LaPlatte Headwaters Ecological Assessment

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Rubenstein School of Environment and Natural Resources
NR 206: Environmental Problem Solving and Impact Assessment

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Executive Summary

The focus of this project is to address our identified problem statement; Lake Champlain is currently experiencing low water quality, decreasing the health of the lake ecosystem. Our NR 206 group worked at the LaPlatte Headwaters Town Forest, a parcel of land located in Hinesburg, VT along with the Vermont chapter of the Nature Conservancy to collect data for TNC that would ultimately contribute to their greater restoration plan. Due to the low water quality Lake Champlain is currently experiencing, this site was identified by the state of Vermont and the Nature Conservancy as crucial area that is in need of a plan to be restored. Data collection is a crucial component of this project that required our group to out in the field and collect information on the herbaceous species, soil type and woody species that can be found in this parcel of land.

Reed Canary Grass, an herbaceous species, along with other invasive and native species, is currently dominating this area, which poses a problem for water filtration. RCG is the most problematic invasive species at the LHTF because it significantly obstructs tree growth and development. Lack of native tree growth decreases the ability for this ecosystem to properly function as a wetland. By improving tree growth, the shade that trees provide work to suppress germination and survival of RCG. Proper restoration of the LHTF as a high functioning wetland will result in better water filtration, which will increase the health of the lake ecosystem.

Acknowledgements

We would like to express our very great appreciation for the people who helped us with this project. Our community partner, Dan Farrell from the Nature Conservancy, for giving us the opportunity to work on this project. We would also like to thank Morgan Southgate, who is a masters student in the Plant Biology department here at UVM, for her willingness to provide us guidance and her time to assist us with this project. Our NR 206 teaching staff has been extremely supportive in this process. Thank you to our professor Zachary Ispa- Landa and our TA Lauren Aiken for their wisdom and valuable advice on the process of this project

Introduction

Our project was performed in partnership with the Vermont chapter of The Nature Conservancy. The mission of the Nature Conservancy is "to conserve the lands and waters on which all life depends" (Nature Conservancy, 2018). Since 1960, the Vermont Chapter has helped protect more than 183,000 acres of ecologically significant natural areas across the state. The Vermont chapter of the Nature Conservancy is working to implement "nature-based solutions for clean water" (Nature Conservancy, 2018). These solutions prioritize of protection and restoration of wetlands, floodplain forests and river corridors to improve the capture of runoff and mitigation of flooding, provide pollution filtration and lead to improvement of water quality. The Vermont chapter of TNC is currently working on multiple projects regarding the LaPlatte River. In addition to the LHTF restoration project, there is a team working down river in Shelburne at the LaPlatte Nature Park, where the river flows into the lake. Here, restoration efforts are needed to minimize the impact of deer browsing in the riparian habitat.

We worked closely with our community partner, Dan Farrell of the Vermont chapter of the nature conservancy throughout this project. Additionally, we worked with Morgan Southgate, who is a graduate student at the University of Vermont and has been working with Dan on this project as well. The Nature Conservancy wanted our help to collect data at the LHTF to be later implemented in a restoration plan for the site. Dan also asked for a comprehensive report of our findings that will be used in the restoration plan. Morgan helped us in the data collection and analysis, as well as in the writing of the report.

The LaPlatte River Headwaters Town Forest (LHTF) is a 301-acre parcel of land located in Hinesburg, Vermont along the upper LaPlatte river, currently owned by the Vermont chapter of the Nature Conservancy. The LaPlatte river empties into Lake Champlain at Shelburne Bay in Shelburne, Vermont. Previously utilized as agricultural fields, the LHTF features herbaceous and woody species that suggest it was historically a wetland habitat. As stated by Zedler 2003, Wetland restoration is one of the most effective ways to diminish the impacts of agricultural practices on the landscape and on water quality. Wetlands provide important ecosystem services by trapping nutrients from entering the lake and mitigating the effects of flooding (Zedler, 2003). The ecosystem services that this wetland once provided have disappeared. The state of Vermont and TNC have identified this area as a restoration priority, to improve the quality of water emptying into Lake Champlain from the LaPlatte River. The Nature Conservancy is currently working on a comprehensive restoration plan for the LHTF, to which our data and ecological report will directly contribute.

There have been previous restoration efforts at the LHTF, but the impacts of those efforts have not been studied. These efforts have been planting of trees at the site.

At the beginning of the semester we formulated our problem statement for this project: *Lake Champlain is currently experiencing low water quality, decreasing the health of the lake ecosystem.*

The goals and objectives we came up with at the beginning of the project remained the same throughout our time working on the project. The are outlined below. We were successful in following our goals and objectives.

<u>Goal 1:</u> The Nature Conservancy will have a map of the current herbaceous vegetation

Objective 1: Meet with Dan and Morgan Southgate (grad student) on Wednesday October 3rd to gain an understanding of how to map species, vegetation sampling protocol in the field, and understand the boundaries and 10 vegetation types that we will be mapping.

Objective 2: Research invasive Reed Canarygrass, vacant farmland, and history of the land during October 1st-10th.

Objective 3: Classify and map herbaceous polygons with GPS units, during 4 field site visits from October 3rd-15th.

Strategy: Utilize the protocol provided to map the herbaceous cover with GPS units.

Objective 4: Have the field work required for mapping the herbaceous species completed by October 17.

Deliverables of Goal 1:

- Map of herbaceous species on GIS (A shapefile containing polygons of classified herbaceous cover)

<u>Goal 2:</u> The Nature Conservancy will have a map of the current woody vegetation in the area

Objective 1: use herbaceous class polygons on GIS to identify where to map woody vegetation, October 16th.

Objective 2: estimate abundance of each woody species within each polygon, starting November 1st

Objective 3: distinguish between individual plant growth (species planted by people) and natural regeneration, November 1st-10th.

Deliverables of Goal 2:

- GIS map of woody species
- Map of future forest communities in relation to soil type and native species growth.

<u>Goal 3:</u> The Nature Conservancy will have a better understanding of the species growth and water table level in the area when they receive a soil map of the Hinesburg Town Forest

Objective 1: sample texture and depth to mottling of soil in designated area at least 4 times, starting November 3rd

Objective 2: map the results of the soil samples in ArcGIS, November 10th

Objective 3: Research and map future natural communities based on soil and research methods to increase survival of species in areas that are infested by Reed Canarygrass, November 8th-13th

Objective 4: Describe relationships between soil, current vegetative species, and topography in draft of report, November 10th-13th.

Deliverables of Goal 3:

- Map of soil classification in area
- Map of future forest communities in relation to soil type and native species growth.
- Draft of final paper analyzing relationships between soil, current vegetative species, and topography

<u>Goal 4:</u> The Nature Conservancy will have an ecological report comprised of the research, data collected, and the connections between the knowledge gathered by our team for the Vermont

chapter of the Nature Conservancy. This report will be utilized and referenced in the final restoration plan for the LaPlatte River Headwaters Town Forest.

Objective 1: Gather data into one place/spreadsheet/GIS map by November 20th

Objective 2: Speak collectively (group and community partner) about results and conclusions through November 20-25

Objective 3: Compile all research, data, conclusions, thoughts, into a presentable paper that can be presented to TNC and used in the future of the restoration plan for the town forest by December 10th.

Deliverables of Goal 4:

- GIS map with herbaceous species, woody species, and soil
- Spreadsheet with all data
- Final paper with all research, data, and analysis made presentable to TNC
- Professional presentation of our project delivered to the Nature Conservancy staff at their office in Montpelier

Methods/Strategies

We had multiple stages to our methods in which we collected data of vegetation species, woody species, and soil type in different polygons that we mapped on our site. We started off by walking around our site with GPS units and mapping the areas of different vegetation clusters in order to gain a better understanding of the distribution of species coverage. In order to classify the clusters that we were mapping, Morgan Southgate (a graduate student at UVM who helped us with this project) created the following vegetation classes. The species percent cover within each polygon was estimated using the following classes:

1 = Trace (<1%)
2 = Rare (1-5%)
3= Occasional (5-20%)
4 = Common (20-50%)
5 = Abundant (50-80%)
6 = Dominant (80-100%)

We then made the GPS points into polygons on a map using ArcGIS and color coded the polygons based on the vegetation class that they fell into. We categorized them into vegetation class based on the data that we collected in the field while taking GPS points. We created 79 polygons.

Once the vegetation classes were mapped, Morgan conducted a random stratified sample to create points at in the polygons at which we would observe woody species and take soil samples. In the polygons, 81 points were randomly chosen. At the point we took a soil sample using a soil probe and observed the core for any signs of mottling. We then looked for any woody species within a ten foot radius of the point and recorded the species of the plant or shrub, whether there was a planting tube present, if there were deer or rodent browse, whether the tree was alive or dead, and if it was over six feet or not.

We used these methods in order to gather data that would help The Nature Conservancy to understand factors that would influence the success of restoration methods that could be implemented in the future. We used Morgan as our main resource throughout this data collection. We also used Dan as a resource when we were initially planning what we needed to do in order to be most helpful to TNC. Some physical resources that we used were GPS units, soil probes,

tape measures, and detailed data collection sheets. We also used ArcGIS in order to create our vegetation map and polygons that allowed us to generate random points for the soil samples and woody species sampling.

Some frameworks that we built our problem-solving on were data collection, data analysis, feedback, and constant communication. Data collection was the main part of our project and it was how we chose to solve (or begin to solve) the problem that we identified. Data collection is not helpful if it is not analyzed, so data analysis was also a big part of our problem-solving framework. We also stayed in very contact with Dan and Morgan which allowed us to always be on the same page and to have constant feedback which made the process of the project run smoothly and promoted efficient problem-solving.

This project was used to help the success of the restoration plan which is a project for the future. In order to measure success on this project, we met with Dan and discussed what he wanted from us by the end of the semester, and what would most helpful for TNC moving forward. We decided that we would measure our success by completion of data collection, a final report, and suggestions for the future. We completed data collection which was necessary for us to succeed in data analysis, a written final report, and essential for giving well-informed suggestions for the future of the project. The data analysis and written report are works in progress because after our data completion, we decided that it was not enough and that more would be needed in the future. Our final report will help Dan and Morgan to have all of the data, suggestions, analysis, and research in one place and will help them to be more efficient moving forward.

Results/Deliverables

The final deliverables of our project are the data we collected and a final report compiling this data to be given to the Nature Conservancy. The format of this report is an inclusion of an abstract, introduction, methods, results and recommendations. This is a compilation of not only the data and data analysis completed, but informal observations gathered by each individual during our many days working in the field on this piece of land. This report will be given to the Nature Conservancy to be directly used and drawn from in the future restoration plan created for the LaPlatte Headwaters Town Forest. This report and the overall restoration plan, takes step towards addressing the original problem which is the restoration of this altered ecosystem ultimately in an effort to regain the ecosystem services, primarily water filtration, once performed by this ecosystem.

The measure of success for this project was the completion of all of our goals laid out in our proposal. Our final results were not always depicted as maps, the data collected on soil texture and composition and woody species is complied in a spreadsheet, this change was simply due to the sampling protocol we utilized for this report. There is the potential for maps of these factors to be mapped in the future. We reached all of our goals in terms of data collection and time spent out in the field working as a group. We consider this a successful project and one that directly addressed our goals and the overarching problem we hoped to address.

Discussion, Recommendations, and Conclusion

After collecting data on herbaceous species, woody species, and soil composition, Morgan compiled the information and was able to extract several important findings. The three main factors of the field-work data collection (vegetation class, trees, and soil type) helped us

understand the relationship between the factors and the specific parcel of land. With Morgan's intuitive data analysis, we were able to see connections between tree presence and health, herbaceous species composition, edaphic (or soil related) characteristics, distance from the forest edge, and browsing presence.

We were able to see where the soil mottling depth occurred from collecting the soil cores. Soil mottling happens when soils are wet for extensive periods of time from flooding or a high water table. This reduces the rate of oxygen movement which can be seen by the variation in color of the soil core. The gray-blue color indicates lack of oxygenated or water-logged soil, while the red-rust color indicates oxidation of iron. This was able to help us see that this parcel of land had obvious moisture content. From Morgan's data analysis, we saw that trees had better survivorship in drier areas, rather than wetter ones which suffocate the roots. This is also directly related to the vegetation classes in which future planting should be focused within Goldenrod abundant classes because it thrives in drier soil types.

Another suggestion is that in regards to research, increased sampling density of the woody species and soil types should be encouraged to get a better view of continuous water table presence throughout the parcel. Morgan suggested that one of the ways to restore the area would be to work with the natural course of forest succession by "pushing the edges", in which tree planting should occur closer to the forest edge and work its way out toward the field. This would ensure the stabilization of the soil and tree root structure, which ultimately could help inhibit Reed Canary Grass growth.

Something that we had not known before and have found out while presenting at The Nature Conservancy was that the protective plastic tubes were removed from many trees prior to our woody species data collection days. This information slightly skewed our third objective in Goal 1 in that we observed and noted that trees with tubes were classified as planted, while trees without tubes were naturally regenerated. This new piece of information allowed us to realize that a number of trees that we observed as "naturally regenerating" were in fact planted. However, this is not a significant blow to our research, it just means that further data collection will have to be performed to see if there is a different relationship between planted trees and naturally regenerating trees. Another piece of new knowledge that was presented to us was that the Reed Canary Grass was intentionally planted for whatever reason.

Since most of our work went fairly smoothly in regards to deadlines, the Nature Conservancy, and with data collection, we did not experience any extremely serious limitations, problems, or obstacles. However, one of the main limitations of this project was the limited documentation of previous species composition and records of the history of the LHTF land. Without this information, it will be difficult to predict the likely future forest composition in the area. We realized that data collection of the vegetation classes, trees, and soil types would have benefitted us much more if it were performed much earlier in the season before the first frost. The trees lost their leaves before we were able to identify them, so identifying them by bud and/or bark was tedious. Since this was only a semester-long project for us starting in September, it would have been difficult and time-consuming for Morgan and Dan to collect all the data themselves in the summer or early fall. Another small obstacle that we encountered was just the limited knowledge of field methodologies and ArcGIS programs. Some members of our group had extensive knowledge of identifying herbaceous and woody species and using ArcGIS programs, while some of us had very limited experience. This wasn't something that prevented us from completing our deliverables, but it just took a little time to become accustomed to. If time allowed, preparation of herbaceous and woody species identification kits and instructions

on creating and editing polygons would have been helpful, especially for future groups that may be continuing field data collection and preparation.

Part of our follow-up work for the Nature Conservancy was to include research on Reed Canary Grass within the final report which will be used as a draft by Morgan as a restoration plan; particularly on the growth dynamics and ways to mitigate its succession in disturbed areas. Dan also mentioned that the conservators of the LaPlatte Headwaters Town Forest provided him with a large amount of data that will need to be organized to find out what trees have been planted and when, which can be a future goal or objective for the next NR 206 group that tackles this project. Another aspect of follow-up work, either for the next NR 206 group or for Morgan or Dan, would be to map the likely future natural communities using information from our herbaceous species, woody species, and soil type data.

With all the data that our group has collected, and with the data analysis that Morgan has provided, we are confident that our report will be substantial in creating a restoration plan for the Town Forest field. Continued and increased data collection within the area by the Nature Conservancy and possibly future NR 206 students will help build a sturdy database indicating what the wetland site needs to be restored and potentially thrive. With wetland protection and restoration, we are hopeful that this site will contribute to better water quality in Lake Champlain.

Works Cited

Zedler, J. B. (2003). Wetlands at your service: reducing impacts of agriculture at the watershed scale. *Frontiers in Ecology and the Environment*, *1*(2), 65-72. https://www.jstor.org/stable/pdf/3868032.pdf