Senior Integrative Study Final

Best Management Practices: Opportunities and Strategies

Jerimiah Booream-Phelps

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INTRODUCTION

Seneca Lake is one of the most important natural resources for a wide range of animals, plants, and humans within the surrounding area. In fact, it "provides class AA drinking water to ~100,000 people with total permitted withdrawals of ~9 million gallons of water per day (Callinan, 2001)" (In Halfman, 1). Therefore, it must remain a top priority for all stakeholders to stay actively engaged in the protection and rehabilitation of the entire Seneca Lake watershed. One of the major issues facing many watersheds today is excess nutrient loading, which can lead to eutrophication – a lake ecosystem's response to an overabundance of nutrients which results in an overproduction of algae and other plant matter. When allowed to progress to an extreme, this process can cause an entire body of water to be covered in unpleasant and destructive algae, killing off many other important species, producing anoxic bottom waters, and leading to a plethora of adverse consequences (Halfman 5-6).

While Seneca Lake has not reached this point yet, the current trajectory is potentially dangerous. Based on stream and lake monitoring conducted by professor John Halfman of Hobart and William Smith Colleges, it has become apparent that over the past decade "the lake [has] transformed from an oligotrophic lake to a borderline oligotrophic-mesotrophic lake" (Halfman 21). This means that although the lake was initially at a relatively low productivity level, it has been steadily rising. While there are a variety of both point and nonpoint sources of pollution, the Seneca lake watershed is 46% agriculture, 38% forests, and 5% urban (the remaining 12% is occupied by Keuka lake) (Halfman 3). Given that agricultural land is the dominant land type, it is reasonable to believe that the, "primary water quality threat to the lake is nutrient loading from organic wastes and agricultural runoff" (Halfman 3).

Therefore, it is reasonable to conclude that remediation efforts directed towards and in cooperation with the vibrant agricultural sector within the watershed is an important step in addressing nutrient loading and other pollution concerns. The most effective means of controlling non-point source pollution in a given watershed dominated by agriculture is the implementation of a variety of farming working-land conservation structures and management techniques referred to as best management practices (BMPs). However, these practices often represent a sunk cost to farmers with minimal perceived benefits to their individual operations. Consequently, it may be quite difficult to persuade farmers to implement BMPs when time and financial resources are a major limiting factor. In order to address this, there are a variety of state and federal programs to assist farmers with cost sharing mechanisms, technical assistance, and general education. With the right incentives, many farmers can be persuaded to voluntarily adopt best management practices which would aid in the healthy long term function of their watershed.

ASSISTANCE PROGRAMS

There are a variety of government programs designed to assist farmers and address environmental concerns arising from farming activities. While their methods differ widely, each one may be more or less relevant to individual farms depending on economic circumstances, characteristics of operators and land, and long term goals. The Farm Service Agency (FSA) and the Natural Resources Conservation Service (NRCS) are two of the top federal agencies involved in allocation of funds for these programs, although there are others as well. The passage of the 2008 farm bill greatly increased the availability of and funding for conservation programs. In fact, the Congressional Research Service says that this bill includes over $24 billion to support mandatory conservation programs over a four year period. This shows a greater commitment to non-traditional commodity programs, including conservation programs. Between 2002 and 2007,

actual spending averaged $3.162 billion per year on conservation programs. Conversely, the 2008 farm bill provides an average of $4.491 billion in spending on yearly conservation programs between 2008 and 2012 and an average of $6.260 billion between 2013 and 2017. Clearly, federal congressional support is growing for these types of programs, which will likely create new opportunities for remediation efforts within the Seneca Lake watershed. Some of the more potentially useful programs are summarized below, but this is by no means a comprehensive list. (Monke and Johnson)

AGRICULTURAL MANAGEMENT ASSISTANCE (AMA)

This program is limited to 16 states, including New York, which makes the potential for funding more likely. AMA helps farmers by providing technical and financial assistance (up to $50,000 per participant and 75% of installation costs) in order to address issues of water management, water quality, and erosion control. Many farmers in the Seneca Lake watershed could be eligible, as owners of their own land must only have a minimum in annual potential sales of $1,000. In 2011, nearly $600,000 in financial assistance was given to farmers in New York. (NRCS)

CONSERVATION RESERVE PROGRAM (CRP)

The Conservation Reserve Program (CRP) and the Conservation Reserve Enhancement Program (CREP, which is administered through CRP) together are some of the largest programs in the US for this purpose. Under this program, farmers are allowed to enroll in a program spanning ten to fifteen years which pays them to retire their farmland from use and install conservation cover crops in place. There are also options to enroll for the purpose of developing various working-land conservation structures. (Lambert et. al) Almost $2 billion is spent yearly on this program, with over 30 million acres under contract throughout the US and an estimated ~120 million pounds of reductions in phosphorus runoff, with 71 million pounds in reductions directly

attributable to grass filter strips and riparian buffers installed under this program. The average payout in February 2012 was $57 per acre. (FSA)

THE ENVIRONMENTAL QUALITY INCENTIVES PROGRAM (EQIP)

Farmers enrolled in EQIP can receive both financial and technical assistance to install and implement various conservation practices. Both management practices and structural/vegetative changes can be eligible for reimbursement up to 75% of the cost to the producer. It is worth noting that a relatively high percentage (~60%) of these funds goes to livestock producers, but there are still ample opportunities for agriculture-specific farming operations (Lambert et. al 7-8). For example, the Agricultural Water Enhancement Program (which is administered under EQIP) has an annual budget of at least $60 million and is targeted at agricultural producers by providing financial and technical assistance in order to implement conservation initiatives focused on water quality and preservation. (NRCS)

WHAT INFLUENCES ADOPTION OF BMPS?

Despite the plethora of federal and state programs in place to encourage farmers to implement BMPs in their operations, the continued evidence of nutrient loading problems in the Seneca Lake watershed indicates that adoption rates are lower than they should be. A wide variety of studies have been conducted to determine what makes producers choose to implement BMPs, and a better understanding of these results may assist in effective targeting and increase adoption rates.

Clearly there is a wide variety of factors that come into play when a farmer is faced with a decision which may fundamentally change their behaviors, structure, or revenues. Profit and loss avoidance, policy adherence, environmental attitudes, operator skill, household goals, access to information, age, and availability of networks are all examples of possible influences, but quantifying their effects is more difficult than merely naming them.

META ANALYSIS OF PAST STUDIES

Baumgart-Getz, Prokopy, and Floress conducted an econometric analysis of forty five individual studies that attempted to explain what influenced adoption of BMPs. Their results provide some valuable insight into what may be the most influential factors and should provide guidelines for more effective targeting of outreach efforts in the Seneca Lake watershed.

FARM SIZE (+)

By far the most influential factor that helps predict an increased likelihood of adoption is farm size. As acreage increases, the potential for adoption increases as well. While there are a variety of farm sizes in this watershed, this nonetheless implies that larger farms which can be the biggest contributors to nutrient loading are also the most likely to implement BMPs. As a farm increases in size, its average cost of implementation goes down. This is useful for a variety of potential BMPs, including practices such as a nutrient management plan. While farms change over time in regards to their necessary fertilization rates, farmers who have not conducted this type of analysis may fall into a "if it's not broken don't fix it mentality" – which means that they may be over-fertilizing merely because it has worked in the past. (Baumgart-Getz et. al) Adoption of nutrient management plans with the help of local agencies would allow large farms to save potentially significant monetary outlays in unnecessary fertilization, which would also reduce runoff. Additionally, a separate study analyzing the 2001 USDA Agricultural Resource Management

Survey (ARMS) shows that erosion plans are often implemented in conjunction with a variety of other BMPs – a practice which would preserve the integrity of agricultural soil and save costs in the long run while increasing the potential for further BMP adoption. Clearly, targeting large farms with outreach efforts could have a high rate of success. (Erdal et. al)

AGE (-)

Age was found to have a negative effect on BMP adoption, implying that older farmers are less likely to implement conservation practices. This relates to long term goals and planning horizons, as younger farmers have more of an incentive to improve their farms if they plan on maintaining their land far into the future as their primary source of income. Older farmers may be closer to retirement and may not see the payback or other benefits from BMPs until farther into the future when it would not be relevant to their individual operation. Initiating dialogues with younger farmers could prove more fruitful, with the potential for longer-term spreading of information through formal and informal networks having a positive ripple effect. (Baumgart-Getz et. al)

EXTENSION TRAINING (+)

Education was analyzed looking at both formal education levels (High school, college, etc.) and extension training. While formal education did not have a statistically significant effect, extension training showed a notably positive outcome. Extension training could come in various forms, but often refers to single day training and education sessions conducted by governmental agencies and local advocacy groups. This could be useful in planning future efforts within the watershed that focus on short but effective outreach efforts to farmers that would result in increased awareness on the benefits of BMPs and positive stakeholder engagement. (Baumgart-Getz et. al)

INFORMATION (+)

Increasing levels of information regarding BMPs and assistance programs was also shown to have a notably positive effect. While some farmers may be aware of these programs and benefits, it makes sense that an increased level of information will increase their desire or ability to engage in conservation practices. This could take many forms but may be as simple as an educational pamphlet or targeted outreach programs along the lines of further extension training. (Baumgart-Getz et. al)

PERCENT OF INCOME FROM FARMING (+)

As agricultural producers are more reliant on farming for their overall income, their likelihood of BMP adoption increases notably. This follows from the fact that this can be generally seen as a producer's financial commitment to farming, and there are potential cost savings resulting from environmental conservation practices. In most cases this will likely be related to farm size, since larger farms are likely to be generating higher percentages of income. Once again this provides a useful targeting mechanism for education and outreach efforts which could positively affect overall BMP adoption. (Baumgart-Getz et. al)

NETWORKING (+)

Networks in the form of agency, university, local, and business groups were found to be a significant predictor of BMP adoption. While the study could not conclusively prove which networks had the most effect, the overall networking category is still notable. Promotion of involvement in networks for farmers could therefore increase overall information, influence attitudes, and have a generally positive effect.

COUNTY CHARACTERIZATION AND RELEVANCE

The Seneca Lake watershed is composed of parts of Ontario, Seneca, Yates, Schuyler, and Chemung counties. According to the 2007 Census of Agriculture, there are a total of 3,003 farms constituting 584,519 acres of farmland in these counties, with the average size farm being 194 acres. (USDA) Of this, Ontario, Seneca, and Yates make up 75% of all farms and 78% of total cropland.

According to an analysis of the 2006 National Land Cover Dataset, the Seneca Lake watershed is actually composed of 341,119 acres. Of these, 61,281 (18%) acres are classified as "cultivated crops" (Hobart and William Smith et. al, 45). A large portion of this farmland is located in Ontario and Yates counties. A summary of relevant data is provided in Table 1:

TABLE 1: SUMMARY STATISTICS (SOURCE: USDA)

County	Ontario	Seneca	Yates	Schuyler	Chemung	Average	Total
Number of Farms	859	513	864	394	373	601	3,003
Land in Farms (acres)	198,937	127,972	126,118	66,368	65,124	116,904	584,519
Average Size of Farm	232	249	146	168	175	194	
Crop Sales ($1000)	49,498	33,048	31,812	12,563	3,143	26,013	130,064
Corn for Grain and Silage (Acres)	52,205	32,872	22,091	9,240	5,355	24,353	121,763
Farms making over $100,000	190	183	324	58	35	158	790
Average Production Expenses ($)	136,045	134,644	70,682	59,776	43,032	88,836	
Average Net Income ($)	54,457	38,871	42,650	29,771	6,567	34,463	
Average Age of Principle Operator	54.2	53.1	49.9	56.9	56.7	54.2	

IMPLICATIONS

Given the data presented in Table 1, Ontario, Seneca, and Yates counties appear to have the most potential for remediation efforts. When coupled with the realizations reached by the previously mentioned meta-analysis, conclusions can be drawn regarding the potential for remediation efforts in the Seneca Lake watershed. While it is difficult to draw completely accurate

conclusions without the utilization of individual farm-level data, generalizations can be extrapolated from the data above about specific counties. Given the predominance of corn cultivation and its associated high potential for contributions to nutrient loading, analyzing the percent of corn grown in each county is relevant. Additionally, the average net income of farms and the existence of farms with revenues above $100,000 per year is telling. Farms with larger yearly sales can be reasonably assumed to have a correspondingly greater acreage, dependence on farming as a primary source of income, and consequent potential for effective environmental conservation measures. (USDA)

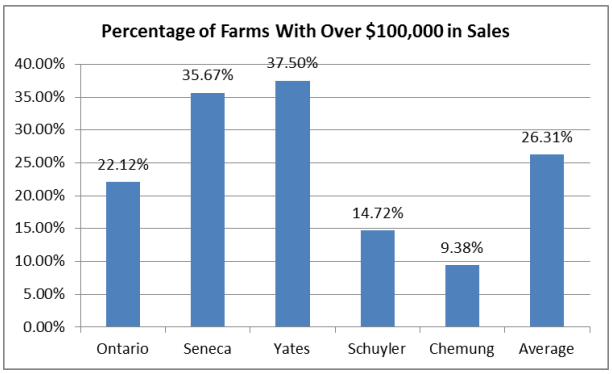

FIGURE 1: HIGH REVENUE FARMS

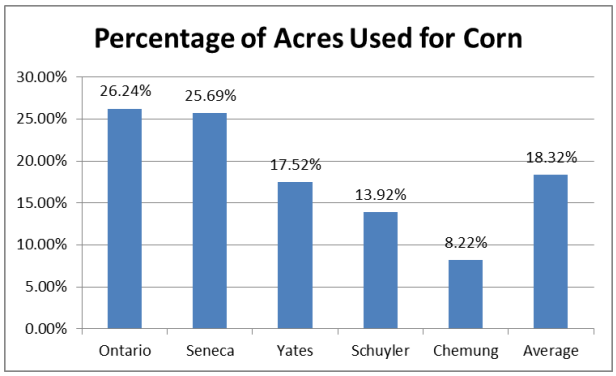

FIGURE 2: AGRICULTURAL LAND USED FOR CORN

ONTARIO COUNTY

Ontario County has the most farmland out of the five counties in the Seneca Lake watershed. It also has the highest devotion to corn growing in both absolute and percent terms. With over 22% of farms garnering sales of over $100,000 there is a high potential for best management practices implementation. Of farmland in Ontario County, 76.96% is used as cropland – 153,101 acres. Therefore, over one third of cropland in Ontario County is used for corn (34%). It is not reasonable to assume that this proportion directly correlates with the number of farms making over $100,000 per year, but one can extrapolate that a decent amount of these larger, more financially robust

farms are growing corn on a large scale. Targeting remediation efforts towards these specific farms has a higher potential for success and consequent reduction in nutrient loading. (USDA)

SENECA COUNTY

Seneca County has the second largest acres of farmland, but a notably lower average net income and number of farms. Similar to Ontario, Seneca County has 80.41% of farmland devoted to crops – 102,902 acres. Given the relatively lower net income, but high percentage of individual farms making over $100,000 per year, Seneca either has a high number of smaller farms that bring down the average net income or its farms are relatively cost ineffective. Either way, this shows that targeted conservation efforts aimed at the largest farms could bring effective excess nutrient reductions and potential cost savings for inefficient farms. (USDA)

YATES COUNTY

Yates County has a significantly higher number of farms with revenues above $100,000 per year, despite the smaller average farm size and decreased reliance on corn. It also has a lower percentage of farmland devoted to crops, 68.66% - 86,593 acres. Therefore, it may be less appropriate to focus solely on larger farms. However, it is relevant to note the lower average age of principle farm operators (49.9). Despite less acreage devoted to corn, the prevalence of high revenue farms and younger principle operators still indicates high potential for an altered program of outreach. It would necessarily be different than the strategies appropriate for Ontario and Seneca, but could nonetheless be quite effective in working with resident farmers to implement BMPs. (USDA)

RECOMMENDATIONS

There are a wide variety of best management practices that may be implemented in a farming operation. These range from active management styles like conservation tillage and nutrient management plans to physical conservation structures like filter strips, riparian forest buffers, and grass waterways. Given the wide range of potential for implementation, actual plans will depend in large part on the individual characteristics and goals of farming operations and availability of funding opportunities.

The data presented here can provide a starting point for further investigation and targeted conservation efforts by policy makers, local agencies, and advocacy groups. Specifically larger, more financially robust farms preferably with younger operators should be viewed as strong potential candidates for BMP implementation. Given limited resources, it makes sense to target those who have the highest likelihood of success. Ideally, a two tiered approach could then be adopted which utilizes existing or future networking opportunities to encourage early adopters to help educate other farmers and create a positive feedback loop which increases overall engagement and contributes to the health of the watershed.

The best possible outcome for BMP adoption lies in voluntary cooperation. Education efforts such as extension training on the financial and environmental benefits of BMP adoption are important and when coupled with an effective plan to target likely adopters should prove to be the best use of limited financial and personnel resources. A less desirable approach lies in mandatory, policy driven objectives that force farmers to implement specific BMPs. Each individual farm will see different returns and effects from various BMPs, so it follows that programs of action tailored to specific operations will have a higher degree of success and will be a more efficient use of financial resources. Forcing farmers to change their practices has the potential to create an adversarial

relationship and hamper efforts to encourage anything above the base line requirements. It is worth investigating further what place policy has in this larger plan – it may prove useful in providing financial support for existing agencies or creating new positions focused on outreach efforts.

LIMITATIONS

While this document provides a method for framing a conversation about more effective analysis and implementation, the lack of availability of specific data was greatly limiting. Ideally, one would have access to historical data on individual farms that are located specifically within the Seneca Lake watershed. Although it is possible to draw some conclusions from the generalized data released by the 2007 census of agriculture, it is difficult to draw reliable conclusions without making drastic assumptions that could prove to be entirely wrong. Only portions of each county lie within the watershed, and there was no publically available data on the characteristics of each respective section.

If individual farm data were possible to view, a more comprehensive analysis would look at age of operators, total farm size, crop or animal type (by acres used in each), total farm income and costs (with a line-item breakdown of both revenues and costs as well as percentage of income from farming), what BMPs are already in place and the initial/annual cost of each. Additionally, participation and payout rates for each farm enrolled in a cost sharing program would be helpful and provide a framework for a more tailored approach to peer farms that are lacking similar BMPs. Theoretically, this data could be aggregated and interpreted to show average costs for farms in the Seneca Lake Watershed to implement specific practices. When paired against line-item costs over history, it may be possible to extrapolate exactly what financial benefits each practice garnered and

the payback of each, which would provide strong arguments for other farms with similar planning horizons.

This could lead to the development of specific strategies tailored to the two tiered system previously suggested which would first target the most likely adopters and then form the basis for further proliferation and information sharing among formal and informal networks. Ideally, an analysis of this sort would focus on the most cost-effective and environmentally beneficial practices and encourage their use. Taken further, estimated data on effectiveness of the predominant BMP's could be merged with the cost-effectiveness to form a complete cost-benefit analysis that takes reduced phosphate loading as a primary concern. Without this type of in depth data, it is very difficult to draw accurate conclusions. The reliability of country wide or average data is questionable at best, as the individual needs and characteristics of this region will vary significantly from other areas of the country.

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