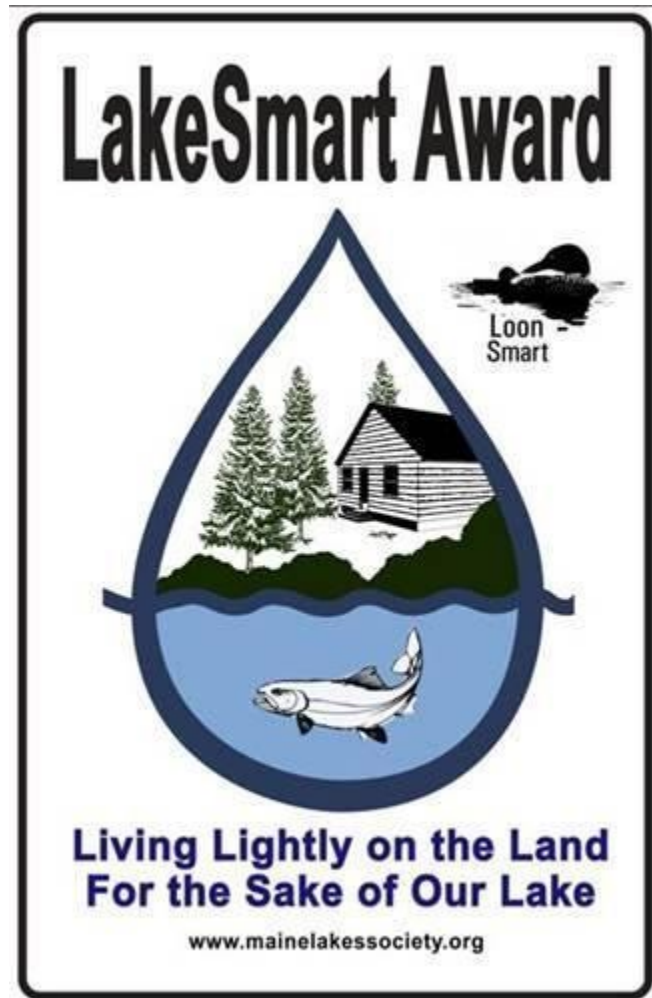


LakeSmart 2.0:

A Qualitative Approach to Understanding the Effectiveness of
LakeSmart Standards in Light of a Changing Climate

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1. Introduction

The LakeSmart program was created by the Maine Department of Environmental Protection in 2003 to address declining lake water quality due to urban/suburban landscaping and development. LakeSmart is at its heart a program working to promote homeowner behavior change, and careful thought was given to identifying the major barriers to desired activities and to the behaviors needed on-the-ground to reduce pollution and erosion. LakeSmart award standards were created by the MDEP 10 years before the program was transferred to the Maine Lakes Society in 2013. They were purposefully and thoughtfully set to balance what was achievable and would generate widespread buy-in and social dispersion, with what might ultimately be the most desirable in terms of pollution reduction. For example, the minimum buffer width for a LakeSmart award was set at 10 feet. For lakefront properties lacking a buffer, a 10-foot buffer is one that can be reasonably achieved by an average homeowner. Ultimately a much wider buffer (40-50 feet or more) would do a better job at pollution reduction, but is one that is simply not possible for many homeowners on small lots. Getting more homeowners engaged with LakeSmart using a 10-foot buffer was deemed a good trade-off over getting fewer homeowners with wider buffers.

Since 2003, LakeSmart has been a great success, but increased pressure on lakes from intensifying storms, increased summer temperatures, increased droughts, and changes in winter ice cover (CITATION) has prompted us to reevaluate our program standards, specifically those defining shoreline buffers. LakeSmart standards must be high enough so that they continue to make a difference for water quality - now and in the coming decades - but also remain achievable for homeowners to reasonably reach. How can we adjust LakeSmart standards to be both more protective of water quality yet still be realistic for motivated property owners?

To help us find answers, we reached out to several local experts on NPS pollution and lake health, including researchers in academia, our peer lake conservation organizations, and state government to share their ideas and opinions. We believe that collecting this new information will help us make an informed decision about when and how we upgrade our standards in the near future.

2. Methods

Online Survey

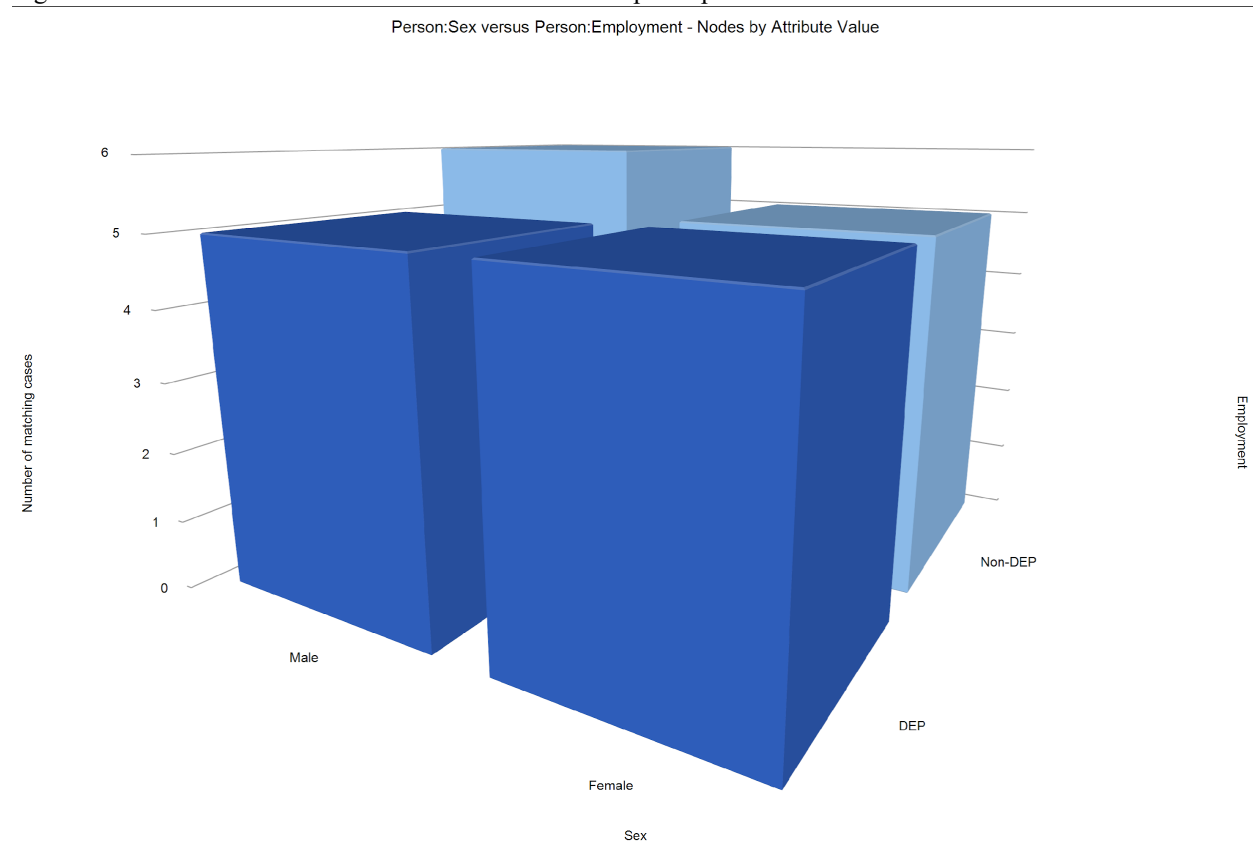
An online survey was constructed and distributed in January 2020 (Appendix A). The survey consisted of 13 open-ended questions related to our LakeSmart standards. The staff at Maine Lakes Society selected 31 experts in NPS pollution and/or water quality to receive an online survey invitation. The invitation included an informational brochure about LakeSmart and a summary of current LakeSmart standards. The invitation and reminder schedule was based on the Tailored Design Method (Dillman et al, 2014). Survey invitations were sent out on January 8, 2020 and 10 people responded within the first week. Those who did not respond were sent a reminder on January 15, after which we received an additional 8 responses. A second and final reminder was sent on January 22, resulting in 3 more participants. One participant chose to be interviewed, so notes from that interview were added to the analysis. Overall the survey had a response rate of 68% (21/31 responses). Analysis of responses, and creation of graphics, were completed using NVIVO 11 qualitative data analysis software.

3. Results

3.1. Background of Survey Participants

Out of 21 participants, 11 were male and 10 were female. 10 participants are currently or formerly employed by the Maine Department of Environmental Protection, and 11 are currently or formerly employed by a conservation or research organization. Sexes were distributed evenly between the employment groups (Figure 1).

Figure 1: Distribution of male/female and DEP/Non-DEP participants



3.2 Language and Sentiment

The most frequently used term by all participants was the term “buffer” (including the variations “buffers”, and “buffered”) which was written 143 times. “Lake” (including “lakes”) was used second most often at 117 times. “Water” and “property” were the next most frequently used terms. See Figure 2 for a visual representation of the most frequently used words: the larger the word in the figure, the more often that word was used.

Tables 1 and 2 show the overall sentiment of the language used by all participants (i.e. if the language they used is primarily positive, primarily negative, or primarily neutral). DEP employees used 44% positive language and 56% negative; Non-DEP employees used 46%

positive and 54% negative (Table 1). Male participants used 48% positive language and 52% negative; females used 43% positive language and 57% negative. This shows that sentiment level was very similar across both kinds of demographics.

Figure 2: Word cloud with most frequently used terms by all participants

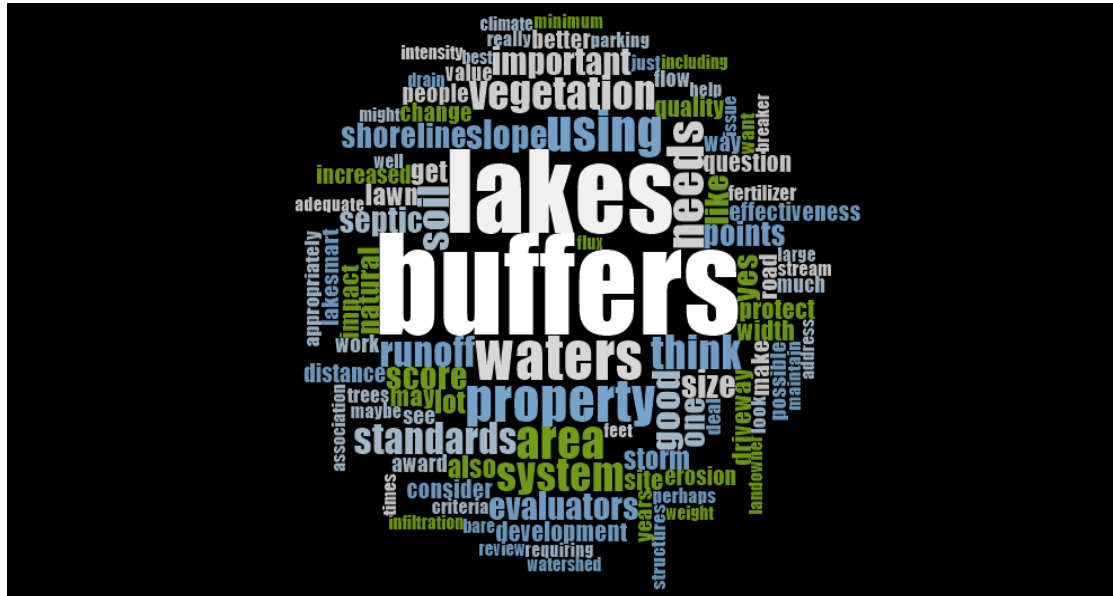


Table 1: Overall Sentiment, DEP/Non-DEP

	DEP	Non-DEP
Positive	58	32
Very Positive	15	12
Moderately Positive	43	20
Negative	72	37
Moderately Negative	31	15
Very Negative	41	22

Table 2: Overall Sentiment, Male/Female

	Male	Female
Positive	44	46
Very Positive	16	11
Moderately Positive	28	35
Negative	48	61
Moderately Negative	26	20
Very Negative	22	41

3.3. Climate Change

We asked our survey participants what they think, based on their knowledge of the literature and their academic pursuits, are the most important climate change impacts on lakes, and if there are additional standards we might consider. Following are some quotes that represent their main concerns:

More Frequent and Intense Storms

"More frequent and higher intensity storms will likely require greater buffers (depth, effectiveness of tiers) Not sure what can be done to counter higher summer temperatures and less ice cover except even stronger LS standards, Shoreland Zoning Standards, development standards in general."

"We are already seeing some - more intense storm events so once stable driveways or driveway outlets can't handle the storm intensity so how close these areas are to the lake, the slope, where the water is directed and can it retain its stability? Higher water levels on free flowing lakes in the spring (faster melt events) so deeper and more woody buffers."

"One of the biggest climate change impacts is/will be the volume and intensity of rainfall. Storms will be larger and more intense than in the past and that can easily result in existing infrastructure being overwhelmed. The best way to address this is to break up the watershed on shore front lots so that small amounts of water in several locations instead of a lot of water in one location."

"Extreme events, earlier ice-out. I think the standards hit these but the more steep the watershed, the more issues these will present."

"CC is coming with more frequent, violent storms. Landowners should manage the tree growth on their lands such that they minimize the risk of trees coming down (uprooted). Driveway and access road culverts should be cleaned out frequently to reduce the risk of washout."

"Any culverts on driveway or property should be sized and armored to accommodate storms (nothing smaller than 12 inches, maybe 15 inches best?)"

"More intense storms make it harder to prevent erosion of driveways and parking areas if they are not paved and well maintained. Maximizing the amount of driveway and parking area runoff that is diverted and distributed in buffers will be even more important in the future."

"Severe storms are having a big impact. Driveways and roads seem to be a large potential threat; most weren't designed properly and can't handle the intensity of the storms we are getting. Culverts are undersized, broken, or clogged; roads and driveways and sheeting water properly because they aren't crowned or super elevated as they need to be, etc."

Warming Temperatures

“Leave buffers on the tributary streams that feed lakes to filter runoff and keep it cool assess and fix road related erosion”

“Better buffers to deal with increased volume rain events, more canopy to cool littoral areas.”

“Warming temperatures with increased time of ice out period put more stress on lakes in terms of dissolved oxygen and increase algal productivity so that preventing added phosphorus to the lake is even more critical.”

3.4. Best Management Practices

3.4.1 Driveways and Parking Areas

We asked our survey participants if our standards for Driveways and Parking Areas would be adequate in light of climate change. Following are select quotes representing their main concerns:

Deicers

“Consider incorporating the use of deicing products (sand and salt). With increasingly extreme weather in the Northeast, more deicing will likely need to be done. Sand and salt used to manage snow and ice is harmful to lakes.”

“If possible, it would be nice to incorporate some measure of maintenance practices here. Do they liberally salt/sand their driveway in the winter? Do they hose it off in the summer?”

Driveways and Buffers

“I believe the size of the driveway and parking area deserves more importance. These areas are frequently sized for peak use periods and this results in an excess amount of impervious surfaces. If there are large parking areas, then they should have buffers directly downslope or they should be reduced in size.”

“The ultimate question here is: Is the driveway a threat to water quality? It could have deep ruts, but have no runoff getting to the lake. Alternatively, it could have only rills, but be a very large area that is steeply sloped directly to the lake. The latter could have much more impact than the former, but yet the point values could end up the same. While there are several parts to this question, the impact of the driveway isn't weighted proportionately.”

“Appropriately Sized”

“To know if standards are adequate, need to know what guidance the evaluators are using to make judgements. What is an appropriate size?”

“I would try to make some of these criteria less subjective. The evaluator would need to be trained to identify what 'appropriately sized' means, for example. Does this mean that a very large driveway is 'appropriately sized' if the owner owns a lot of cars, or hosts visitors regularly? Is there a definition of what an appropriate size is? I would maybe re-word to 'are they limited in size?' or 'do permanent parking areas take up the minimum space necessary?'”

3.4.2 Structures and Septic Systems

We asked our survey participants if our standards for Structures and Septic Systems would be adequate in light of climate change. Here are select quotes highlighting their main concerns:

Age of System

“This does not adequately address the septic system. What is the age of the system?”

“Age of the septic tank is an issue. Old systems should be inspected for effectiveness.”

“I think these standards are good however they could be augmented with questions about: the age of the septic system, whether or not the homeowner has seen or has the plans. I'm not sure if these questions should be scored but they need to be brought up.”

“Age of septic system is also an important consideration, particularly if the septic system is installed in sandy/gravelly soils or shallow to bedrock soils. There can be a short circuit that is not detected by the test you use above. Ask if there is a permit for the septic system (system installed since 1974 should have one). If not permit, it may be an old system or one not legally installed. If there is a permit, there is some assurance it is a legitimate system.”

Type of System

“....it is unclear to me if the type of septic is considered at all.”

“Add (1) age of system. Could be based on when plumbing code was passed but I recommend picking a few years later because it took awhile for the program to be implemented. Or rather than age, they need to have a 'modern' system with tank, splitter box, and leach field (perforated pipe or infiltrators).”

“Consider type of onsite wastewater treatment system and age. They are not all created equal. Newer technologies can remove more pollutants. Consider incorporating products used in the home that are flushed down the drain and into the onsite wastewater treatment system, including salt used in water softeners.”

Pumping schedule

"Pumping schedule is important to a system working correctly. I would define 'regular' pumping schedule; otherwise a 'yes' without definition is of little value. Most septic system designers recommend 3 - 5 years depending on use. I think not getting it pumped that frequently is a deal breaker and an easy one to correct and get the score up and to an award. A number of people after an evaluation, had their system pumped, called and we adjusted the score."

"I would subdivide pumping: within 2 years or within 5 years. N tends to leave system at about 20% per year, so maximum frequency for pumping to make much difference is 5 years."

"Septic standards will likely need to be strengthened eventually, possibly requiring more frequent pumping or visual inspection schedule."

Distance to Water

"(2) Distance to lake. Again I realize sometimes there is little choice, but if they rank high on all the other criteria they would still pass."

"I would consider adding a criterion about distance of leach field to the lake, or perhaps extra bonus points if the system is newer? I would almost want to disqualify systems installed before 1975, when the more stringent septic standards were put in place, although it is entirely likely that some of these systems are still in good working order if they're being well maintained and are seldom used."

3.4.3 Yard, Recreation Areas, and Footpaths

We asked our survey participants if our standards for Yard, Recreation Areas, and Footpaths would be adequate in light of climate change. Here are select quotes highlighting their main concerns:

Fertilizers

"I would like to see more weight for the herbicide, pesticide and fertilizer questions. Are they using these products for aesthetic purposes only or is there a real underlying issue? If it is only aesthetics for herbicides or fertilizers, then perhaps these should be deal breakers.."

"Fertilizer use and bare soils might warrant a negative score if excessive."

"I think fertilizer use should be a deal-breaker (i.e., a score of 0 should automatically disqualify you from a LakeSmart award)."

Lawns and Buffers

"These are good, though I would place a much higher value on the buffer if it is vegetated with a variety of plants (shrubs and trees, not just a lawn), the runoff is sheeting into it and it is large enough to handle the flow (this may be adequately addressed in the Buffer and Water Access criteria, but not, for example, if the buffer is not a shoreline buffer but is in adjacent forested area."

"Weight answers to reflect importance. Add size to vegetated buffer and complexity of buffer values."

"(3) buffer is listed in this section and again in the final. Not sure why- it is very important. Might reward in this section buffers that are continuous across the property. Nearly 100% with only gap the path to the lake gets highest point total. Increase value since buffers are very important and owners can always or nearly always add or improve. Use points to push behaviors we really want so if they need to improve their score that is where they will focus their efforts."

"Appropriately Sized"

"The 'lawn appropriately sized' criteria should be awarded more points and should have a maximum above which you are not eligible for consideration. Someone with an acre of more of lawn should not get a lake Smart award. Need to provide some guidance on what is a reasonably sized lawn to evaluators."

"I still don't like the phrase 'appropriately sized' because it is wide open to interpretation and I could see someone justify having a huge lawn and then getting points for it. I would reword this to something like 'minimal open lawn areas' or [something] similar."

3.4.4 Buffer and Water Access

We asked our survey participants if our standards for Buffers and Water Access are adequate in light of climate change. Here are select quotes representing their main concerns:

Unnatural beaches

"Unnatural beach as disqualifier."

"Yes, as long as there's a piece about a 'beach' being a natural beach, not a truckload of sand dumped in."

"Perhaps this is incorporated into the shoreline and beach standards, but I wonder if it is helpful to have something specific that accounts for a non-natural beach area that has been made by depositing sand, etc.."

Buffer Width

"At issue from my perspective is the width of the buffer. All of these help, but a 25-50' buffer protects so much more than 10'."

"I would prefer a wider minimum, perhaps 20 feet, but something is better than nothing - a lawn or eroding soil all the way to the water - so maybe you should give much less credit to a minimum width buffer."

"25 feet would be better - at least for areas receiving runoff. 10' will likely not be an effective filter."

"A 10' buffer is only symbolic in treating runoff. 30' might be considered."

"Current SLZ standards call for a 100' buffer in new construction. All grandfathered property owners should be using that yardstick as a goal."

"While some benefits can occur at 10', the emphasis should be on extending the buffer width, especially to make shorelines and riparian areas more resilient to increased runoff intensity. I understand there is a desire to be able to reward landowners for "some" buffer, requiring a minimum of only 10 feet downplays the benefit and importance of adequate buffers. Minimal buffer widths should be at least 50-100 feet to be "LakeSmart", which, I think, should be an indication that the landowners are helping the lake - not simply meeting minimum guidelines."

"Wider is better but may not be realistic."

Slope

"Yes, slope is important. Properties with a slope greater than a specified slope might need a larger buffer and less lawn, more distance between parking area and lake. Again maybe a table. What might this look like? for slopes 0-5% 75 foot buffer or 1/2 the distance between nonconforming structure and lake, 6-10% 100 feet or 2/3rd the distance, and so on. I picked 75 feet to start because I think that is the current setback distance (which is not based on science)."

"degree of slope is likely the most important"

"The width also depends on slope, both in the buffer and upgradient. How much energy does the storm water have when it reaches the buffer? Is there good resistance to overland flow?"

"Topography is key. From water quality perspective, presence of a shoreline natural berm is more important than the buffer vegetation. However, from aesthetic perspective, the vegetation is important. I don't have a formula for judging adequate distance, though would recommend tying it to slope and presence of berm."

"In general, it would have to do with the size of the bare area, slope of the land and the distance from a ditch, stream, or the lake. However, it's so site-specific that it would be hard to say."

"Evaluators should check to see if there is concentrated flow through the buffer. That is dependent on a number of factors including slope of buffer and upgradient slope and soil type."

Even if there is a good looking buffer, if runoff water travels through it in concentrated flow, it is not being effective. On small lots and/or lots with gentle slope, that is not as much a concern. You can have a vegetated buffer that scores well but is less effective than one that scores poorly. The bottom line is: is the buffer working.”

Other Buffer Concerns

“I think these are good but buffer depth is the big question. We know that deeper vegetated buffers are better for water quality but at the same time we don't want to exclude too much of the lakefront population from participating and learning about lake impacts. I wonder whether the current minimum standards should stay in place but lake associations could opt for a higher standard for their lake. This would put the decision in the hands of those most affected.”

What are the 'minimum' scores? 2/3 of shoreline buffered or all but 8' that doesn't get channelized flow? at least 3 tiers? depth 15' with no slope? No one can answer if the standards are adequate without knowing the scoring. We need the details....a buffer needs to be at least somewhat mature to be effective, not a few rows of 1' high seedlings.”

“I am curious about the criteria that are needed to be met for the deal breaker categories. How do evaluators deal with uneven buffers (for example, sites that have a great buffer in one area but no buffer in another)? How do you define a "natural"/"stable" shoreline? (For example, there are a few lakes around Maine that had berms installed around their perimeters decades ago. This is not "natural" but is protective of water quality. Conversely, a retaining wall is a stable structure, but is not something we necessarily want to encourage or reward on lake shorelines).”

Buffers – More Heavily Weighted?

We asked survey respondents to discuss any areas that they think should be more heavily weighted in the LakeSmart evaluation, and most brought up the buffers again in this section:

“Buffer width is really important to property impact, so I would weight that most heavily, and that seems to be the case.”

“Buffer width and quality of vegetation and ground cover; septic location and maintenance schedule; erosion control practices”

“Buffers, clearing of veg, and bare soil are crucial.”

“Channelized flows, bare soils, lawns, weak buffer vegetation....”

“Vegetated buffers, which you already have weighted heavily”

“Yes. Width of buffers, complexity of buffers, development distance from water. Appearance of property from water should provide a good example.”

“You can have a multi-tiered buffer that is deep but concentrated flow is traveling through it because the soil is compacted or poorly drained. If the soil is poorly drained, it will not infiltrate runoff when it rains and the soil is saturated. Is there an organic duff layer present or just a few leaves on the soil surface. That makes quite a difference. On steep slopes, it is often necessary to provide some sort of resistance to slow runoff down and spread it out. Is that happening?”

Buffers – One of the most important things for lake protection

We asked participants to list the three most important things property owners can do to protect water quality. Once again, buffers were brought up for their importance.

“Buffers, septic, no wake boats”

- “1. leave 75% of their lot in a natural state
2. reduce impervious area or make sure it has an adequate natural buffer below it
3. learn about what affects lakes”

“Maintain an adequate buffer, Join together in lake associations, see how their property fits into the larger puzzle of their lakes watershed.”

“Prevent concentrated storm water flows from entering a lake, pond, stream or drainage swale. Provide for a buffer that has the capability of infiltrating storm water flows
Don't ditch groundwater and turn it into surface water that can carry sediment into the lake”

“Buffer zones, yard waste management (including leaves, grass clippings), fertilizer avoidance.”

“Vegetative buffers, erosion control, proper septic maintenance”

3.4.5. Deal Breakers

We asked participants if we should add to or change our list of “deal breakers” for receiving an award. Here are select quotes:

Fertilizer and Pesticide Use

“Herbicide and fertilizer use.”

“Excessive fertilizer use”

“Actively eroding sites. Use of fertilizer/pesticides.”

“As mentioned [previously], I think a 0 score under "fertilizer use" should be a deal breaker.”

Signs of Erosion

"Thinking that deal breakers are a way to prioritize where we want a homeowner to focus their efforts and spend money or time as well as potential water quality impact: (1) Eroding driveway or parking area that could reach the lake (2) Evidence of failing septic system - for more than the lake, human health. (3) Possibly bare soil. If there is a large area, even worse if it is close to the lake. (4) as mentioned above I like the buffer deal breakers."

"Any erosion from driveway, yard etc. with direct path to lake or stream (or with limited filtering) should be a deal breaker. This is an opportunity to get them to fix."

"If concentrated flow leaves the property and directly enters a lake, pond, stream or drainage swale or wetland that is connected to the lake, that should be a deal breaker. Wetlands are good nutrient and sediment sinks when they are not saturated or ponded but not when they can't infiltrate water into them."

"Polluted runoff should not be making its way to the lake"

Buffer Characteristics

"Width of buffers, lawn size, development distance from shoreline. Manicured lawns, beaches, raked littoral habitat."

"Setback distances, areas of bare ground in riparian buffer"

"I think the buffer also should have duff layer or mulch and more than just the canopy layer."

"Is there a way for an evaluator to use best professional judgement to disqualify a site if there are issues that are not addressed on the form? I can envision a few weird scenarios where the site technically scores the requisite points but is not really a good example of lake protection - such as they cut down a lot of trees and vegetation on their property, or do not have a buffer along a stream shoreline, or have other erosion problems that are not well accounted for on the form?"

Other Considerations

"Maybe look at overall square footage within shoreland zone for non-conforming structures? Again, people tend to add on over time and it's not always caught."

"I think the size of the lawn and disturbed area should have a maximum that cannot be exceeded in order to get an award, unless the program moves toward a tiered award approach, with, for example gold, silver and bronze levels. McMansions should not be eligible for a full accreditation."

"Consider having property owners self-certify after a few years if they are still LakeSmart. And, when property changes hands."

“Septic systems must be up to standards”

5. Discussion and Conclusions

Recommendations (based on survey results)

- More consideration to size of parking areas
- More consideration to size of lawns
- Septic systems - incorporate age, type, pumping schedule and distance from lake
- Shoreline buffer - increase width, incorporate slope, inspect for pooling/erosion
- Unnatural beaches should be considered
- Deicers should be considered
- Fertilizer - possible dealbreaker
- Signs of erosion - possible dealbreaker
- Make survey standards more objective (how do deal with “appropriately sized”?)
- Different scoring system?

6. Acknowledgements

This study was made possible thanks to generous funding from the Davis Conservation Fund. Thank you to Susan Gallo and Maggie Shannon for content development and participant selection. Thanks to everyone who participated in the survey.

7. References

Dillman, D.A., Smyth, J.D., and L.M. Christian. 2014. Internet, phone, mail, and mixed-mode surveys: The tailored design method. John Wiley and Sons, Inc. Hoboken, NJ.

Appendix A: Survey Questions

1. Do you think the standards for Driveway and Parking Areas are adequate to protect water quality in light of climate change and increasing development pressure?
2. Do you think the standards for Structures and Septic Systems are adequate to protect water quality in light of climate change and increasing development pressure?
3. Do you think the standards for Yard, Recreation Areas, and Footpaths are adequate to protect water quality in light of climate change and increasing development pressure?
4. Do you think the standards for Buffer and Water Access are adequate to protect water quality in light of climate change and increasing development pressure?
5. Are there particular standards that should be more heavily weighted?
6. Should any other standards count as "deal breakers" if they are not met?
7. Are there any missing evaluation areas that should be covered in our questions? If so, please list here:
8. Current LakeSmart standards require a minimum 10-foot vegetative buffer along the owned shoreline, with at least three layers of vegetation. a. Is this wide enough to be effective in light of changing climate and increasing developmental pressure? If not, what width would you recommend and why? b. Are there other buffer characteristics (e.g. amount of canopy, degree of slope, etc.) that we should be considering in our evaluation? If so, please list. c. Is there a good formula or methodology for determining a "safe" distance from a lake where bare soil or a lack of vegetation will have little impact on lake water quality?
9. What do you believe are the three most important things landowners can do to protect water quality in their lake?
10. What are the biggest climate change impacts we should be considering? Is there a standard we should consider adding in light of these impacts?
11. Do you have any suggestions for other ways Maine Lakes Society can improve the LakeSmart program?
12. Do you have any suggestions for recent journal articles that would help us with our LakeSmart standards review?
13. Please use the space below to provide any additional comments.