbicide.htm. April 20, 2016.

Maine Department of Environmental Protection. 2016. Nonpoint Source Priority Watersheds List - Lakes. Augusta, Maine.

Maine Lakes Resource Center. 2014. The MLRC. http://mainelakesresourcecenter.org/the-gallery/. April 8, 2016.

Maine Lakes Society. 2015. Why be LakeSmart? http://mainelakessociety.org/lakesmart/.

April 24, 2016.

Maine Lakes Society. 2016. About the Maine Lakes Society. http://mainelakessociety.org/about/. April 8, 2016.

Maine Office of Tourism. 2015a. 2015 Maine Tourism Highlights: Why Tourism Matters to Maine Residents. http://visitmaine.com. April 29, 2016.

Maine Office of Tourism. 2015b. 2015 Maine Office of Tourism Annual Report. http://visitmaine.com. April 29, 2016.

Maine Volunteer Lake Monitoring Program. 2016. About the Maine Volunteer Lake Monitoring Program. http://mainevlmp.org/about/. March 14, 2016.

Matson, L. 2015. Belgrade Lakes Association Fall 2015 Milfoil Update: STOP MILFOIL Campaign. http://belgradelakesassociation.org. March 29, 2016.

McCullough, I. M., C. S. Loftin, and S. A. Sader. 2013. Landsat imagery reveals declining clarity of Maine's lakes during 1995 - 2000. Freshwater Science 32:741–752.

McKenzie-Mohr, D. 2006. Fostering Sustainable Behavior: Community-Based Social Marketing. Online Edition. New Society Publishers.

Merrell, K. 2013. Why Maine's Mandatory Shoreland Zoning Act Standards Work. The Federation of Vermont Lakes and Ponds Newsletter:12.

Merrell, K., J. Deeds, M. Mitchell, and R. Bouchard. 2013. Determining if Maine's Mandatory Shoreland Zoning Act standards are effective at protecting aquatic habitat. Vermont Department of Environmental Conservation and Maine Department of Environmental Protection.

Merrell, K., E. A. Howe, and S. Warren. 2009. Examining shorelines, littorally. LakeLine Magazine 29:8–13.

Michael, H., K. Boyle, and R. Bouchard. 1996. Water quality affects property prices: A case study of selected Maine lakes. Maine Agricultural and Forest Experiment Station. Miscellaneous Report 398.

Monagle, B. 2002. Zoning for lake protection in Maine. LakeLine Magazine 22:25–28.

Müller, R., and P. Stadelmann. 2004. Fish habitat requirements as the basis for rehabilitation of eutrophic lakes by oxygenation. Fisheries Management and Ecology 11:251–260.

Nasir Khan, M., and F. Mohammad. 2014. Eutrophication: Challenges and Solutions.

Pages 1–15 *in* A. A. Ansari and S. S. Gill, editors. Eutrophication: Causes, Consequences and Control. Springer, Dordrecht, Netherlands.

Natural Resources Council of Maine. 2013. Troubled waters: Damage to Maine's lake protection program under the LePage administration. Augusta, Maine.

Nonpoint Source Training & Resource Center. 2000. A homeowner's guide to environmental laws affecting shorefront property in Maine's organized towns. Maine Department of Environmental Protection, Augusta, Maine.

Ohm, R. 2014. Veto of Maine lakes protection bill upheld. Central Maine News. March 31, 2016.

Olin, M., M. Rask, J. Ruuhijärvi, J. Keskitalo, J. Horppila, P. Tallberg, T. Taponen, A. Lehtovaara, and I. Sammalkorpi. 2006. Effects of biomanipulation on fish and plankton communities in ten eutrophic lakes of southern Finland. Hydrobiologia:67–88.

Paterson, J. 1989. Water management and recreational values; Some cases in Victoria, Australia. Water Science and Technology 21:1–12.

Pavri, F., A. Springsteen, A. Dailey, and J. D. MacRae. 2012. Land use and socioeconomic influences on a vulnerable freshwater resource in northern New England, United States. Environment, Development and Sustainability 15:625–643.

Peckenham, J., and D. Hart. 2012. The path to sustainable water resources solutions. Maine Policy Review 21:46–57.

Portland Water District. 2015a. Sebago Lake Ecology Center's Pervious Pathway. Standish, Maine.

Portland Water District. 2015b. Lakes Like Less Lawn - Environmental Landscaping for Water Quality. Standish, Maine.

Portland Water District, and Maine Department of Environmental Protection. 2006. Conservation Practices for Homeowners Factsheet Series. Standish, Maine.

Qualtrics. 2016. About Us. https://qualtrics.com/about/. April 22, 2016.

Rees, J. H., S. Klug, and S. Bamberg. 2015. Guilty conscience: motivating pro-environmental behavior by inducing negative moral emotions. Climatic Change 130:439–452.

Reitzel, K., J. Hansen, F. Andersen, K. S. Hansen, and H. S. Jensen. 2005. Lake restoration by dosing aluminum relative to mobile phosphorus in the sediment. Environmental Science and Technology 39:4134–4140.

Rissman, A. R., and S. Carpenter. 2015. Progress on nonpoint pollution: Barriers and opportunities. Daedalus:35–47.

Rogers, E. M. 1983. Diffusion of Innovations. Third edition. The Free Press, New York, New York.

Scardina, J. 2014, April 30. LePage vetoes lakes protection bill. Central Maine News. April 30, 2016.

Schindler, D. W. 1977. Evolution of phosphorus limitation in lakes. Science 195:260–262.

Schumaker, R. J., W. H. Funk, and B. C. Moore. 1993. Zooplankton responses to aluminum sulfate treatment of Newman Lake, Washington. Journal of Freshwater Ecology 8:375–387.

Shahady, T. D., S. C. Mozley, and D. E. Francisco. 1994. The grazing impact of Daphnia parvula on phytoplankton in a southeastern, eutrophic reservoir. Lake and Reservoir Management 8:189–203.

Smith, V. H. 2003. Eutrophication of freshwater and coastal marine ecosystems. Environmental Science & Pollution Research 10:126–139.

Soediono, B. 1989. Consequences of human lakeshore development on emergent and floating-leaf vegetation abundance. Journal of Chemical Information and Modeling 53:160.

Søndergaard, M., J. P. Jensen, and E. Jeppesen. 2003. Role of sediment and internal loading of phosphorus in shallow lakes. Hydrobiologia 506:135–145.

De Sousa, S., B. Pinel-Alloul, and A. Cattaneo. 2008. Response of littoral macroinvertebrate communities on rocks and sediments to lake residential development. Canadian Journal of Fisheries and Aquatic Sciences 65:1206–1216.

State of Maine. 1971a. 38 MRSA §435-449 Mandatory Shoreland Zoning Act. Augusta, Maine.

State of Maine. 1971b. 38 MRSA §419 Cleaning Agents and Lawn and Turf Fertilizer Containing Phosphate Banned. Augusta, Maine.

State of Maine. 1978. 38 MRSA §481-490 Site Location of Development Act. Augusta, Maine.

State of Maine. 1987. 38 MRSA §480 Natural Resources Protection Act. Augusta, Maine.

State of Maine. 1995. 38 MRSA §420-C Erosion and Sedimentation Control Act. Augusta, Maine.

State of Vermont. 1970. 24 VSA §4410a Zoning of Shorelands Law. Motpelier, Vermont.

State of Vermont. 2014. 10 VSA §1441 Shoreland Protection Act. Montpelier, Vermont.

Steinman, A. D., E. S. Isely, and K. Thompson. 2015. Stormwater runoff to an impaired lake: Impacts and solutions. Environmental Monitoring and Assessment 187:549.

Steinman, A., R. Rediske, and K. R. Reddy. 2004. The reduction of internal phosphorus loading using alum in Spring Lake, Michigan. Journal of Environmental Quality 33:2040–2048.

Story, P. A., and D. R. Forsyth. 2008. Watershed conservation and preservation: Environmental engagement as helping behavior. Journal of Environmental Psychology 28:305–317.

Tanada, S., M. Kabayama, N. Kawasaki, T. Sakiyama, T. Nakamura, M. Araki, and T. Tamura. 2003. Removal of phosphate by aluminum oxide hydroxide. Journal of Colloid and Interface Science 257:135–140.

The Associated Press. 2011, March 18. LePage unveils “Open for Business” sign on I-95. Bangor Daily News. Bangor, Maine. April 7, 2016.

Town of Belgrade, M. 1991. Shoreland Zoning Ordinance for the Town of Belgrade, Maine:1–97.

Town of Belgrade, M. 1993. Minimum Lot Size Ordinance for the Town of Belgrade, Maine:1–27.

Town of Belgrade, M. 1999. Floodplain Management Ordinance for the Town of Belgrade, Maine: 1–45.

Vermont Department of Environmental Conservation. 2003. Vermont’s Shoreland Zoning Law. Montpelier, Vermont.

Vermont Department of Environmental Conservation. 2016. What is Lake Wise? http://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise/what. April 28, 2016.

Watershed Management Division. 2015. The Vermont Shoreland Protection Act. Vermont Department of Environmental Conservation. Montpelier, Vermont.

Welch, B., and C. Smith. 2008. From pilot to statewide. LakeLine Magazine 28:27–32.

Welch, E. B., and G. D. Cooke. 1999. Effectiveness and longevity of phosphorus inactivation with alum. Lake and Reservoir Management 15:5–27.

Welsch, H., and J. Kühling. 2009. Determinants of pro-environmental consumption: The role of reference groups and routine behavior. Ecological Economics 69:166–176.

Whitehead, P., R. L. Wilby, R. W. Battarbee, M. Kernan, and A. J. Wade. 2009. A review of the potential impacts of climate change on surface water quality. Hydrological Sciences Journal 6667:37–41.

Whittier, T. R., S. G. Paulsen, D. P. Larsen, S. A. Peterson, A. T. Herlihy, and P. R. Kaufmann. 2002. Indicators of ecological stress and their extent in the population of northeastern lakes: A regional-scale assessment. BioScience 52:235–247.

Williams, D. R., and S. I. Stewart. 1998. Sense of place: An elusive concept that is finding a home in ecosystem management. Journal of Forestry 96:18–23.

Williams, S., and R. Hill. 2013. Maine Lakes Report 2012. Maine Volunteer Lake Monitoring Program. Auburn, Maine.

IX. APPENDICES

Appendix A: All LakeSmart Lakes

Table 1. All lakes with at least one LakeSmart award, organized by county. Data were obtained from the Maine Lakes Society and the Belgrade Lakes Association.

Lake Name	Status	Number of Awards	Year of First Award
Androscoggin County			
Brettuns Pond	Threatened	1	2010
Little Wilson Pond	Threatened	1	2005
North Lake	-	1	2015
Taylor Pond	Threatened	9	2003
Thompson Lake	Threatened	1	2006
Aroostook County			
Pleasant Lake	Threatened	2	2006
Square Pond	Threatened	3	2004
Cumberland County			
Crescent Lake	Threatened	16	2009
Little Sebago Lake	Threatened	1	2005
Pleasant Lake	-	2	2015
Sabbathday Pond	Threatened	4	2015
Sebago Lake	Threatened	1	2004
Watchic Pond	Threatened	31	2004
Woods Pond	Threatened	1	2015
Franklin County			
Clearwater Pond	-	1	2005
Dodge Pond	Threatened	2	2006
Gull Pond	-	4	2014
Locke Pond	-	8	2005
Porter Lake	-	10	2005
Quimby Pond	Threatened	10	2011
Rangeley Lake	-	2	2006
Sand Pond	Threatened	7	2006
Mooselookmeguntic Lake	-	8	2006
Hancock County			
Abrams Pond	Threatened	6	2011
Beech Hill Pond	Threatened	10	2010
Branch Lake	Threatened	15	2003
Green Lake	-	19	2004
Kennebec County			
Annabessacook Lake	Impaired	2	2006

Table 1. Continued.

Lake Name		Number of Awards	Year of First Award
Cobbosseecontee Lake	Threatened	15	2006
David Pond	-	16	2010
East Pond	Impaired	26	2009
Echo Lake	-	11	2014
Great Pond	Impaired	90	2005
Long Pond, Belgrade	Impaired	50	2007
Lovejoy Pond	-	4	2004
Maranacook Lake	Threatened	5	2005
McGrath Pond	Threatened	6	2011
North Pond	Threatened	4	2014
Parker Pond	Threatened	3	2005
Salmon Lake	Threatened	3	2011
Three Mile Pond	Impaired	1	2006
Torsey Pond	Threatened	6	2014
Washington Pond	-	4	2015
Webber Pond	Impaired	3	2009
Wilson Pond	Threatened	28	2004
Knox County			
Alford Pond	-	1	2015
Lermond Pond	-	4	2014
Megunticook Lake	Threatened	5	2015
Megunticook River	-	1	2015
Lincoln County			
Biscay Pond	-	12	2009
Damariscotta Lake	Threatened	30	2009
Duckpuddle Pond	Threatened	3	2011
McCurdy Pond	-	2	2015
Muscongus Pond	-	1	2015
Paradise Pond	Threatened	3	2011
Pemaquid Pond	Threatened	13	2009
Oxford County			
Anasagunticook Lake	Threatened	26	2004
Bryant Pond	-	4	2013
Christopher Lake	-	1	2015
Cupsuptic Lake	-	2	2008
Farrington Pond	-	5	2009
Five Kezar Ponds	-	1	2004
Green Pond	-	2	2009

Table 1. Continued.

Lake Name		Number of Awards	Year of First Award
Keoka Lake	-	15	2010
Mirror Pond	Threatened	1	2009
Stearns Pond	-	1	2004
Whitney Pond	Threatened	1	2014
Worthley Pond	-	27	2008
Penobscot County			
Cold Stream	Threatened	6	2015
Nokomis Pond	Threatened	1	2006
Puffers Pond	-	3	2007
Sebasticook Lake	Impaired	2	2003
Wassookeag Lake	Threatened	17	2004
Waldo County			
Coleman Lake	-	1	2013
Sheepscot Lake	-	1	2015
Winnecook Pond	-	6	2015
York County			
Long Pond, Parsonsfield	Threatened	8	2005
Mousam Lake	Threatened	1	2004
West Pond, Parsonsfield	-	2	2005
Unknown Location			
Loone Lake	-	1	2007

In addition, Nickerson Lake (Aroostook), Norcross Pond (Franklin), Round Pond (Franklin), Three Corner Pond (Kennebec), Pattee Pond (Kennebec), Pushaw Lake (Penobscot), Schoodic Lake (Washington), and Moose Lake (county unknown) have properties that have received commendations, but no award properties.

Appendix B: LakeSmart Evaluation/Screening Form 2015

2015 SCREENER/EVALUATOR FORM FOR LAKESMART

Date
Is this a Screening or an Evaluation? (circle)
Screener or Evaluator

PROPERTY OWNER CONTACTS AND SITE INFORMATION:
Lake / Watershed / County
Property Owner(s)
USPS Address: Summer
USPS Address: Winter
Best Telephone number for Summer and Winter:

Email address(s)

Property Address: Street **Town**
Year built
Number of Years Owned **Year round or Seasonal** (circle)
Road Association Name

QUESTIONS TO ASK HOMEOWNERS:

1. What motivated you to participate in LakeSmart?
2. Do you have outside pets?
3. Where is your Septic Tank and Leach Field?
4. How often do you pump the Septic Tank?
5. When was the last time you had the tank pumped?
6. Do you use herbicides and pesticides? (Y/N) How frequently?
7. Do you use fertilizer? (Y/N) How frequently?
8. How high do you set the mower bar when you mow the lawn?
9. For decks not attached to the house: When were they built? Size
10. May we post your name on our website for participating in LakeSmart? (Y/N)
11. May we use photos taken here for teaching purposes or to publicize the program? (Y/N)

PRELIMINARY EVALUATION (Must be approved by Maine Lakes Society):

SECTION	NAME	SCORING STANDARD	SCORE	QUALIFY (y/n)
Section 1	Driveway and Parking Areas	11/15 possible points		
Section 2	Structures and Septic System	13/18 possible points (!)		
Section 3	Yard, Recreation Area, and Footpaths	22/33 possible points		
Section 4	Buffer and Water Access	25/37 possible points (!)		
All Sections				

Maine Lakes Society
FOR THE SAKE OF MAINE'S LAKES

LAKESMART PROTECTS WATER QUALITY, WILDLIFE AND PROPERTY VALUE
SO YOU CAN HAVE YOUR LAKE AND KEEP IT TOO!

SECTION 1: DRIVEWAY AND PARKING AREAS

LakeSmart Standard	Ranking System	Points
a. The driveway and parking area are defined and minimized	0 = undefined and/or excessive 1 = somewhat defined and/or excessive 2 = mostly defined, slightly excessive 3 = well defined and minimal in size	
b. Driveway and parking surfaces are stable with no signs or erosion.	0 = > 10% eroding 1 = between 5% and 10% eroding 2 = between 1% and 4% eroding 3 = no erosion	
c. Shoulders and ditches are stable with no signs of erosion.	0 = > 10% eroding 1 = between 5% and 10% eroding 2 = between 1% and 4% eroding 3 = no erosion	
d. Stormwater moves as sheet flow over driving surfaces. OK if purposely channelized by swale or other diversion to move water off road	0 = mostly channelized 1 = more channelized than sheet flow 2 = more sheet flow than channelized 3 = entirely sheet flow	
e. Stormwater flow from driveway/parking area is directed to an effective vegetated buffer or other BMP	0 = None 1 = Some 2 = Most 3 = All	
Total Available Points =15	(11 to qualify) Total =	

Section 2: Structures and Septic System

LakeSmart Standard	Ranking System	Points
a. Roof runoff is infiltrated or directed to rain garden, barrel or stable outlet	0 = None 1 = Some 2 = Most 3 = All	
b. Is there evidence of animal waste (farm animals or household pets) **?**	0 = much waste piles or manure 1 = waste or manure near lake 2 = minimal waste 3 = no waste	
(!) c. No evidence of leach field or septic system malfunction: *Award can't be given is soil is squishy and odiferous.* Out houses, grey water systems and holding tanks are considered legal septic systems. If an outhouse is in place, a grey water system for household sink drain is required for it to be OK	! 0 = significant evidence of malfunction 1 = system installed pre-1974 and homeowner doesn't know where leach field is, if any exists 2 = Post-1974; possible evidence of malfunction (Possible if there is a difference in plant color or size in area immediately downstream from leach field) 3 = no evidence of malfunction	(!)

d. Leach field is free of woody vegetation so system is not threatened by roots.	0 = much vegetation 1 = some vegetation 2 = threatened by encroaching vegetation 3 = free of woody vegetation	
e. The septic system is regularly pumped and maintained (Ask if the camp or cottage is a rental property because that will increase usage)	0 = more than 5 years 1 = every 5 years 2 = every 4 years 3 = every 3 years *or on a regular schedule as recommended by septic service company*	
f. Home heating oil tank or exterior toxic chemical storage, like gasoline cans or pesticide or other chemical containers do not pose a threat of water contamination	0=valve of exterior heating oil tank or toxic chemical container is leaking, rusty, and not protected from snow/ice cascading off roof 1=valve of exterior oil tank not covered, but not located where it could be hit by cascading ice 2=valve of exterior oil tank has valve cover 3= exterior tank is completely covered or no exterior tank, or gasoline cans outside.	
(!) g. Decks and stairs meet the setback requirement of 100 feet unless built before 1986.	OK for award or Ineligible – no award allowed Identify any structures within 100'	! xx ok xx no
Total Available Points = 18	(13 to qualify) Total =	

SECTION 3: YARD, RECREATION AREA, AND FOOTPATHS

Includes land around home exclusive of shoreline buffer – buffer width may vary site to site from 10' to 150'

LakeSmart Standard	Ranking System	Points
a. Soil erosion is not occurring on site.	0 = > 10% eroding 1 = between 5% -10% 2 = between 1% - 4% 3 = no erosion	
b. Stormwater flow goes to an effective vegetated buffer or other BMP.	0 = None 1 = Some 2 = Most 3 = All	
c. Are herbicides and pesticides used?	0 = Routinely 1 = Whenever needed 2= Rarely 3 = Never	
d. Homeowner either omits or minimizes use of fertilizer and knows that it is best to test soil before applying fertilizer.	0 = Areas fertilized yearly 1 = Areas fertilized less than once a year 2 = Areas fertilized based on soil test 3 = Fertilizer is never used	
e. Lawn area is minimized	0 = Excessive 1= Moderate 2 = Minimized 3 = No lawn	

f. Turf is maintained at 2.5 to 3.5 inches and Clippings are left on lawn ("How high do you set the mower bar and do you leave clippings?")	0 = Never 1 = Sometimes 2 = Mostly 3 = Always	
g. Duff layer is maintained wherever possible (Duff is thick & deep; mulch is a secondary solution. Exclude lawn area from this question. Garden mulch is considered duff.]	0 = None 1 = Some duff and/or mulch 2 = Most areas have duff/mulch 3 = All areas with duff /mulch	
h. Topography has not been leveled; in other words, it's the same now as it was before residence development.	0 = None 1 = Some 2 = Most 3 = All	
i. All bare soil and cultivated areas are covered with mulch.	0 = None 1 = Some 2 = Most 3 = All	
j. Recreation areas are defined and limited.	0 = None 1 = Some 2 = Most 3 = All	
k. Paths are limited, defined, curved and do not convey runoff directly into lake. [Receives full points if there are not paths but there is no obvious need or visible pattern of water].	0 = None 1 = Some 2 = Most 3 = All	
Total Available Points = 33	(22 to qualify) Total =	

Section 4: Buffer and Water Access

LakeSmart Standard	Ranking System	Points
a. Buffer location and condition: Is there a well-distributed stand of mixed vegetation along shoreline?	0 = None 1 = Some 2 = Most 3 = All	
(!) b. Buffer contains 5 tiers of vegetation: canopy, shrub, understory, ground cover, duff - - all effective in filtering stormwater *Minimum of 3 tiers required.*	0 = no tiers effective 1 = 1 tier effective 2 = 2 tiers effective 3 = 3 tiers effective 4 = 4 tiers effective 5 = 5 tiers effective	**(!)**
c. Buffer vegetation is composed of native or native friendly species	0 = mostly invasive plants 1 = mostly native friendly 2 = both native friendly and native 3 = all native plants	
d. Buffer is receiving sheet flow, not channelized, concentrated flows.	0 = all flow concentrated 1 = most flow concentrated 2 = most flow is sheet 3 = all flow is sheet flow	

(!) e. Buffer is sufficiently wide to filter stormwater effectively. (A buffer less than 10 feet wide disqualifies the property for an Award. Slope is a factor; a steep slope will require a deeper buffer than the minimum 10'.) For rare situations in which it isn't possible to have a 10' buffer, such as a hard- packed and rocky ice-berm, please provide photos and explanation with this form.	0 = less than 10 feet in width 1 = 10 to 20 feet 2 = 21 to 30 feet 3= 31 to 40 feet 4= 41 to 50 feet 5 = over 50 feet in width, negative slope or natural ice berm intact	(!)
f. Duff layer is maintained wherever possible (Duff is thick & deep)	0 =None 1= Some duff and/or mulch 2= Most areas with duff and/or mulch 3= All areas with duff	
g. Natural uneven topography has not been changed for residence development.	0 = None 1 = Some 2 = Most 3 = All	
h. Shoreline is stable. (This means there is no sign of erosion, such as bank undercutting along the shore.)	0 = mostly unstable 1= moderately unstable 2 = mostly stable 3 = totally stable	
i. Shoreline is natural. (Where riprap or concrete is used, it is covered with vegetation and only applied where needed to stabilize the shore)	0 = Unnatural shore, exposed riprap, no vegetation 1 = Riprap is about 1/3 vegetated 2 = Riprap is between 1/3 and 2/3 vegetated 3 = Shoreline is completely natural, or riprap and/or wall vegetated and appear natural	
j. Pathway and dock approach don't compromise the buffer's effectiveness	0 = Effectiveness of buffer is compromised 1 = some buffer still functioning 2 = most buffer still functioning 3 = Design of pathway and dock works with buffer	
k. Beach or swimming access is stable and designed to prevent runoff.	0 = Not stable 1 = Some is stable 2 = Most is stable 3 = Both are stable and do not permit runoff	
Total Available Points = 37	(25 to qualify) Total =	

Evaluator/Screener Reporting Information for Host Group and Maine Lakes Society

Time spent doing the Evaluation and speaking with Homeowner:
Time spent in Travel:
Time for write up and reporting to Host Group
Total Time:

Appendix C: Belgrade Lakes Shoreline Resident Survey 2011

Belgrade Lakes Survey
Colby College Summer 2011

Colby College is conducting a collaborative research project funded by the National Science Foundation in the Belgrade Lakes region. Colby has partnered with the Maine Congress of Lake Associations and the Belgrade Regional Conservation Alliance. We are contacting residents who own or rent property along the shoreline of one of the Belgrade Lakes to learn about their recreation, perceptions of water quality, and general lake experiences. Your survey responses will be confidential. Responses will be analyzed and reported as summaries in which no individual's answers can be identified. Thank you for taking a few minutes to share with us your opinions about the lakes. **If you have internet access, please fill this survey out online. To access the online version, use the following URL:**

www.colby.edu/environ/lakesurvey

1. **Where is your lake residence? (If you own more than one, please answer the following questions about your primary lake residence)**

   ☐ East Pond ☐ Great Pond ☐ North Pond

2. **Do you own or rent your primary lake residence?**

   ☐ Own ☐ Rent ☐ Other (please specify):_____

3. **In which town is your primary lake residence?**

   ☐ Belgrade ☐ Belgrade Lakes ☐ Mercer ☐ Oakland ☐ Rome ☐ Smithfield ☐ Other (please specify):_____

4. **For how many years have you owned or rented your primary lake residence? _____Years**

5. **For how many years have you spent time on the Belgrade Lakes (if different than Q.4)? _____Years**

6. **Do you live in your primary lake residence seasonally or year round?**

   ☐ Seasonally ☐Year round (Skip to 7)

   → **6a. If you are a seasonal resident, what is the zip code of your permanent residence? _____Zip code**

   → **6b. On average, how many days do you spend in your lake residence annually? _____ Days**

   → **6c. During which months do you typically visit your lake residence? (Please check all that apply)**

   ☐ January ☐ February ☐ March ☐ April ☐ May ☐ June
   ☐ July ☐ August ☐ September ☐ October ☐ November ☐ December

7. **Are you a member of any of the following groups? (Please check all that apply)**

   ☐ Lake Association ☐ Hunting and Fishing Group ☐ Environmental Organization ☐ None
   ☐ Country Club ☐ Volunteer Lake Monitoring Group ☐ Road Association ☐ Other (please specify):_____

8. **Does your lake have a lake association?**

   ☐ Yes ☐ No (Skip to 9) ☐ Not sure (Skip to 9)

   → **8a. Do you have friends, family, or neighbors who are members of the lake association?**

   ☐ Yes ☐ No ☐ Not sure

   → **8b. In your opinion, how active is your lake association?**

Very Inactive	Inactive	Neither Active nor Inactive	Active	Very Active
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

9. **Do you have a lawn at your lake residence?**

   ☐ Yes ☐ No (Skip to 10) ☐ Other (please specify):_____

   → **9a. Approximately what percent of your lake property is covered by lawn? _____Percent**

   → **9b. Which of the following fertilizers do you use on your lawn? (Please select all that apply)**

   ☐ Standard ☐ Phosphorus Free ☐ Organic ☐ I don't use fertilizer ☐ Other (please specify):_____

   → **9c. While at your lake residence, approximately how many hours/week do you spend on your lawn (mowing, fertilizing, weeding)?**

   _____Hours/week

Questions 10-12 refer to Photo A and Photo B below. When answering these questions, please disregard the house structures and focus only on the landscaping.

PHOTO A

PHOTO B

10. Which landscaping would you prefer? **Please tell us why you chose photo A or photo B:**_____

☐ Photo A ☐ Photo B _____

_____

_____

11. Is the landscaping at your lake residence more similar to Photo A or B? (Please answer as if you were viewing your house from the lake)

Very Similar to A			Between A and B			Very Similar to B
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

12. Is your neighbor's landscaping more similar to Photo A or B? (Please answer as if you were viewing your house from the lake)

	Very Similar to A			Between A and B			Very Similar to B
Neighbor to the left	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Neighbor to the right	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

Questions 13-15 ask about the shoreline on your property. The questions refer to your entire shoreline as well as the shoreline directly in front of your house. For example, in Photo C the red box outlines the shoreline directly in front of this lake house, while the yellow box outlines the property's entire shoreline.

PHOTO C

13. Approximately what percent of your entire shoreline is vegetated? _____**Percent**

14. Approximately what percent of the shoreline directly in front of your house is vegetated? _____**Percent**

15. **A vegetated shoreline buffer is an undisturbed band adjacent to the water that consists of trees, shrubs, and ground cover. Would you consider the shoreline directly in front of your house to have a vegetated buffer?**

☐Yes ☐No (Skip to 16) ☐Not sure (Skip to 16)

15a. How would you rate the buffer directly in front of your house in terms of potential for reducing stormwater run-off?

Poor	Fair	Good	Very Good	Excellent
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

15b. On average, how wide (from the shore to your yard) is the buffer directly in front of your house?

☐ less than 10 feet ☐ 10-20 feet ☐ 21-30 feet ☐ 31-40 feet ☐ 41-50 feet ☐Over 50 feet

15c. Which types of vegetation make up the buffer directly in front of your house? (Please check all that apply)

☐ Natural debris/leaf litter ☐ Ground cover ☐ Grass ☐ Shrubs ☐ Tree canopy ☐ Other:_____

16. **Approximately how many acres is your lake property? _____Acres**

17. **Approximately how many feet of shorefront do you own? _____Feet**

18. **Approximately how many square feet is your lake house? _____Square feet**

19. **Have you been awarded a LakeSmart sign?**

☐ Yes ☐ No ☐ Not sure

20. **While spending time at your lake residence, in which of the following activities do you typically participate?(Please check all that apply)**

☐ Ice Fishing ☐ Open Water Fishing ☐ Swimming ☐ Motor Boating ☐ Jet Skiing ☐ Canoeing or Kayaking

☐ Sailing ☐ Hiking ☐ Snowmobiling ☐ Hunting ☐ ATV Riding ☐ Wildlife/Nature Viewing or Photography

21. **From which groups do you get information about your lake? (Please check all that apply)**

☐ Lake Association ☐ Maine Department of Environmental Protection ☐ Fishing and Hunting Organization

☐ Friends ☐ Neighbors ☐ Other:_____

22. **From which media source do you get information about your lake? (Please check all that apply)**

☐ Newsletter ☐ Television ☐ Email ☐ Facebook ☐Website ☐ Other:_____

23. **In your opinion, how strong is the sense of community among shoreline residents on your lake?**

Very Weak	Weak	Moderate	Strong	Very Strong
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

24. **How familiar are you with the following?**

	Never Heard of It				Could Teach the Term to Someone Else
Best Management Practice	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Phosphorus and Nitrogen Run-off	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Erosion and Sedimentation	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Algal Blooms	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Lake Smart Program	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Shoreland Zoning	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

25. **To what extent do you believe your lake is currently at risk of declining water clarity?**

Very Low Risk	Low Risk	Moderate Risk	High Risk	Very High Risk
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

26. On average, how would you rate the water clarity of your lake during the 2010 summer months? (Please check one box for each month)

	Poor	Fair	Good	Very Good	Excellent	Not Sure
May	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
June	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
July	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
August	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
September	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
October	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

27. How would you describe the trend in water clarity on your lake over the last five, ten, and twenty years?

	Large Decline	Decline	No Change	Improvement	Large Improvement	Not Sure
Last five years	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
Last ten years	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
Last twenty years	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

28. How do you think the average water clarity of your lake compares to the average water clarity of the following lakes?

	Much Worse	Worse	Average	Better	Much Better	Not Sure
Belgrade lakes	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
Maine's lakes	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
US lakes	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
Permanent residence state's lakes (If different than Maine)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

29. To what extent do you think the following could potentially harm or help lake water clarity?

	Very Harmful			No Impact			Very Helpful
Camp roads	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Lawns	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Decks near the shoreline	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Old septic systems	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Organic fertilizers	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Shoreline vegetation	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

30. On average, how would you best describe the water clarity of your lake during the first half of the 2010 summer season (May-July)?

- ☐ Crystal clear water
- ☐ Not quite crystal clear, slight algae visible
- ☐ Definite algal greenness, yellowness or brownness apparent
- ☐ High algae levels with limited clarity and/or mild odor apparent
- ☐ Severely high algae levels with one or more of the following: massive floating scum on lake or shore, strong foul odor, or fish kill

31. On average, how would you best describe the water clarity of your lake during the second half of the 2010 summer season (Aug-Oct)?

- ☐ Crystal clear water
- ☐ Not quite crystal clear, slight algae visible
- ☐ Definite algal greenness, yellowness or brownness apparent
- ☐ High algae levels with limited clarity and/or mild odor apparent
- ☐ Severely high algae levels with one or more of the following: massive floating scum on lake or shore, strong foul odor, or fish kill

32. To what extent do you think the lake's water clarity has increased or decreased your lake property's value?

Large Decrease	Decrease	Small Decrease	No Effect	Small Increase	Increase	Large Increase
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

The following is a table describing different levels of water quality.

Quality Index	Level	Characteristics
Best Possible	A	Beautiful, could not be any nicer
	B	Very minor aesthetic problems. Excellent for swimming, boating and enjoyment.
	C	Swimming and aesthetic enjoyment slightly impaired because of algae levels.
	D	Desire to swim and level of enjoyment of the lake substantially reduced because of algae levels.
Worst Possible	E	Swimming and aesthetic enjoyment of the lake nearly impossible because of algae levels.

East Pond is currently at level D and has been on the Maine Department of Environmental Protection's impaired lake list since 2001 because of reoccurring algal blooms. These algal blooms are partially a result of phosphorus pollution that "runs-off" the surrounding land when it rains. Out of the seven Belgrade Lakes, East Pond is one of the most affected by phosphorus pollution. Fifty-one percent of phosphorus run-off into East Pond comes from residential development and roads. One way to reduce phosphorus run-off is through the implementation of Best Management Practices, such as an effective vegetated buffer between a property and the lake, to reduce erosion and help prevent run-off from entering the lake.

For this survey please assume that improvements to water quality could be made through a watershed wide program that would redirect phosphorus run-off away from the lake. The program would increase the number of vegetated buffers between the lake and surrounding residential properties, commercial properties, and farms. The cost to build these buffers would be paid for by a conservation fund supported by monthly payments from watershed residents. These monthly payments would be made for as long as the residents lived on the lake.

33. **How much would you be willing to pay in a monthly conservation fee to improve East Pond's water quality from level D to level C?**

☐ $0 ☐ $2 ☐ $5 ☐ $10 ☐ $20 ☐ $40 ☐$60 ☐ Other (please specify):_____

34. **How much would you be willing to pay in a monthly conservation fee to prevent East Pond's water quality from falling from level D to level E?**

☐ $0 ☐ $2 ☐ $5 ☐ $10 ☐ $20 ☐ $40 ☐$60 ☐ Other (please specify):_____

35. **If you selected $0 for either Q. 33 or Q.34, why would you not be willing to pay any amount? (Please check all that apply)**

☐ Water quality is not important to me
☐ Water quality is not my responsibility
☐ I can't afford to pay anything at this time
☐ I don't think these pollution reduction efforts would work
☐ I don't want to participate in a group program
☐ I have already invested enough in conservation practices
☐ Other (please specify): _____

36. **In which of the following activities have you participated over the last 2 years at your lake house? (Please check all that apply)**

Removed vegetation from your shoreline	☐
Controlled driveway runoff using rubber razors, turn-outs, water bars, or another method to slow/divert water	☐
Installed a rain garden	☐
Left natural leaf litter/debris on the ground	☐
Controlled roof runoff with gutters, a drip-line trench, a rain barrel, or a french drain	☐
Planted a new buffer of shoreline vegetation or enhanced a pre-existing buffer	☐
Minimized or avoided fertilizer, pesticide, or herbicide use	☐
Read information on lake conservation practices	☐
Attended a lake association meeting	☐

37. What is your gender?

☐ Male ☐ Female ☐ Other

38. What is your age? _____Years old

39. What is your political affiliation?

Very Liberal	Liberal	Moderate	Conservative	Very Conservative	Other
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

40. What is the highest level of schooling that you have completed?

☐ Some high school or less ☐ Some college/vocational school ☐ Some post graduate schooling
☐ High school graduate ☐ College graduate ☐ Advanced graduate or professional degree

41. Which of the following broad categories best describes your total income from all sources in 2010?

☐ $10,000 or less ☐ $30,001-$40,000 ☐ $60,001-$70,000 ☐ $90,001- $100,000 ☐ More than $200,000
☐ $10,001-$20,000 ☐ $40,001-$50,000 ☐ $70,001-$80,000 ☐ $100,001-$150,000
☐ $20,001-$30,000 ☐ $50,001-$60,000 ☐ $80,001-$90,000 ☐ $150,001-$200,000

42. What is your current work status?

☐ Work Full Time ☐ Work Part-Time ☐ Work Seasonal Jobs ☐ Not Currently Working
☐ Student ☐ Self Employed ☐ Retired ☐ Stay at Home Parent

43. What is your primary occupation? _____

44. Do you have children under the age of 18 years living in your lake residence?

☐ Yes ☐ No ☐ Other (please specify):_____

Thank you for taking the time to fill out this survey! If you have any questions, please email us at **lakesurvey@colby.edu**. When you are finished, please use the prepaid and preaddressed envelope to mail the survey back to Colby College. If you lose the envelope you can mail the survey to the following address:

c/o Lake Survey
Environmental Studies Program
Colby College
5300 Mayflower Hill Rd.
Waterville, ME 04901

Remember, if you prefer you can also fill out an online version of this survey instead by using the following URL:

www.colby.edu/environ/lakesurvey

Appendix D: Belgrade Lakes LakeSmart Property Owner Survey 2015

LakeSmart Property Owner Survey
Colby College
Fall 2015

Colby College is collaborating with the Maine Lakes Society and the Belgrade Regional Conservation Alliance to carry out a review of the LakeSmart program. We are contacting the owners of LakeSmart certified properties to learn about their experiences with and perceptions of the program. You are receiving this survey because you were identified as the owner of a LakeSmart certified home. If this is not true, please ignore this request. We would appreciate it if you could take a few minutes to share your experiences. Your survey responses will be confidential. Responses will be analyzed and reported as summaries in which no individual's answers can be identified. Thank you for taking the time to share with us your opinions of and experiences with the LakeSmart program. **To access the online survey, please use the following URL:**

www.colby.edu/environ/lakesurvey

1. **Where is your lake residence? (If you own more than one property, please answer the following questions about your primary lake residence).**

   _____

2. **In which town is your lake residence?** _____

3. **In which year did you become the owner of your lake residence?** _____

4. **Do you live in your lake residence seasonally or year round?**

   ☐ Seasonally ☐ Year round (Skip to 5)

   4a. **If you are a seasonal resident, what is the zip code of your permanent residence?** _____

   If you live outside the US, what is your home country? _____

   4b. **On average, how many days do you spend in your lake residence annually?** _____ **Days**

   4c. **During which months do you typically visit your lake residence? (Please check all that apply)**

   ☐ January ☐ February ☐ March ☐ April ☐ May ☐ June

   ☐ July ☐ August ☐ September ☐ October ☐ November ☐ December

5. **What is the approximate length of the shoreline of your property?** _____ **Feet**

6. **On average, how much money do you spend annually to maintain your shoreline?** $_____

7. **How many days do you devote annually to shoreline work?** _____ **days of my time**

8. **Are you a member of any of the following groups? (Please check all that apply)**

   ☐ Hunting and Fishing Group ☐ Environmental Organization ☐ Road Association

   ☐ Volunteer Lake Monitoring Group ☐ Country Club ☐ Other (please specify): _____

9. **In your opinion, how strong is the sense of community among shoreline residents on your lake?**

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Very Weak Very Strong

10. **Are you a member of the lake association for your lake?**

☐ Yes ☐ No ☐ Not sure

11. **In your opinion, how active is your lake association? Please answer even if you are not a member.**

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Very Inactive Very Active

12. **From which groups did you receive information about the LakeSmart program? Please check all that apply.**

☐ Lake Association ☐ Maine Department of Environmental Protection ☐ Neighbors

☐ Maine Lakes Society ☐ Belgrade Regional Conservation Alliance ☐ Other: _____

☐ Friends ☐ Fishing and Hunting Organizations

13. **Through which source did you first hear about the LakeSmart program?**

☐ Newsletter ☐ Television ☐ Email ☐ Facebook ☐ Website ☐ Pamphlet ☐ Other: _____

14. **In which year was your lake residence LakeSmart certified?** _____

15. **What motivated you to seek LakeSmart certification for your property? Please rank, with 1 being the most important and 6 being the least important source of motivation.**

___ Prestige of the award ___ Desire to achieve the LakeSmart appearance on the property

___ Desire to protect the lake ___ Social pressure (e.g. from neighbors/lake association/road association)

___ Property already fulfilled LakeSmart criteria ___ Other: _____

16. **What was the outcome of your initial LakeSmart evaluation?**

☐ Pass (LakeSmart Award) ☐ Commendation ☐ Fail

17. **If you received a commendation or failed your initial LakeSmart evaluation, which of the following best management practices were suggested by the evaluator to improve your property for LakeSmart certification? Please check all that apply.**

Decrease lawn area	☐
Control driveway runoff using rubber razors, turn-outs, water bars, or another method to slow/divert water	☐
Install a rain garden	☐
Leave natural leaf litter/debris on the ground	☐
Control roof runoff with gutters, a drip-line trench, a rain barrel, or a French drain	☐
Plant a new buffer of shoreline vegetation or enhance a pre-existing buffer	☐
Minimize or avoid fertilizer, pesticide, or herbicide use	☐
Other _____	☐

18. **Regardless of your answer above, how difficult were the following evaluation sections for your property? Please rank, with 1 being the most difficult and 4 being the least difficult (easiest to achieve). Click here to view the LakeSmart evaluation form.**

___ Driveway and parking area ___ Yard, recreation area, and footpaths

___ Structures and septic system ___ Buffer and water access

19. **If you were asked to make improvements to meet LakeSmart criteria, which area of your property needed the most work? Please rank, with 1 being the area that needed most work and 4 the area that needed least work.**

___ Driveway and parking area ___ Yard, recreation area, and footpaths

___ Structures and septic system ___ Buffer and water access

20. **What was the greatest barrier to making the suggested improvements?**

☐ Improvements are too expensive ☐ Reluctant to change property function

☐ No time yet to make improvements (e.g. want to keep lawn for children to play)

☐ Reluctant to change property appearance ☐ Other: _____

21. **Did you find the LakeSmart certification process easy to navigate?**

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Not at all easy Extremely Easy

22. **What aspects of the LakeSmart evaluation process could be improved? Please check all that apply.**

☐ Quality of informational material ☐ Quality of suggestions for improvements

☐ Scheduling of evaluations and screenings ☐ Follow-up

☐ Duration of the property evaluation ☐ Other: _____

23. **Are there ways that you promote the LakeSmart program in your community? Please check all that apply.**

☐ Talking with friends and neighbors ☐ Leading workshops

☐ Giving formal/informal presentations ☐ Other: _____

☐ Distributing informational materials ☐ I don't promote LakeSmart

24. **Were any of your neighbors (include houses within approx. 1/2 mile) LakeSmart certified when you applied?**

☐ Yes ☐ No ☐ Not sure

25. **Do you believe this influenced your decision to apply for LakeSmart certification?**

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

No Influence Significant Influence

26. Have any of your neighbors (include houses within approx. 1/2 mile) become LakeSmart certified after your property was certified?

☐ Yes ☐ No ☐ Not sure

27. Do you believe your LakeSmart award influenced their decision?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

No Influence Significant Influence

28. Do you believe that modifying your property to meet LakeSmart requirements has an effect on the health of the lake?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

No Effect Significant Effect

29. To what extent do you believe that water quality influences your property value?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

No Influence Significant Influence

30. To what extent do you believe the LakeSmart award (including the changes you made to achieve it) has influenced your property value?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

No Influence Significant Influence

31. Do you have a lawn at your lake residence?

☐ Yes ☐ No (Skip to 31)

30a. Approximately what <u>percentage</u> of your lake property is covered by lawn? _____Percent

30b. Which of the following types of fertilizer do you use on your lawn? (Please select all that apply)

☐ Standard ☐ Phosphorus Free ☐ Organic ☐ I don't use fertilizer ☐ Other (please specify):_____

30c. While at your lake residence, approximately how many <u>hours/week</u> do you spend on your lawn (mowing, fertilizing, weeding etc.)?

_____Hours/week

PHOTO A

PHOTO B

32. Regardless of what you know about vegetated buffers, which type of landscaping is more aesthetically pleasing to you?

☐ Photo A ☐ Photo B Please explain your answer in the space below.

Questions 32-33 ask about the shoreline on your property. The questions refer to your entire shoreline as well as the shoreline directly in front of your house. For example, in Photo C the red box outlines the shoreline directly in front of this lake house, while the yellow box outlines the property's entire shoreline.

PHOTO C

33. Approximately what percentage of your entire shoreline is vegetated? _____Percent

34. Approximately what percentage of the shoreline directly in front of your house is vegetated? _____Percent.

35. To what extent do you believe your lake is currently at risk of declining water clarity?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Very Low Risk Very High Risk

36. How would you describe the trend in water clarity on your lake over the last five, ten, and twenty years?

	Large Decline	Decline	No Change	Improvement	Large Improvement	Not Sure
Last five years	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
Last ten years	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
Last twenty years	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

37. How do you think the average water clarity of your lake compares to the average water clarity of the following lakes?

	Much Worse	Worse	Average	Better	Much Better	Not Sure
Other Belgrade lakes	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
Maine's lakes	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
US lakes	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6
Permanent residence state's lakes (if not Maine)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

38. **To what extent do you think the lake's water clarity has increased or decreased the value of your lake property?**

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Large Decrease Large Increase

39. **What is your gender?**

☐ Male ☐ Female ☐ Other: _____

40. **What is your age? _____Years old**

41. **What is your political affiliation?**

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Conservative Liberal

42. **What is the highest level of schooling that you have completed?**

☐ Some high school or less ☐ Some college/vocational school ☐ Some post graduate schooling

☐ High school graduate ☐ College graduate ☐ Graduate or professional school degree

43. **Which of the following broad categories best describes your total income from all sources in 2015?**

☐ $10,000 or less ☐ $30,001-$40,000 ☐ $60,001-$70,000 ☐ $90,001- $100,000 ☐ More than $200,000

☐ $10,001-$20,000 ☐ $40,001-$50,000 ☐ $70,001-$80,000 ☐ $100,001-$150,000

☐ $20,001-$30,000 ☐ $50,001-$60,000 ☐ $80,001-$90,000 ☐ $150,001-$200,000

44. **What is your current work status?**

☐ Work Full Time ☐ Work Part-Time ☐ Work Seasonal Jobs ☐ Not Currently Working

☐ Student ☐ Self Employed ☐ Retired ☐ Stay at Home Parent

45. **What is your primary occupation?** _____

46. **Do you have children under the age of 18 years living in your lake residence?**

☐ Yes ☐ No ☐ Other (please specify): _____

Thank you for taking the time to fill out this survey! If you have any questions about our research or about how your information will be used, please email us at lakesurvey@colby.edu.

Appendix E: LakeSmart Evaluator Survey 2015

LakeSmart Evaluator Survey
Colby College
Fall 2015

Colby College is conducting a collaborative research project to study the LakeSmart program in collaboration with the Maine Lakes Society and the Belgrade Regional Conservation Alliance. We are contacting LakeSmart evaluators who have evaluated properties along lake shorelines to learn about their views on and general experiences with the LakeSmart program. Your survey responses will be confidential. Responses will be analyzed and reported as summaries in which no individual's answers can be identified. Thank you for taking a few minutes to share with us your opinions about the LakeSmart program. **To access the survey, please use the link below.**

www.colby.edu/environ/lakesurvey

1. **On which lake do you perform LakeSmart evaluations? If you work on several, please list all.**

   _____

2. **In which year did you begin as a LakeSmart evaluator?** _____

3. **What was your principal reason for becoming a LakeSmart evaluator?**

   ☐ To help protect lake health
   ☐ To publicize the LakeSmart program
   ☐ To gain a sense of purpose
   ☐ To get to know new people
   ☐ To give back to my community
   ☐ Other: _____

4. **Do you own a lakefront property?** ☐ Yes ☐ No **On which lake?** _____

5. **If so, is it LakeSmart certified?** ☐ Yes ☐ No **Year of certification?** _____

6. **If your property is not LakeSmart certified, why not?**

   ☐ Improvements are too expensive
   ☐ Reluctant to change property function
   ☐ No time yet to make improvements
   (e.g. want to keep lawn for children to play)
   ☐ Reluctant to change property appearance
   ☐ Other: _____

7. **How many properties have you evaluated since you became an evaluator?**

   ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ More than 10

8. **How many evaluations do you carry out in a typical season?**

   ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ More than 10

9. **What training did you receive to become an evaluator? Please check all that apply.**

   ☐ Professional-led workshop
   ☐ Read instructional materials
   ☐ Stakeholder-led workshop
   ☐ Follow-up practice sessions
   ☐ Site visit with trained evaluator
   ☐ Other: _____

10. **Did the training you received make you feel adequately prepared to perform your duties as an evaluator?**

    ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

    Disagree Agree

11. What difficulties did you experience when performing your first few evaluations? Please check all that apply.

☐ Insecurity when interacting with property owners

☐ Unfamiliarity with evaluation process

☐ Difficulty answering property owners' questions

☐ Lack of knowledge about best management practices

☐ Other: _____

12. How might the training be improved to address the initial difficulties you experienced? Please check all that apply.

☐ Job shadowing with experienced evaluators

☐ More scientific background information

☐ More frequent follow-up sessions

☐ More training workshops

☐ Other: _____

Additional Comments:

13. Do you think the LakeSmart evaluation form is intuitive and easy to use? Click here to see the form.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Not Easy At All Extremely Easy

14. If you chose 1, 2, or 3, what do you think makes the form difficult to use? Please check all that apply.

☐ Wording of questions is unclear or confusing

☐ Some questions require judgment calls

☐ Form is too long

☐ Point system is confusing

☐ Other: _____

15. How well do you think the questions on the evaluation form reinforce and reward use of best management practices?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Not Very Well Extremely Well

17. Regardless of your answers above, how would you improve the form? Please check all that apply.

☐ Eliminate one or more sections
☐ Add one or more sections
☐ Give one section more weight than the others
☐ Other: _____
☐ Eliminate the division into sections
☐ Clarify one or more questions
☐ Eliminate one or more questions
☐ Add one or more questions

Additional Comments:

18. If you proposed eliminating sections or questions in Question 17, please indicate which ones and explain why they should be deleted. Click here to see the form.

19. If you proposed adding sections or questions in Question 17, please indicate which ones and explain why they should be added.

20. Please rank the following sections in order of difficulty for properties undergoing a LakeSmart evaluation, with 1 being most difficult and 4 being least difficult (easiest).

___ Driveway and parking area
___ Structures and septic system
___ Yard, recreation area, and footpaths
___ Buffer and water access

21. Why do you think the identified sections are the most difficult to achieve? Please check all that apply.

☐ Improvements are too expensive
☐ No time yet to make improvements
☐ Reluctant to change property appearance
☐ Reluctant to change property function (e.g. want to keep lawn for children to play)
☐ Other: _____

Please explain your response if you feel it is necessary:

22. Based on your experience, do you believe that owners of properties that do not receive an award (fail entirely or receive a commendation) are willing to make the suggested improvements to achieve LakeSmart certification?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Strongly Disagree Strongly Agree

23. What do you think keeps people from making the improvements necessary to achieve LakeSmart certification? Please check all that apply.

- ☐ Cost of materials
- ☐ Cost of labor
- ☐ Lack of time
- ☐ Lack of interest in LakeSmart
- ☐ Reluctance to changing property appearance
- ☐ Reluctance to changing property function (e.g. want to keep lawn for children to play)
- ☐ Other: _____

24. Have you re-evaluated someone who was initially denied LakeSmart certification but then passed your evaluation after having made improvements?

- ☐ Not so far
- ☐ One time
- ☐ Two times
- ☐ Three times
- ☐ Four times
- ☐ Five times or more

25. Please rank what you think is the principal motivation for lakeshore property owners to seek the LakeSmart award, with 1 being the highest motivation and 6 being the lowest motivation.

- ___ Desire to protect the lake
- ___ Desire to achieve the LakeSmart appearance on their property
- ___ Prestige of the award
- ___ Social pressure from neighbors/lake association/road association or other group.
- ___ Property already fulfills LakeSmart criteria
- ___ Other: _____

26. Based on your experience, do you think that people who live next to or near LakeSmart certified properties are more likely to seek LakeSmart certification than those who do not?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Strongly Disagree Strongly Agree

27. Are there ways that you promote LakeSmart in your community? Please check all that apply.

- ☐ Talking with friends and neighbors
- ☐ Giving formal/informal presentations
- ☐ Distributing informational materials
- ☐ Leading workshops
- ☐ Other: _____
- ☐ I don't promote LakeSmart

28. Have you encountered any misconceptions about LakeSmart? If so, please list them and elaborate if you feel it is necessary.

Thank you for taking the time to fill out this survey! If you have any questions about our project or about how your information will be used, please email us at lakesurvey@colby.edu.

Appendix F: LakeSmart Screener Survey 2015

LakeSmart Screener Survey
Colby College
Fall 2015

Colby College is conducting a collaborative research project to study the LakeSmart program in collaboration with the Maine Lakes Society and the Belgrade Regional Conservation Alliance. We are contacting LakeSmart screeners who have screened properties along lake shorelines to learn about their views on and general experiences with the LakeSmart program. Your survey responses will be confidential. Responses will be analyzed and reported as summaries in which no individual's answers can be identified. Thank you for taking a few minutes to share with us your opinions about the LakeSmart program. **To access the survey, please use the link below.**

www.colby.edu/environ/lakesurvey

1. **On which lake do you perform LakeSmart screenings? If you work on several lakes, please list all.**

   _____

2. **In which year did you begin as a LakeSmart screener?** _____

3. **What was your principal reason for becoming a LakeSmart screener?**

   ☐ To help protect lake health ☐ To publicize the LakeSmart program

   ☐ To gain a sense of purpose ☐ To get to know new people

   ☐ To give back to my community ☐ Other: _____

4. **Do you own a lakefront property?** ☐ Yes ☐ No **On which lake?** _____

5. **If so, is it LakeSmart certified?** ☐ Yes ☐ No **Year of certification?** _____

6. **If your property is not LakeSmart certified, why not?**

   ☐ Improvements are too expensive ☐ Reluctant to change property function

   ☐ No time yet to make improvements (e.g. want to keep lawn for children to play)

   ☐ Reluctant to change property appearance ☐ Other: _____

7. **How many properties have you screened since you became a screener?**

   ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ More than 10

8. **How many screenings do you carry out in a typical season?**

   ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ More than 10

9. **What training did you receive to become a screener? Please check all that apply.**

   ☐ Professional-led workshop ☐ Read instructional materials

   ☐ Stakeholder-led workshop ☐ Follow-up practice sessions

   ☐ Site visit with trained screener ☐ Other: _____

10. **Did the training you received make you feel adequately prepared to perform your duties as a screener?**

    ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

    Disagree Agree

11. What difficulties did you experience when performing your first few screenings? Please check all that apply.

☐ Insecurity when interacting with property owners

☐ Difficulty answering property owners' questions

☐ Lack of knowledge about best management practices

☐ Unfamiliarity with screening process

☐ Other: _____

12. How might the training be improved to address the initial difficulties you experienced? Please check all that apply.

☐ Job shadowing with experienced screeners

☐ More frequent follow-up sessions

☐ More scientific background information

☐ More training workshops

☐ Other: _____

Additional Comments:

13. Do you think the LakeSmart screening form is intuitive and easy to use? Click here to see the form.

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Not Easy At All Extremely Easy

14. If you chose 1, 2, or 3, what do you think makes the form difficult to use? Please check all that apply.

☐ Wording of questions is unclear or confusing

☐ Form is too long

☐ Some questions require judgment calls

☐ Point system is confusing

☐ Other: _____

15. How well do you think the questions on the screening form reinforce and reward use of best management practices?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Not Very Well Extremely Well

17. Regardless of your answers above, how would you improve the form? Please check all that apply.

☐ Eliminate one or more sections
☐ Add one or more sections
☐ Give one section more weight than the others
☐ Other: _____
☐ Eliminate the division into sections
☐ Clarify one or more questions
☐ Eliminate one or more questions
☐ Add one or more questions

Additional Comments:

18. If you proposed eliminating sections or questions in Question 17, please indicate which ones and explain why they should be deleted. Click here to see the form.

19. If you proposed adding sections or questions in Question 17, please indicate which ones and explain why they should be added.

20. Please rank the following sections in order of difficulty for properties undergoing a LakeSmart screening, with 1 being most difficult and 4 being least difficult (easiest).

___ Driveway and parking area
___ Structures and septic system
___ Yard, recreation area, and footpaths
___ Buffer and water access

21. Why do you think the identified sections are the most difficult to achieve? Please check all that apply.

☐ Improvements are too expensive
☐ No time yet to make improvements
☐ Reluctant to change property appearance
☐ Reluctant to change property function (e.g. want to keep lawn for children to play)
☐ Other: _____

Please explain your response if you feel it is necessary:

22. Based on your experience, do you believe that owners of properties that do not receive an award (fail entirely or receive a commendation) are willing to make the suggested improvements to achieve LakeSmart certification?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Strongly Disagree Strongly Agree

23. What do you think keeps people from making the improvements necessary to achieve LakeSmart certification? Please check all that apply.

☐ Cost of materials

☐ Cost of labor

☐ Lack of time

☐ Lack of interest in LakeSmart

☐ Reluctance to changing property appearance

☐ Reluctance to changing property function
(e.g. want to keep lawn for children to play)

☐ Other: _____

24. Have you re-screened someone who was initially denied LakeSmart certification but then passed your screening after having made improvements?

☐ Not so far

☐ One time

☐ Two times

☐ Three times

☐ Four times

☐ Five times or more

25. Please rank what you think is the principal motivation for lakeshore property owners to seek the LakeSmart award, with 1 being the highest motivation and 6 being the lowest motivation.

___ Desire to protect the lake

___ Desire to achieve the LakeSmart appearance on their property

___ Prestige of the award

___ Social pressure from neighbors/lake association/road association or other group.

___ Property already fulfills LakeSmart criteria

___ Other: _____

26. Based on your experience, do you think that people who live next to or near LakeSmart certified properties are more likely to seek LakeSmart certification than those who do not?

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10

Strongly Disagree Strongly Agree

27. Are there ways that you promote LakeSmart in your community? Please check all that apply.

☐ Talking with friends and neighbors

☐ Giving formal/informal presentations

☐ Distributing informational materials

☐ Leading workshops

☐ Other: _____

☐ I don't promote LakeSmart

28. Have you encountered any misconceptions about LakeSmart? If so, please list them and elaborate if you feel it is necessary.

Thank you for taking the time to fill out this survey! If you have any questions about our project or about how your information will be used, please email us at **lakesurvey@colby.edu**.