Network Mapping Land Use Stakeholders in Franklin County, Massachusetts

An Interactive Qualifying Project Report
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Abstract

The goal of this project was to create a map of land use organizations in Franklin County Massachusetts. This includes a broad array of organizations from Community Gardens to Alternative Energy. We specifically looked at the network of collaboration between these organizations, who is working together and in what capacity. This is of interest because there are a lot of good environmental causes, but only so much land and resources, so collaboration is necessary for making the best decisions on how to use efficiently use the land. This project was essentially a small-scale trial run for our sponsor, WPI Professor Seth Tuler, who is looking to eventually map the network of land use organizations for the entire state of Massachusetts, not just Franklin County. We examined our process to identify potential difficulties Professor Tuler may run into when scaling to the full state.

Executive Summary

Land use planning is the process of turning broad environmental goals into a specific plan of action for a specific plot of land. Due to the interconnected nature of our environment, land use planning benefits from collaboration and informed decision making. Our team is comprised of four WPI students, and the long-term aim of our work is to get valuable decision-making information to land use organizations in a specific area.

The goal of this project was to map the interactions between land use organizations in Franklin County Massachusetts. This includes a broad array of organizations from Community Gardens to Alternative Energy companies. Our sponsor, WPI Professor Seth Tuler, was interested in mapping the network of collaboration between land use organizations in the hopes of revealing potentially valuable information. We were interested in interactions such as shared labor, information, or resources. This project is essentially a small-scale trial run of his larger effort to map the collaborations in the state of Massachusetts.

Methods

We used the following research questions to guide our analysis of Franklin County land use organization networks:

1. Who is collaborating with whom, and in what capacity?
2. Which sectors lack collaboration, communication, or funding; Which have an abundance?
3. Who are the organizations most central to this network?
4. What are the reasons for little communication?
5. What can be done to help establish collaboration?

We collected information about the land use organizations in and around Franklin County assisted by our sponsor and his colleagues, who have contacts in Franklin County. With the assistance of a stewardship mapping team from the United States Forest Service, we created a survey to distribute to these organizations. The survey inquired about the nature of that organization's work as well as the extent of their interactions with other organizations. Once survey response data began returning from these organizations, we began mapping the network of reported collaboration. To do this, we created an interactive map which displays each responding organization with a connection to each organization it reported as a collaborator. The interactive map can easily visualize a variety of information about the organizations in the network, such as network centrality, geographic distribution, sector, scope, etc. We published the interactive map to a website for anyone to interact with the data and examine its trends for themselves. The website also includes a link to complete the survey.

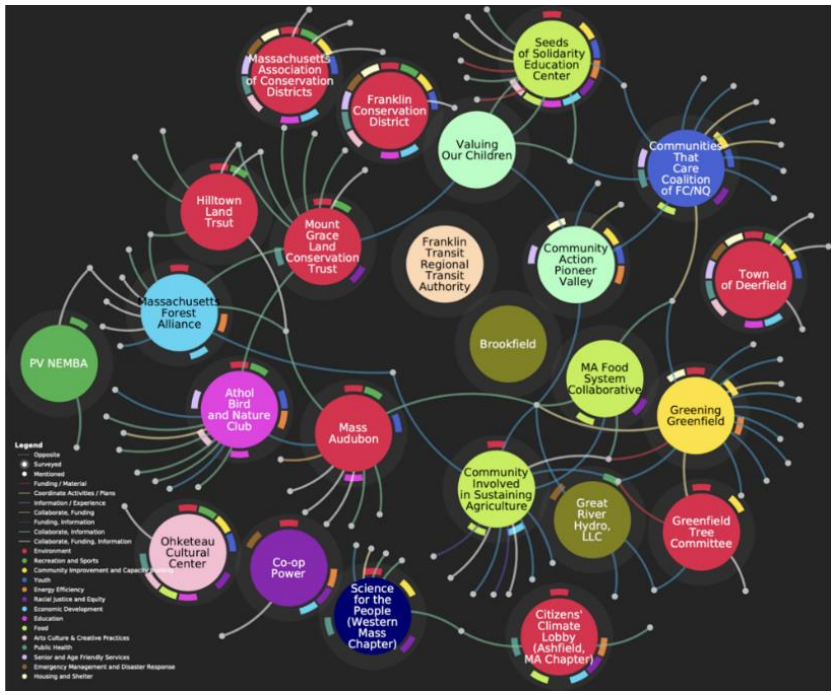
Findings

Examination of Survey Results

We should preface the analysis by mentioning the limitations of the sample size. We only sent the survey to 91 organizations, and of those only 24 responded. There are more than 91 land use groups in Franklin County, MA; however, we were limited by time and unable to continue to gather new organizations before we had to begin to collect data. This is important because this network map is incomplete; There are groups that appear to work alone that could be working with many other organizations, but they were not surveyed. The sample size is too small to say anything with full confidence, but still large enough to show potential of the network map.

In the view of the network map shown on the right, the responding organizations are the large colored bubbles, and the organizations they mentioned (which did not take the survey) are the smaller grey dots. Organizations are colored based on the reported sector of work, for example, “Environment”, “Recreation”, “Food”, “Racial Justice”, etc. Organizations were asked to name a primary sector they work within, visualized in the main color of the bubble. They were also asked to list all of the sectors they participate in, visualized on the colored flags bordering the bubbles. For example, the leftmost organization PV NEMBA reported that they only work in “Recreation and Sports”. Their neighboring organization The Massachusetts Forest Alliance, however, is primarily engaged in “Economic Development”, but also does some work in “Environment” and “Energy Efficiency”.

The sample size was small, but the response rate exceeded expectations. We were hoping for 10% realistically and 20% optimistically but ended up getting 26.4%. In contrast, the team from the Forest Service got a 6% response rate from a similar survey of Springfield County. Additionally, each responding organization listed on average 5 collaborating organizations. We attribute the high response rate to the weekly reminder emails, and highly recommend future iterations to periodically resend their survey to non-responsive organizations as well.



There are many different views of the network map, however, it can be easily customized to display a variety of the network data. In the view shown on the right, the organizations are sized and shaded by how many times they were independently mentioned in surveys. We also asked organizations about the nature of their interactions with other organizations, and this data is visualized in the color of the connecting line between bubbles. The largest organization, the darker blue octagon in the middle is the Franklin Regional Council of Governments, which was mentioned 6 times. The different views can be accessed and interacted with at the website.

When we examined the information provided by the survey responses, we were able to find several interesting pieces of information. One of the first findings is that the respondents formed a nearly complete network with each other. With a few exceptions, all of the respondents were connected either directly or indirectly in one large web with several key organizations forming central points.

When looking at the nature of collaborations across the network, we discovered a high level of shared information, which we saw as a good thing; a network with little information sharing is unlikely to be effective. There is also a good deal of shared labor, especially combined with shared information, which is also encouraging. On the other hand, there was comparatively little shared resources. This is not necessarily a fault; it is difficult to say with confidence whether the network would benefit from more or less circulation of resources. From this we can see that these forms of collaboration are largely dependent, and that the nature of collaborations follows a progression from the least committal and builds towards more complex and resource intense forms.

Examination of Process

Here are a few key takeaways from the methods. The network map is especially sensitive to response rate, so it is important to make getting responses a priority. We attribute our surprising response rate to the weekly reminder emails that we sent to organizations which gave no response. It is also important to note that this survey was specifically for Franklin County, meaning organizations may have felt more compelled to respond to help their community. There were also several people who reached out to inquire more before taking the survey and following up with each of these people proved very fruitful.

Conversations with organization representatives showed us the difficulty of communicating our goals and intentions effectively to total strangers over email. Additionally, scalability becomes an issue when considering the same percentage of Massachusetts organizations needing further explanation. Steps should be taken to eliminate space for confusion in the communication with organizations. It is important to maintain a professional and welcoming public appearance, and to communicate effectively. We learned this lesson our first attempt at distributing the survey, where we accidentally lost all of the formatting, graphics, and hyperlinks. With a malfunctioning format and unclickable links our first impression with many organizations made us look somewhat illegitimate. Organizations are less likely to click links from sources perceived as illegitimate, and this is detrimental to the response rate and the accuracy of the network map.

In its current state, scaling our method to the statewide level would require either significantly more time or significantly more people. As the number of organizations grows, the number of connections grows exponentially. This means the amount of manual labor required to process the connections will also grow exponentially. The survey questions which asked respondents to name collaborators was a simple text box, so respondents could name an organization however they saw fit. For example, two respondents could list the same organization, but one might use an acronym and the other the full name, so the response data for this question required manual cleaning to make it consistent. We recommend a searchable drop-down of the organization names be used instead of a plain text box to eliminate inconsistency and make it possible to automate. If this part of the process could be automated, the method would become far more scalable, and additionally it then could be possible to create a system which automatically updates the geographic and network maps as new responses come in.

Our final recommendations are this: send frequent reminders, present a professional digital presence, and communicate effectively. Additionally, it may be possible to restructure the survey to fully automate the system, which will make scaling to Massachusetts a much easier process.

Acknowledgements

We would like to extend our gratitude to the many individuals who helped us complete this project. Special thanks to our sponsor, Professor Seth Tuler; our advisors, Professor Melissa Belz and Professor Jennifer deWinter; WPI IT Services; Rachel Stoler and Kimberly Noake MacPhee from the Franklin Regional Council of Government; and finally, Michelle Johnson, Can Sucuoglu, and David Bloniarz from the USDA Forest Service for helping us with a framework to complete our IQP.

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Introduction

Introducing the Need for a Network Map

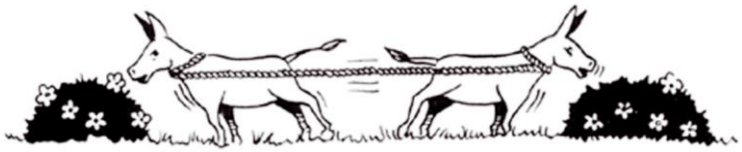

Figure 1 The Donkey Comic

Once upon a time there were two donkeys tied together facing their respective bushes. They were hungry, and they were so consumed by their focus on the bushes ahead of them that they were totally unaware of the other donkey and the rope connecting them. Eventually after tiring themselves out straining against the rope, they both collapsed, and thereby each became aware of the other. They could then work together to have as much food as they each like.

Land use planning is a task which, similar to the two donkeys, requires collaboration. Scholars have noticed that land use organizations have worked themselves into 'silos', each working in isolation to achieve their individual goals on their individual parcels of land. However, many experts in the field believe that it is essential for the planning process to be collaborative if it is to make any headway (Daher et al, 2019). Just like with the donkeys, in order for these organizations to collaborate they must first have the relevant information about who they are collaborating with.

This project aims to map and study the network of land use stakeholders in Franklin County, Massachusetts, for our sponsor Worcester Polytechnic Institute Professor Seth Tuler. This is part of a larger project whose goal is to develop the Massachusetts Integrated Landscape and Land use Research for Sustainability (MILLURS) Network by applying a similar method at the statewide level. Once this network is established and analyzed, the larger project hopes to be able to make confident recommendations to the included organizations and potentially policymakers on how to improve the overall system of land use planning in Massachusetts.

Our project constitutes an early, yet crucial stage of this larger project. It aims to help land-use management, planning, or advocacy groups in pursuit of important sustainability and climate resilience goals communicate to prevent their methods from conflicting and encourage collaboration. The map will act as a tool to help land use organizations connect and foster stakeholder collaborations characterize the level of fragmentation present and highlight gaps of communication where progress can be made towards a more collaborative community. Understanding the conflicts and levels of communication can lead to joint initiatives or alternatives that suit more than just one individual party in the short term. (Daher et al, 2019) Integrated land use plans will be more robust and have a greater positive impact on our environment.

Land Use

One of the most essential questions we face as a society is how to develop our capabilities in a sustainable manner, which can be maintained into the future with the resources we find here on Earth. Land Use planning is the field in which we attempt to face the challenges and conflicts presented by developing sustainably (Godschalk, 2004). According to the Food and

Agriculture Organization for the United Nations (FAO), the field of "Land-use planning is the systematic assessment of land and water potential, alternatives for land use and economic and social conditions in order to select and adopt the best land-use options" (FAO, 1996). The purpose of the field is to examine potential uses for our land and determine what is best based on a set of priorities or values like economical use, ecological benefits, or social equity.

The Need for Collaboration in Land Use Planning

The main difficulty in land use planning is defining our priorities and resolving conflicts among other land uses planned with slightly different values. As Owens and Cowell state in their influential 2002 paper, "trying to turn the broad consensual principles into policies, procedures, and decisions tends not to resolve conflicts, but to expose tensions inherent in the idea of sustainable development itself" (p. 43). It is these conflicts that keep land use planners busy. Do we prioritize the economy in land use planning at the expense of the environment? Do we prioritize the livability of cities over the economy? As Godshalk writes, "[Sustainable Development's] central value can be boiled down to a balance among the three "E"s: environment, economy, and equity".

More rigorous methodology has been developed by academics in the field to help systemically unravel these inherent tensions, such as Campbell's 'The Planner's Triangle' which places these three main central values of Sustainable Development at the three corners of a triangle. Along each axis between these points there is a different conflict between the two connecting points, "The property conflict" lies between economy and equity, "The development conflict" is between equity and environment, and finally "The resource conflict" falls between environment and economy (Campbell, 1996). This framework helps better define the complex interconnected problems land use planners face. As we can see, the land use planner must be an expert in seemingly every field to best tackle all the different sides and angles that come with turning priorities into zoning ordinances. More accurately, land use planning must be done with a heavy focus on interdisciplinary collaboration and integrated design.

The FAO stresses this in their guidebook saying "land-use planning is not sectoral. Even where a particular plan is focused on one sector, e.g., smallholder tea development or irrigation, an integrated approach must be carried down the line from strategic planning at the national level to the details of individual projects and programmes at district and local levels" (FAO, 1996). Not only does land use planning require interdisciplinary collaboration, but it must also occur at a variety of levels of government to be effective.

It is essential for planning to happen in an integrated manner across scales ranging from national to local. As the FAO states, "At the national level, planning is concerned with national goals and the allocation of resources. In many cases, national land-use planning does not involve the actual allocation of land for different uses, but the establishment of priorities for district-level projects." The national level of planning is responsible for uniting its lower levels under broad priorities, while the lower levels are tasked with the specific implementation of these priorities into zoning ordinances. In the United States specifically, there are "4 levels of government ... land-use planning is among the powers retained by the states, but all states delegate large parts of their authority to local governments through state constitutions and statutes" (OECD,

2017). However, this is not to say that the federal and state governments do not hold sway over the land use planning which occurs in the country.

The Organization for Economic Co-operation and Development (OECD) publishes a report on the land use planning systems present in the governments of many countries, including a breakdown of which parts of the process happen at which level in that country. According to the report, most of the implementation-level planning happens on the local level, although this is because most states choose to "delegate this authority to local governments through state constitutions and statutes". Land use plans are put into effect through "zoning ordinances" which are essentially maps which contain information about what regulations fall onto what districts or parcels. These zoning ordinances are created by the local government based on the priorities handed down from higher levels, which helps define the bounds of how land can be used. It is here that private sector and civil society organizations focused on sustainable development and land stewardship come into play, working within the bounds of the zoning ordinances to lead land use towards, hopefully, something better.

Environmental Goals in Alignment

As global populations and economies increase rapidly, so does the demand for resources. In fact, it is projected that by 2050, global need for water, food, and energy will increase by 55%, 60% and 80% (Daher et al, 2019). Furthermore, global carbon emission rates have increased by approximately 90% (US EPA, 2016). These global trends have led to public and private initiatives to decrease carbon emission rates and increase sustainability efforts. The Massachusetts government for example, has announced a net-zero greenhouse gas emissions roadmap by 2050 (Ismael, 2020). This lofty goal encourages private and public organizations to continue or further their sustainability land resilience initiatives.

In Massachusetts, 523,517 acres of cropland, pasture, wetlands, and water filtering woodlands reduce flooding, recharge aquifers, and are home to several biologically diverse eco-systems that house fish, wildlife, and birds (MLFSP, 2015). The American Farmland Trust estimates almost 1.7 billion tons of topsoil are lost each year. Conserving the soil quality and using conservation practices while farming is crucial because it maximizes the land's ability to act as a carbon sink, offsetting a portion of carbon emissions (Lehigh County, 2020). As of 2015, about 14% of farmlands in Massachusetts are under protection. The main legislature responsible for the protection of agricultural land is the APR Program (Hall, 2021). However, in recent years, funding from the state government has decreased. The lack of protection for and the decline of crop lands is diminishing the viability of the agriculture sector, taking its food and environmental benefits with it (MLFSP, 2015).

Despite being the third most densely populated state, 63% of Massachusetts is covered by forests. The 3.2 million acres of forests that cover the state provide a variety of ecological and environmental benefits (National Association of State Foresters, 2018). These benefits include wildlife habitat, flood and erosion control, public health benefits, recreational opportunities, and offsetting human carbon emissions (Mass Audubon, 2021). Despite the ecological services that forests provide, 13.5 acres of trees are cut down each day for development in Massachusetts. This gradually reduces the forests' ability to remain host to its ecosystems and act as a carbon sink (National Association of State Foresters, 2018).

Massachusetts is at the forefront of climate resilience and sustainable housing, yet improvements must still be made in order to reach the net-zero emissions goal by 2050 (Walsh, 2014). As of 2014, the housing sector accounted for over a fifth of Boston's carbon footprint. One of the main ways housing networks such as the Massachusetts Association of Community Development Corporations aim to improve the environmental impact of housing is by integrating renewable energy technologies such as solar (MACDC, 2021). The energy sector and housing sector are linked in the sense that emissions from housing are difficult to offset without these renewable energy technologies. In 2020, Massachusetts was aiming "for installed renewables capacity call for 1600 MW of solar and 2000 MW of Wind by 2020" (Department of Energy Resources, 2021). The true potential for renewable energy has yet to be unlocked in Massachusetts. In just the last 10 years, 24 times the solar energy is being produced and wind energy is soon to see similar trends (Decker et al). In fact, offshore wind could generate almost 20 times the energy Massachusetts consumes every year. Furthermore, if every home had solar panels on the roof, almost half of Massachusetts's energy needs would be met.

Environmental Goals in Conflict

Despite long-term sustainability and de-carbonizing goals appearing aligned, land use organizations in various sectors competing for land use in Massachusetts often have conflicts due to differing short-term methods (Daher et al, 2019). For example, there are legal documents detailing state policy from 2003 that reveal land use conflicts in the ongoing battle between affordable housing and open recreational spaces in Massachusetts (Bobrowski, 2003). These zoning regulations and policies still affect land use planning today. Lack of vision from policy makers has pitted proponents of these two sectors against one another for decades (Cash W. et al, 2006). Sections from the Community Preservation Act of 2000 offer tradeoffs between open spaces and affordable housing. This has created a dynamic where towns choose one over the other, as opposed to an integrated policy that attempts to account for both, effectively stifling opportunities for collaboration (Bobrowski, 2003).

Benefits of Collaboration

In order to accomplish the world's conservation goals it is necessary to collaborate. Collaboration is a powerful tool that non-profit organizations are increasingly using to raise the overall value of the work they do (Weber et al., 2017). Globally, there are numerous studies that advocate collaboration based on the positive results observed. For example, one study looked at the effect of collaboration on productivity of dairy farming in Kenya. Among two groups of dairy farmers, collaborative work and study was able to improve milk quality and yield, establish a network of related individuals, and promote innovation (Restrepo et al., 2020). Restrepo was able to create this successful effort by encouraging an equal and open environment among the participants where knowledge was shared freely for the general benefit.

Collaboration is a great way for improving production outcomes. A study in 2018 on collaboration models of the Ghana cocoa industry found that advanced value chain collaboration like unified buying and selling procedures brings positive results on the industry's social, human, and natural capital compared to conventional methods. The newly formed integrative approach of purchasing and utilizing resources also made production more sustainable and effective. It was concluded that having a

bridging organization to help them partner with other land use stakeholders would help in facilitating them in land use negotiations and evaluating trade-offs at the landscape level. (Deans et al., 2018)

In the Swedish mountains, partnership between private and public organizations lead to greater tangible outputs (Bjärstig, 2017). In Bjärstig's observations, when groups collaborated the majority of the time initiatives were able to find success with 85% of groups reporting greater social outcomes, 62% reporting greater ecological outcomes, and 69% reporting greater economic outcomes as a result of having collaborated.

Barriers to Collaboration

While evidence points to collaboration having a positive outcome on sustainable practices, there are factors which have discouraged organizations from collaborative efforts. One of the potential barriers to a successful collaboration is the cost required for oversight (Zscheischler et al., 2019). While costs in terms of both time and expenses remain the same with or without collaboration, some agencies are experiencing reductions in funding and have to push forward with a smaller resource pool (Margerum & Whitall, 2004). This problem can be further exacerbated when rigid expectations from funders restricts collaborator's ability to adapt (van Tulder & Keen, 2018) otherwise the project can lose funding and collapse. Actors in the corporate community often decline joint efforts because the social and environmental goals are not worth the monetary or time investment (Robinson, 2012; Daniel et al., 2013). Physical distance can prevent collaboration due to increased travel costs. However, the inverse can also deter collaboration as close proximity can insight competition for resources, rivalry, and by aversion to cooperation (Mascia et al., 2017).

In some situations, the largest barrier to collaboration is differences in core values or goals of actors. Even if the actors involved have a common goal, each group will have their own objectives and needs which change how they value and view activities (Restrepo et al., 2020). When priorities differ, the effectiveness of collaboration suffers. Each group can view situations on a different scale. Small local groups may have deeper insight into a local issue, but fail to consider the repercussions on the larger scale (Margerum & Whitall, 2004). Conversely, when a wide-reaching organization has an excellent grasp of how changes cascade into surrounding areas, it can lack insight into the subtleties required at the local level. In instances of smaller scale collaborations, differences can be even more pronounced. Collaborating among individuals, conflict may arise "from different cultural perspectives, values or orientations, mishaps in coordination, or structural breakdowns" or even from social differences or poor social interactions (Dibble & Gibson, 2013). While differences play a role in preventing collaboration, similarities between groups can do the same. Organizations which are too similar experience heightened rivalry creating a reluctance to collaborate (Mascia et al., 2017). Differences can extend into topics which are far more subjective in nature such as an organization's definition of success, conflicting missions, or even mistrust, which can stall organizations' ability to work together (Gordon et al., 2013).

This also extends to government, and how policy can challenge collaborative effort. When working on a collaborative initiative, the personal outlooks of the organizations and the public policy that governs them can determine whether the collaboration is successful. For example, efforts which affect

multiple regions, states or nations. If a project is planned to collaborate across a border of any kind where regulations on the intended subject differ on either side, the effort may be untenable (Daniel et al., 2013). In an attempted effort at managing mountain waterways on the border of Washington and Idaho, Daniel et al. found that the web of national, state, and tribal regulations greatly increased the difficulty of their effort. Even if the only policy being dealt with is that of a single area, the timeline of policy can lead to issues. By necessity, collaborative ecological initiatives have timelines that often stretch for decades while policy can change as quickly as a single election cycle (Margerum & Whitall, 2004) leading to disruption or complete collapse of the initiative. With this changing of public policymakers, advocation for good previous policy often falls to private groups, (Weir et al., 2009) however, this can prevent collaboration with the incoming administration, while accepting new policy can deteriorate existing collaboration. While there are many observable barriers to the success of collaborations among sustainable organizations, this is not the whole story.

Methods

The goal of this project was to map the interactions between land use organizations in Franklin County Massachusetts. This includes a broad array of organizations from Community Gardens to Alternative Energy companies. We used the following research questions to guide our analysis of Franklin County land use organization networks:

1. Who is collaborating with whom, and in what capacity?
2. Which sectors lack collaboration, communication, or funding; Which have an abundance?
3. Who are the organizations most central to this network?
4. What are the reasons for minimal communication?
5. What can be done to help establish collaboration?

Creation of Survey

For our project, the main method of data collection was via a survey. We used a revised version of a survey created by the United States Forest Service. Previously used to survey Springfield County, MA, we adapted it with the help of Professor Tuler and his assistant Erin Bryan to tailor to our goals of finding information about Franklin County organizations' focus, agenda, scope, and most importantly who they work with.

Once we obtained access to the survey, much of the process was focused on altering the preliminary text, directions, and interface to make the survey as user friendly as possible. This was to avoid user confusion and misinterpreting questions that yield useless data. Much of the original survey was kept intact as the questions already addressed the information this project was looking for; however, we changed the survey preamble to reflect the project and we heavily revised section 5 which handles collaboration as our project focused much more heavily on this topic than the original did.

The survey was split into six sections that were designed to collect data on both general information of the respondent and group, as well as specific information on their focus, agenda, scope, and collaborators. Sections 1 and 2 asked for their name, contact information, and basic information about their organization such as their location. Section 1 allowed the group to see when the respondent was someone other than the one who received one of our emails. If someone different took the survey, their name was added to the Franklin County Organization spreadsheet. Section 2 gave us data on the organization's locations for the network map.

Section 3 looked extensively at the area of focus, agenda and scope of the organizations surveyed. It asked about the groups mission statement, vision for sustainable and resilient landscapes and whether the organization is involved with advocating, monitoring, educating etc. in their respective sector (I.e. food, water, housing etc.). These questions were very important as they gave us an insight into the group's goals and how they are trying to accomplish these goals. The last question in this section looked to answer whether any of their action plans may result in conflicts with the goals or actions of other competing land use sectors. This question aimed to look at the potential breakdowns in communication and how conflicts may be contributing to the gaps in communication.

Section 4 focused on collecting data on the land use groups reach and focus. The section asked what land use sector the group is a part of and which cities and towns in Franklin County the organization works in to assess how large an area they make an impact in.

Section 5 is essential as its purpose was to learn about the collaborators of each surveyed organization which was key to answering our research questions. Originally, for the US Forest Service purposes, this question operated with a dropdown/search box which detailed 500 organizations from the Springfield area. However, after receiving feedback from a FRCOG respondent about the complexity of this format and considering our limited list of 75 organizations, this format no longer seemed feasible. To improve the user experience, we changed this method to use a single text box without answers being limited to a curated list. However, this created a massive issue with scalability. By allowing organizations to respond freely, each response needs to be manually cleaned of errors, acronyms and any responses given in ways other than anticipated. While this additional work was acceptable at the Franklin County scale to get more responses, this project serves as a pilot for an eventual statewide initiative where additional processing would be exponentially higher and far too inconvenient. In order to apply this survey to a larger area it would be necessary to recreate the original dropdown from a curated list or a similar method with improved explanatory text, avoiding a massive time sink.

Lastly for the survey's makeup is section 6 which asked a few final questions about the details of the respondent's organization, primarily who works for the organization such as members, staff, and volunteers as well as their hours to get a glimpse of the size of each group. This section also gave respondents the chance to provide any additional information they deemed useful. Most importantly, this section asked whether the respondent was comfortable being included in the final network map. If not, their data would still be collected and analyzed, but omitted from the publicly visible map.

Data Organization

Additionally, we were given a spreadsheet of organizations and contact information by Franklin Regional Council of Governments (FRCOG). Initially it contained missing emails, inconsistent formatting and placeholder names that needed to be edited to automate an email list for sending out the survey. This meant manually sifting through the spreadsheet, adding contact information we found by searching online, deleting random spaces and punctuation, and deleting all of the placeholder data.

To track our contact with organizations regarding the survey, we established a comprehensive system of dynamically linked spreadsheets (See figure 2). This helped us maintain a master list of all the organizations we found in and around Franklin County to keep track of organizations who we discovered. It includes the organization's name, a unique identifier, contact email and phone information, address, webpage, responding land use sectors as well as a special status code along with information like which wave was an organization invited and reminded, and their corresponding survey ID if they have filled out a survey. All the data is maintained to help with data consistency and correctness.

The status code was developed to denote information like the stage that each organization is on in the process (no emails sent, invite sent, survey filled, survey rejected, phone call required, not related, paper survey required and more).

Additional pages were created alongside the main list of organizations to detail each wave of invite/reminder sent to organizations for the convenience of Professor Tuler, since the macro require two new sheets to work. These supplemental spreadsheets were also used for record keeping so that the group could reference when and how many times, a land use group had been contacted.

Figure 2 Master List of Organizations

To bridge our work with the future statewide work, a separate sheet was maintained with organizations from across the state. This sheet was similar to the master sheet for Franklin County; however, it did not have any status codes as surveys had not been sent statewide and contains more specific information such as which county they are from. The statewide database also had nearly 900 organizations as opposed to just over 100 in the Franklin sheet.

Distribution of Survey

Automation

To distribute the survey quickly and efficiently to the respondents, it was necessary to find a simpler method than sending an email to each person individually. Manually, this process would take hours and make tracking which organizations have received which emails difficult. Furthermore, this method would be impossible to handle when the project moved to the statewide scale.

Originally, we utilized Microsoft Excel with the help of a macro created to send emails. This macro allowed the user to send copies of an email to an unspecified number of recipients by listing all the recipient emails in one column, and both the body of the email and the subject in specified cells. While this method was capable of sending emails on any scale and was highly compatible with our contact information storage (as it was already in an excel sheet), it became apparent that there was no clear way to customize the message with important details such as the recipient's name or the organization they are part of. Lack of customization for the greeting line made emails less personal and much less likely to be read or responded too.

Instead, we used a feature within the Microsoft suite called merge mail. Merge mail functions similarly to our original macro, allowing for mass email distribution, although two special Excel sheets had to be made. This feature was far more developed, specialized for our purposes, and had the flexibility we needed. To make this feature work required the use Microsoft Excel, Outlook, and Word together in their desktop application versions as the browser versions are limited and do not support the feature.

First, the sender needed to open and sign in to Outlook with the desired email. Next, Excel was used to store all the variable information. For the feature to function properly we needed two excel files, one for the recipients that we had the name of, and another to list the organizations we had no name for. The first row of each document must contain column labels like email addresses, first and last names if known, or the organization we are sending to. Each of the rows need to at least contain an email address. For the organizations that we know the recipient's first name, it should also contain that first name. The two Excel sheets then needed to be saved to the sender's computer before use to make it accessible to Microsoft Word. Finally, most of the actual mail merge is done in Microsoft Word. After creating a document and writing an email body with an empty greeting line and spaces to pull from variables, the mail merge itself could be started.

Once the feature was accessed from within the Word document, a new menu appeared which allows control of the merge. The first and most important step in completing the merge was to select the recipient list which is one of the Excel sheets. Once a sheet is selected, it was necessary to match the fields from the sheet to the merge's parameters so that the columns are accessed correctly. With our columns accessible,

we were able to insert a variable to the greeting line which could address the recipient by first name using the information from the sheet or adding a default line should we have been missing a name for any recipient. The final step was to finish the merge wherein our email column could be selected as our recipient list, the subject line could be added, and the text format could be chosen, which for the feature to preserve links should be in the HTML format. From there, a button press sends all the emails fully customized to each recipient. The mail merge needs to be repeated to send emails to recipients both with and without a known first name.

Reminders

After adjusting following the initial wave of emails, the method proved successful and was used for all of our future mass communications. To ensure the most responses possible, each week we generated two lists of organizations who had not filled out the survey, excluding those who declined in any way or should not be sent further emails. We provided Professor Tuler with the lists so a new wave of reminders can be sent. The reminder email was drafted with a text body that was different from the original. Newly discovered organizations or organizations deemed as collaborators from the survey that were situated in Franklin County were gathered in two new lists and provided to Professor Tuler to be sent a survey invite in the same manner as the first wave of organizations.

We were sending plain text survey invites and survey email recipients have suggested to us that we use a more nicely formatted email invitation and showed us one from another survey. We looked further into formatted HTML emails and created one for future use (See figure 3).

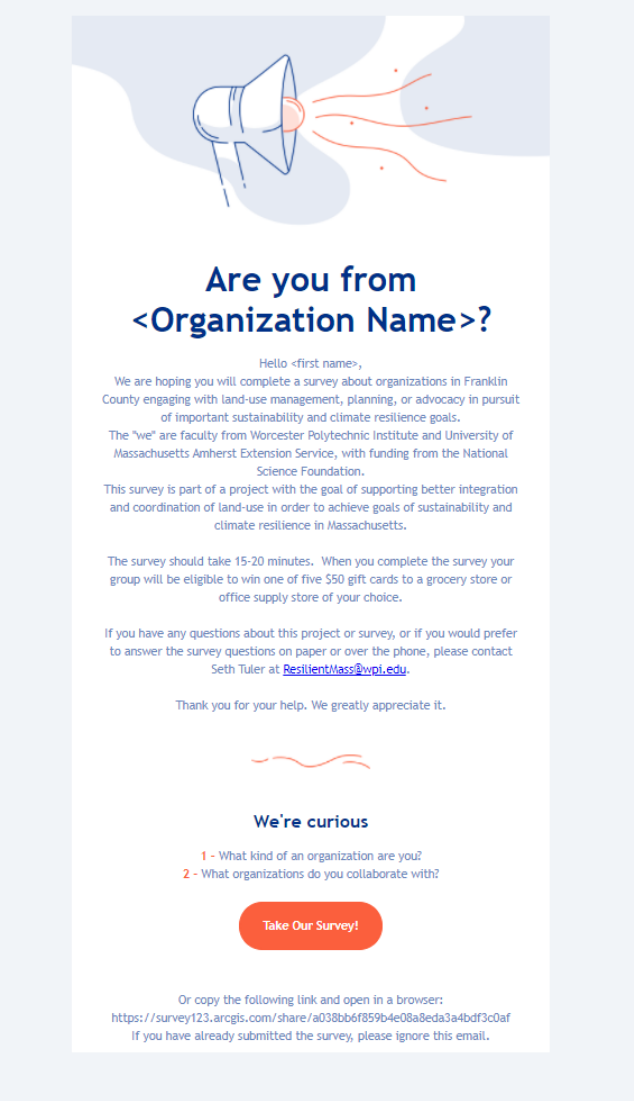

Figure 3 HTML email created for future use

Project Website

During our interview with professionals from the US Forest Service that have previously done a similar project, it was suggested by them that we create a project website for anyone that may want to take our survey or interact with our results to look more authentic and to have one place to display data and information (See figure 4). We created a static HTML website that contains a portal to the survey, an embedded interactive map of our survey results, our survey statistics and some links and contact information. It is temporarily hosted on an external website (https://franklin-ma-stew-map.glitch.me) and will be ported to a WPI Global Labs address. Unfortunately, we were unable to make this website update live, so users will not be able to see their survey inputs appear in the interactive map and statistics right away. This could potentially be automated to improve through future iterations of this project.

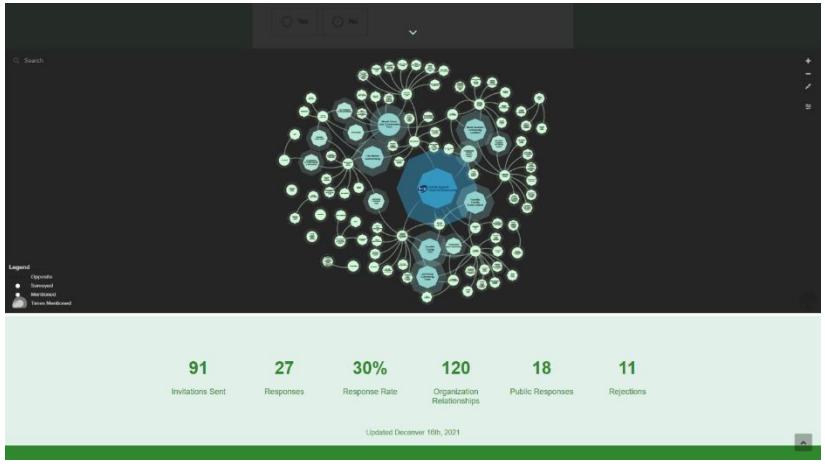

Figure 4 Project Website

Result Processing

Geographic Map Generation

The second major step we conducted was making the network communications map using the STEW-Map approach using ArcGIS. ArcGIS is a mapping software that allows the user to input data in layers to map a variety of different variables. The goal of the network map to comprehensively highlight the gaps in communications between land use organizations in different sectors. This will provide the scaffolding for future, bigger projects that will tackle the issue of how to best utilize network gaps to improve Massachusetts sustainability efforts.

We found it was easier to keep the dataset consistent and make small, surgical edits when necessary. This is so that when we export the data set back to ArcGIS, we do not need to rearrange anything because it is already in the format it expects, the format we received it in. We've also added a significant amount of documentation and comments, as well as reworking for code clarity and conciseness.

We were given the processing script that the Forest Service team used to process their Survey123 results into a usable map. This script is a Python script in the form of a Jupyter Notebook, which is the recommended means of back-end ArcGIS development. This Jupyter Notebook operates as a collection of "cells" which contain Python or Markdown which is used to explain the functionality of the Python cells. At a large scale, the script loads in the survey response data, finds latitude

and longitude for every cell with an address or zip code, creates some plots which visualize the data from certain questions, and sends all of that back to ArcGIS to then be embedded in a Web App. This will be the next step for our process, embedding the results of our script in a Web App and building out the functionality of the App, including queries and filters and other tools to let people interact with the data in any way which they might find meaningful.

In general, the work we have done on the Forest Service script constitutes adaptation and debugging. The reasons we had to adapt came from differences in the survey and API changes. Our changes to this script additionally reflect an effort to simplify the code to reduce the errors. For example, in the Forest Service version, they make a significant number of edits to the dataset: adding and removing columns, reordering, etcetera. Then, at the end they force their dataset into a hard-coded format.

Somehow, they were able to input their login credentials outside of the script, likely in the install of the ArcGIS module into their python virtual environment, but we were not able to figure that out, so we had to type our credentials into the script. This is something future executors of this process might raise issues with as it is certainly a security issue, and if the script needs to be published could compromise the integrity of the author's ArcGIS account and potentially leak information that respondents had asked to be confidential / anonymous

More specifically, the Forest Service version of the script began by accessing their survey and importing that survey's data into a data analysis tool called a Pandas DataFrame. In our altered version of the script, we changed the code to instead access the survey data in the WPI ArcGIS organization. We kept the Pandas DataFrame to handle the data as it is recommended in the ArcGIS Developer documentation. The next cell of their notebook removed a hardcoded subset of their entries which they explained in a comment were test entries. We modified this to search our data to remove our test entries, or more specifically entries whose Contact Name is 'This is a test by Seth'. They also had other forms of cleaning and formatting scattered throughout the notebook, but we decided to frontload all this type of processing so then throughout the rest of the notebook we were dealing with a clean and consistent data set.

This formatting includes putting phone numbers and dates in a consistent format, removing duplicate entries (just in case), and replacing NaN (Not a Number) values with that column's version of 0 (meaning columns have different data types). This last part was not a part of the Forest Service's script, in fact it appears that at the time of the creation of their script the default value Survey123 puts for an unanswered question was a String with a space, and they went through and replaced all the spaces with NaN. Now, Survey123 puts a None Object instead of a String with a space. Additionally, we're not sure if this was the case when they wrote their version, but NaN values break the JSON compliance of the data set, meaning that it cannot be converted into a map form and sent back to ArcGIS, so we had to write new code to clean out all the NaN values. The next step of their script does the geolocation for every entry which contains an address. This part was not working because of the JSON compliance previously mentioned, but as part of the

debugging process to find out why this was not working, we ended up reworking it to be more compact and to not change the shape of the data frame. The next 7 cells in their script are dedicated to plotting “Stewardship Function”, “Site Type”, “Organization Focus”, “Information Sharing”, “Org Services”, “Budget Questions”, and “Volunteer Hours”. The first three datum and the last one is the same in both surveys, but the other three work differently. The “Information Sharing” is a much larger part of our focus than it was for the Forest Service, and so our data for that question is stored separately. We also do not ask “Org Services” or “Budget” questions, most likely this was removed by Professor Tuler before we even saw the survey. We will potentially adapt these cells toward data we do have if there is a need for more than the 4 diagrams we can generate. Also, we can generate the plots using their code, but we have not adapted it toward the consistent-shape style; so, if we generate the plots, we cannot send dataframe back to ArcGIS. We will have to look at how ArcGIS’s Web App Builder works to know if we need to adapt the code or if we can save the generated plots as images and embed those images in after exporting the dataframe. Finally, the “Turf” layer which the Forest Service’s script is supposed to generate is not appearing on the exported map, this may be due to the significant rearrangements we have made, or potentially the layer is there, and we are just unable to view it yet. Much still needs to be done with the map generation process, and then after that there is much to do with the Web Application which the map gets embedded.

Network Map Generation

A major part of this survey is to collect information on the collaboration between organizations and the nature of the collaboration. A network map was deemed the best method to display data in that manner. By the recommendation from the interview with the US Forest Service, we chose Kumu.io for an online interactive network map database.

For Kumu to display the data, it first needs to be processed to Kumu’s formats. Kumu expects two Excel sheets that contain the organizations (the nodes on a network map) and their collaboration (the edges and its type). We made two more sheets in the MasterList called the NodeList (See figure 6) and the EdgeList (See figure 5), as well as an external Excel file for importing to Kumu called Kumu Post Process Sheets. This file contains Excel formulas that are dynamically linked to the MasterList’s NodeList and EdgeList to process data and filter what gets uploaded to Kumu.

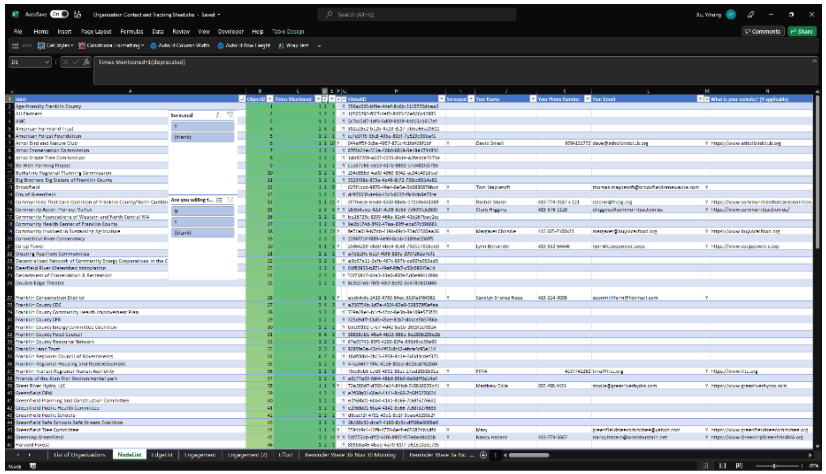

Figure 5 NodeList in MasterList

The NodeList and EdgeList are manually processed versions of raw survey data (csv files) exported from Survey123. They use survey questions as their form headers and each row is a survey response from an organization (NodeList) or a collaboration connection from one organization to another (EdgeList). Manual work is required at this stage to process some columns in the NodeList to human readable formats (like replacing all “OF_PubHlth” with “Public Health”) and Kumu readable formats (like replacing “,” separators with “|” separators for creating tags). It is also important to clean any data wanted on the Kumu. This includes fixing all website addresses to the standard “https://www.” style, fixing twitter handles and making geological addresses separate correctly. Then, copy all collaboration “targets” from the EdgeList to the NodeList so every “source” and “target” in the EdgeList can be found in the NodeList. This part needs careful manual work so duplications are eliminated, and organization names are consistent. We did this by alphabetically sorting organization names and then checking from top to bottom for potential issues such as: misspelled words, acronyms, and alternative names. Additionally, there may be problems like one user filling out one survey for multiple organizations instead of submitting multiple survey responses, or one collaboration entry containing multiple organizations. This part will take most of the post processing time for the future project since it will get much heavier as the list grows.

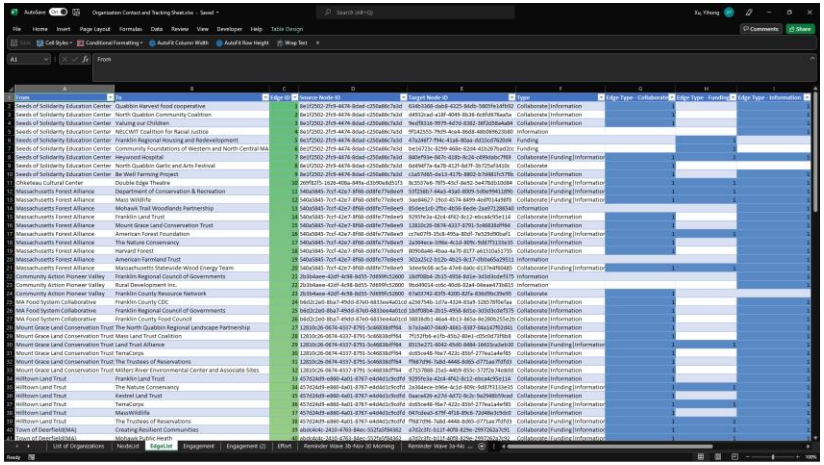

Figure 6 EdgeList in MasterList

The next step for post processing was filtering the data for Kumu. We made another Excel file and another pair of NodeList and EdgeList (See figure 7). We did this for multiple reasons: First, we do not want all the survey questions and answers to be accessible on Kumu, so columns in these sheets dynamically take data from the MasterList sheets and process it to look professional. Second, survey results do not look good unprocessed, some columns contain formulas to automatically format information only if that section was filled and leave it blank if that organization did not answer that question.

Conveniently besides those, we also wanted to change column names for Kumu so they show up to be reasonable which is something that comes with a new list.

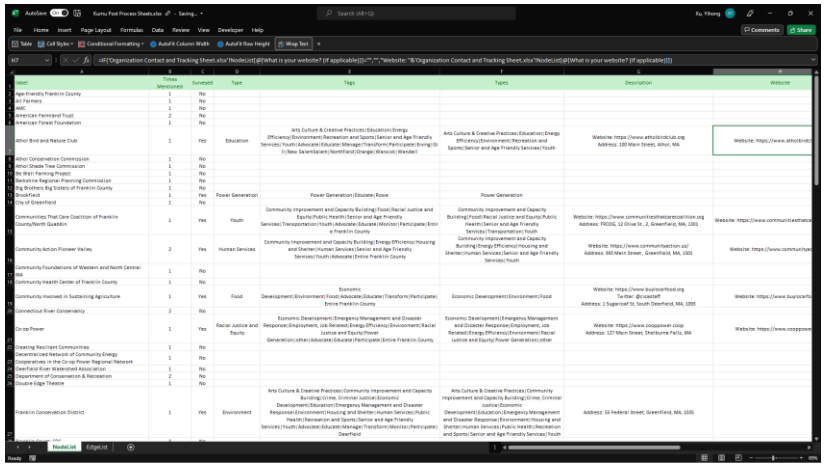

Figure 7 NodeList in Kumu Post Process Sheets

The better processed the sheets are, the easier they are to work with after being uploaded to Kumu.io. Importing the sheets are simple and Kumu tests the sheets for compatibility issues. After importing, a plain map (See figure 8) should show up along with a view editor on the right for further customizations. We used the advanced editor and wrote multiple pieces of code to function as different selectable views (See figure 9). Many views are based on a basic view as they import the “basic view” code segment to improve readability and organization.

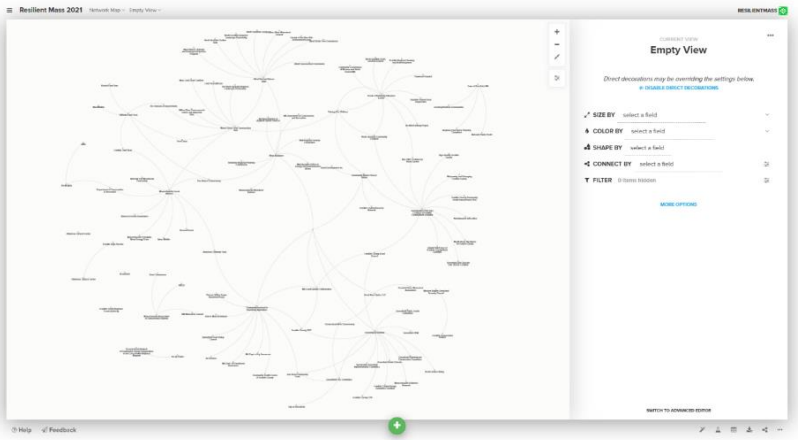

Figure 8 Default view after import

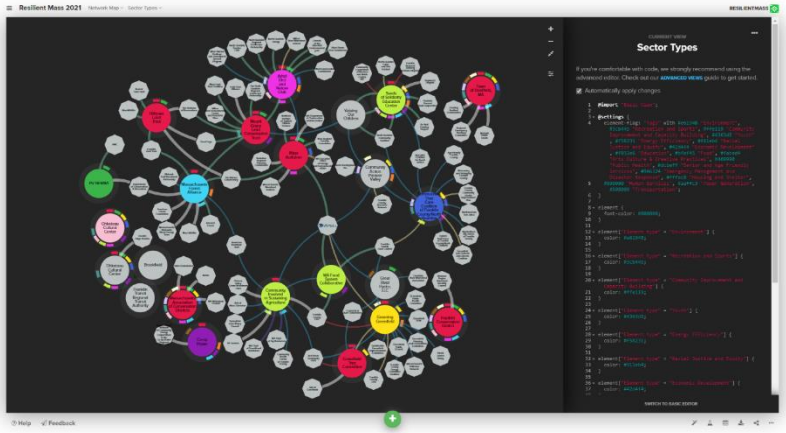

Figure 9 The “Sector Types” custom view

Findings and Analysis

This chapter contains the two halves of our analysis. The first part will focus on the survey results and data. We begin by analyzing our broad results which contain the survey response rate data that we have. This will be followed by a brief analysis of our ArcGIS geographical map. Next, we outlined some of the key plots and results from some of the more important questions in the survey. These are the key raw results from the survey we are highlighting. Our questions and response rates for each section of the survey can be found in the appendix. The last half of the chapter focuses on the analysis of the process. This part focuses on some of the lessons we learned throughout the project. This is to help future researchers to streamline their project and avoid some of the obstacles we faced and build on the positives. It contains key takeaways the group pulled from the project as well as a few obstacles the group faced. Then we detail the limitations of our data focusing on the issue of sample size. This is followed by a section that touches upon the portions of the project that have yet to be fully realized in terms of scalability. This section contains both the issues and potential solutions or avenues to reach solutions for future larger scale projects.

Analysis of Broad Results

Survey Statistics

At the time of writing, 91 survey invites were sent in total and we received 27 responses. 11 organizations rejected the survey for reasons like relevancy or privacy problems. 53 invites did not give a response. This represents a surprisingly high 30% response rate (Please note that the response statistics were updated to reflect late submissions, while the analysis data only contains the original 24 worth of data). It is much higher than our expectation of 10%-20% responses. In fact, when the US Forest Services did a similar survey in Springfield County, MA, they only received a response rate of 6 %. Out of the 27 responses, 20 organizations were willing to have their information posted on a publicly accessible website. 25 organizations submitted other land use groups that they collaborate with, and they reported an average of 5.5 other organizations. We see this as a great success in our procedures of contacting organizations, especially sending weekly reminders. Although the percentage is high, keep in mind that this is still a small sample size and just a snapshot of Franklin County.

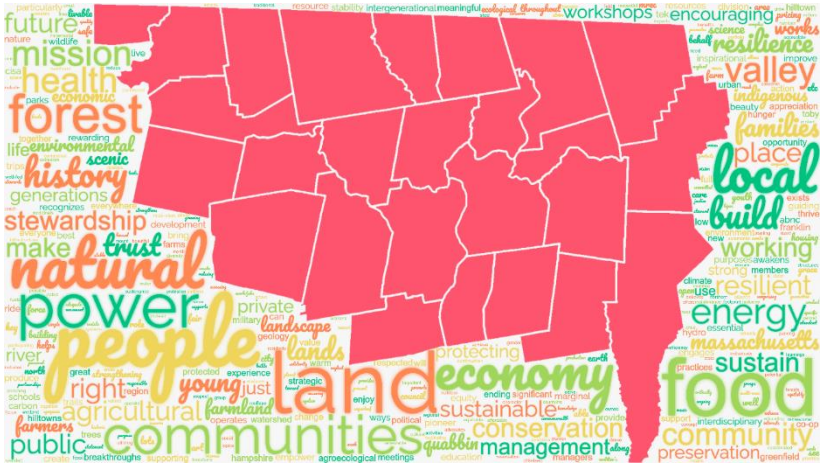

Figure 10 Organization Mission and Vision

Geographic Map Analysis

Example Geographic Map

As part of our analysis, we created a geographic distribution of organizations that responded to the survey. Responding organizations are represented by the red dots, and the shaded blue is Franklin County (See figure 11). This image does not actually include every organization which responded as responses were coming in on a continual basis, and it is merely included to give an example of what the interactive map is capable of. This is the result of the geographic map generation efforts described in the Methods section. This will also be available on the website so that users can get a sense of the organizations involved before examining the interactions between them in the network map.

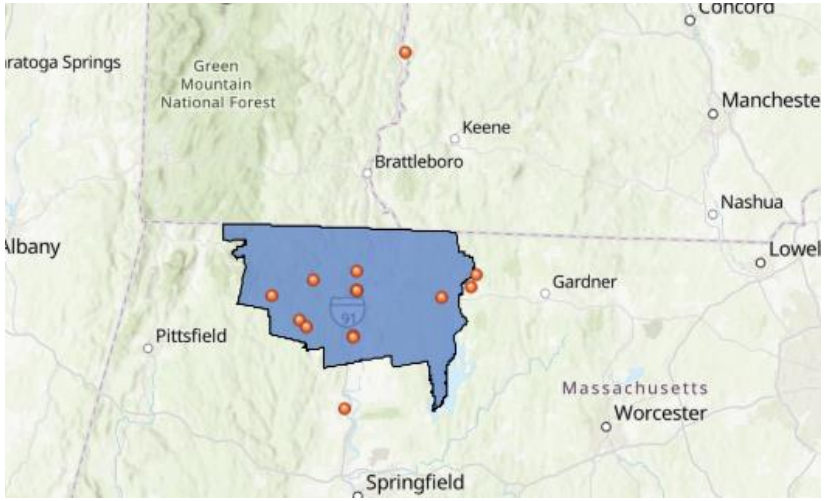

Figure 11 Example Geographic Map

Example Geographic Map Interaction

The map is interactive, so users may click on an organization to bring up a popup menu containing that organization's survey responses (See figure 12). This is a great way for interested parties to interact with the data and get an understanding of the surveyed organizations before shifting to analysis of the network map, where is more fruitful territory for analysis since it is much easier to visualize multiple aspects of the data. In the future this will be a useful tool for organizations to find valuable information.

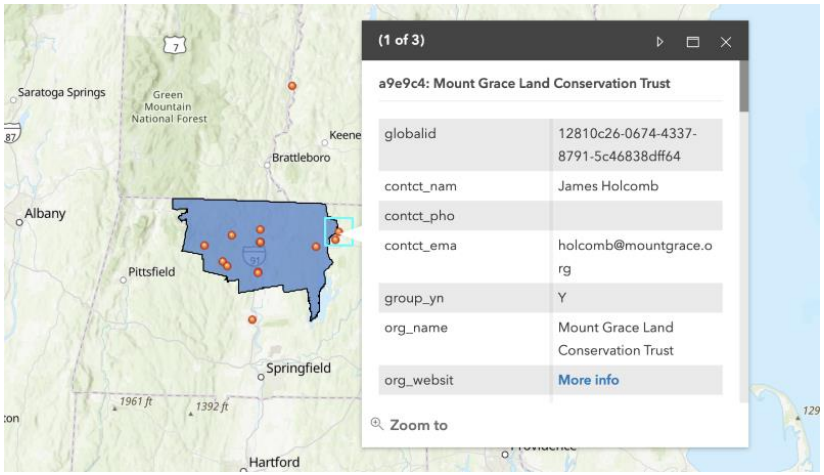

Figure 12 Geographic Map Interaction

Network Map Analysis

The Basic View

To start we created a network map with 22 of our respondents which are shown as circles with lines representing their collaborations connecting them to each other and to organizations they mentioned represented by octagons (See figure 13). Although this view of the map is more basic, there were still things we were able to learn. The first is that a large majority of the respondents were part of a single network. Rather than being several disconnected networks or not forming networks at all, the organizations we surveyed were interconnected even with the small sample size which implies that Franklin County represents a highly connected network.

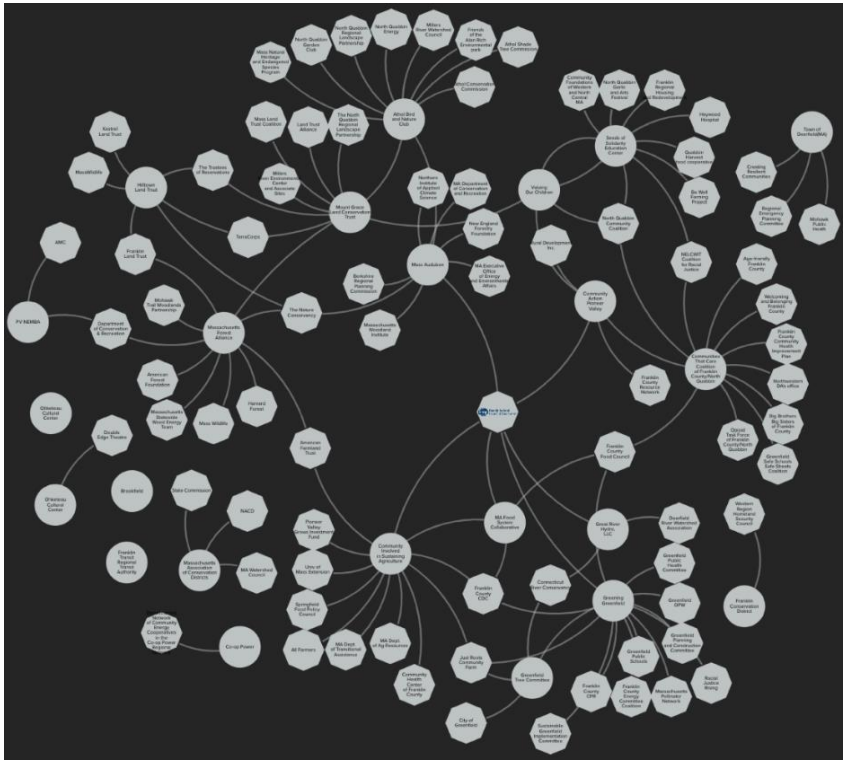

Figure 13 Network Map - Basic View

Collaboration Types

In addition to asking organizations who they collaborate with, we inquired about the nature of their collaborations. We can see that across organizations there is a high level of shared information. Information sharing was included in 88% of collaborations (See table 1). There were fewer organizations participating in direct collaboration on joint initiatives with only 60% of collaborations including this type; however, this was still more than shared resources which was only in 29% of collaborations (See table 1). This is not necessarily a fault; it is difficult to say with confidence whether the network would benefit from more circulation of resources. From this we can see that the frequency of collaboration types follows a progression from the least committal forms and builds towards more complex and resource intense forms. If we take into account combinations of the three measured forms of collaboration, something interesting is noted. From this we can see that these forms of collaboration are largely dependent on other, more common and less intensive collaborations, with joint initiatives appearing most often in conjunction with information sharing (green connections, see figure 14), and shared funding appearing most often in collaborations including both information sharing and joint initiatives (grey connections, see figure 14).

Table 1 Organization Collaboration Types

Collaboration Type	**Count**	**%**
Information	99	88%
Collaboration	68	60%
Funding	33	29%
Total	**113**	

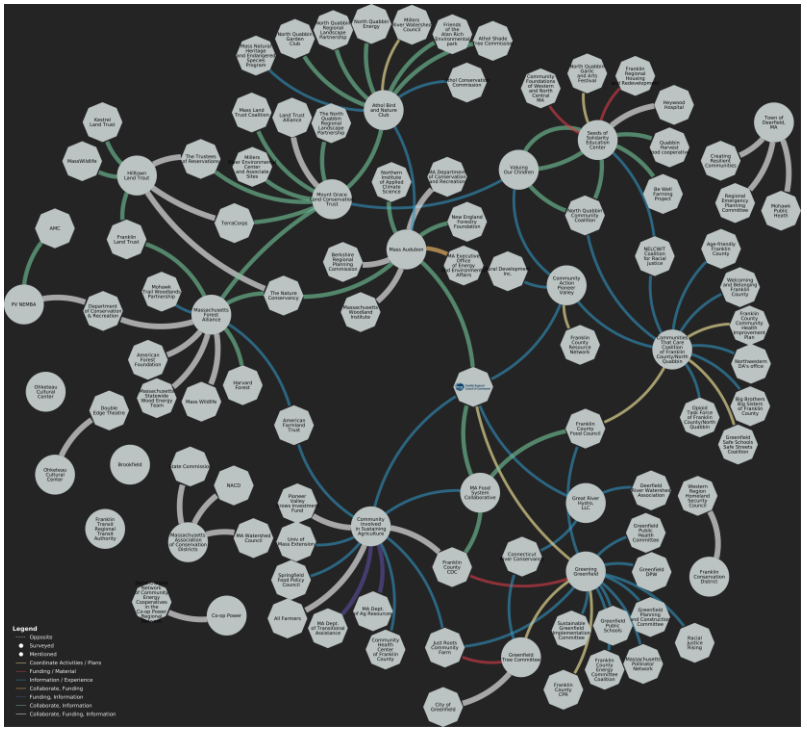

Figure 14 Network Map - Collaboration Types

Collaboration Frequency

In the network map of Figure 15, we have scaled the size of each organization by how many times it was listed as a collaborator by another organization. In essence, this shows how important a node is to the overall network of collaboration. Some organizations are floating by themselves because they did not connect to the "main grid" of collaboration. And as we can see, the largest node that was mentioned the most times, is FRCOG (the Franklin Regional Council of Government) (See table 2). This is to be expected as they were a large player within the Franklin County community. Some other groups such as the Just Roots Community Farm which had a high mention rate were confirmed to be larger players as well. This indicates that this frequency is at least partially representative of the connectedness of organizations working within Franklin County, however, it is still possible that some of our highly mentioned organizations are more minor than they appear, that some major players appear to be minor or that we are missing some highly connected organizations merely based on the random sample and size.

Table 2 Organization Collaboration Frequency

Times Mentioned	Number of Organizations	%
6	1	6%
3	6	17%
2	8	16%
Total	**103**	

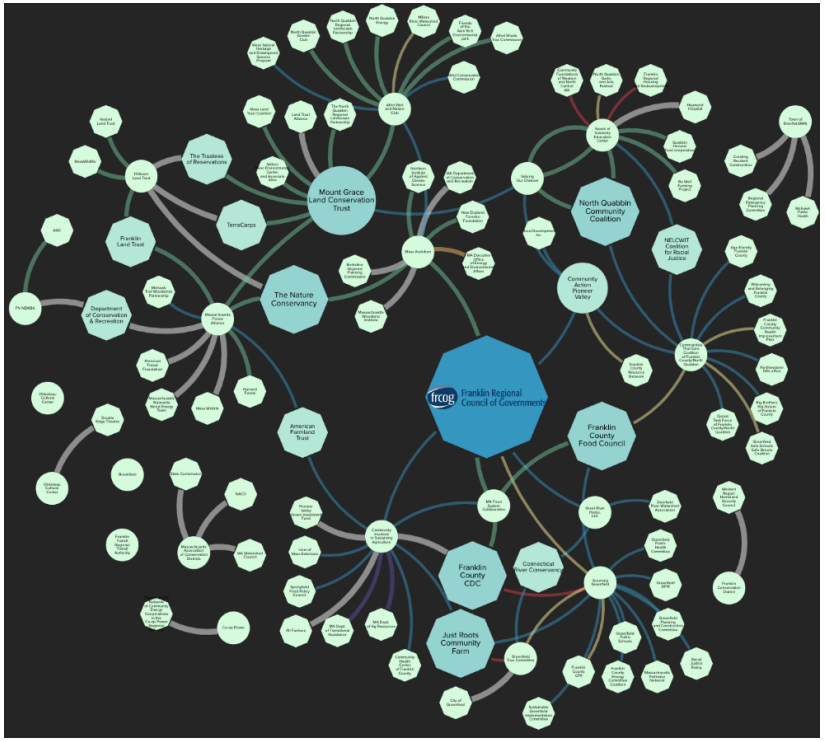

Figure 15 Network Map - Collaboration Frequency

Sector Types (Full Network)

Figure 16 visualizes which sector each organization works in. The responding organizations are the large colored bubbles, and the organizations they mentioned, which did not take the survey, show up as the small grey dots. The organizations chose from a list of sectors, for example, “Environment”, “Recreation”, “Food”, “Racial Justice”, etc. Organizations were asked to choose a primary sector as well as list all the sectors they think they also participate in. The primary sector is represented by the color of their bubble, and secondary sectors are represented as the colored tags surrounding it.

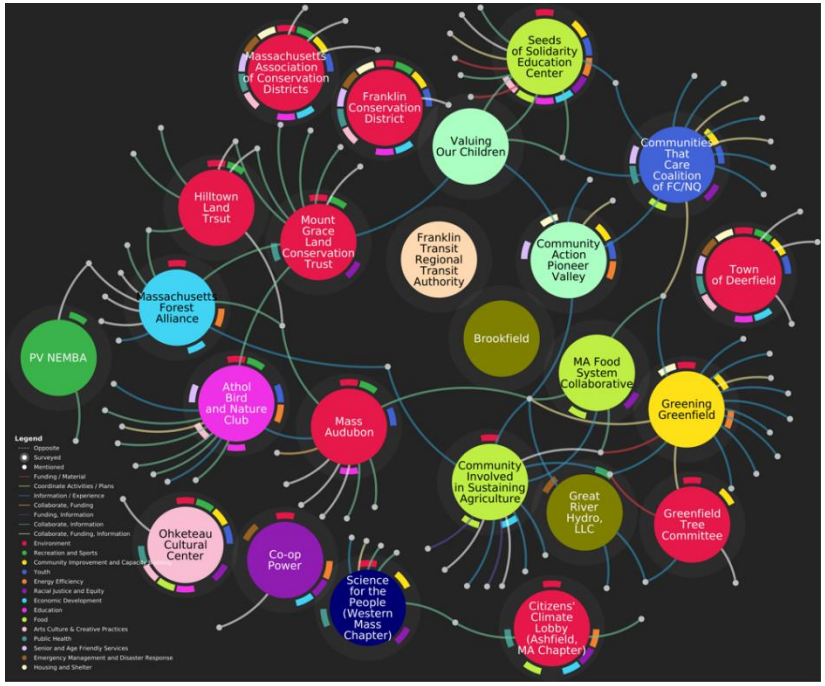

Figure 16 Network Map - Sector Types

Table 3 Sector Types

Sector Type	**Primary**	**All**
Environment	25%	60%
Food	15%	25%
Recreation	5%	40%
Community Improvement	5%	35%
Youth	5%	35%
Racial Justice and Equity	5%	30%
Economic Development	5%	25%
Education	5%	25%
Arts / Culture	5%	20%
Energy Efficiency	0%	30%
Public Health	0%	20%

Sector Types (Filtered)

In Figure 17 we have filtered out organizations that only got mentioned but do not connect to anything else to simplify the view. Most of the organizations are working on the Environment sector, both primarily and in general while sectors such as Arts and Culture, and Public Health had much lower engagement (See table 3). One interesting note was that three respondents, the Town of Deerfield, Massachusetts Association of Conservation Districts (MACD), and Franklin Conservation District (FCD), had identical responses yet did not list each other as collaborators (See figure 17). This could represent a missed opportunity for these groups to work together, however, it is also possible they simply neglected to list each other when answering the survey. The latter seems highly likely to be the case for the MACD and FCD, as the FCD are likely members of the MACD since it is a conservation district in Massachusetts but may not have considered this to be a collaboration.

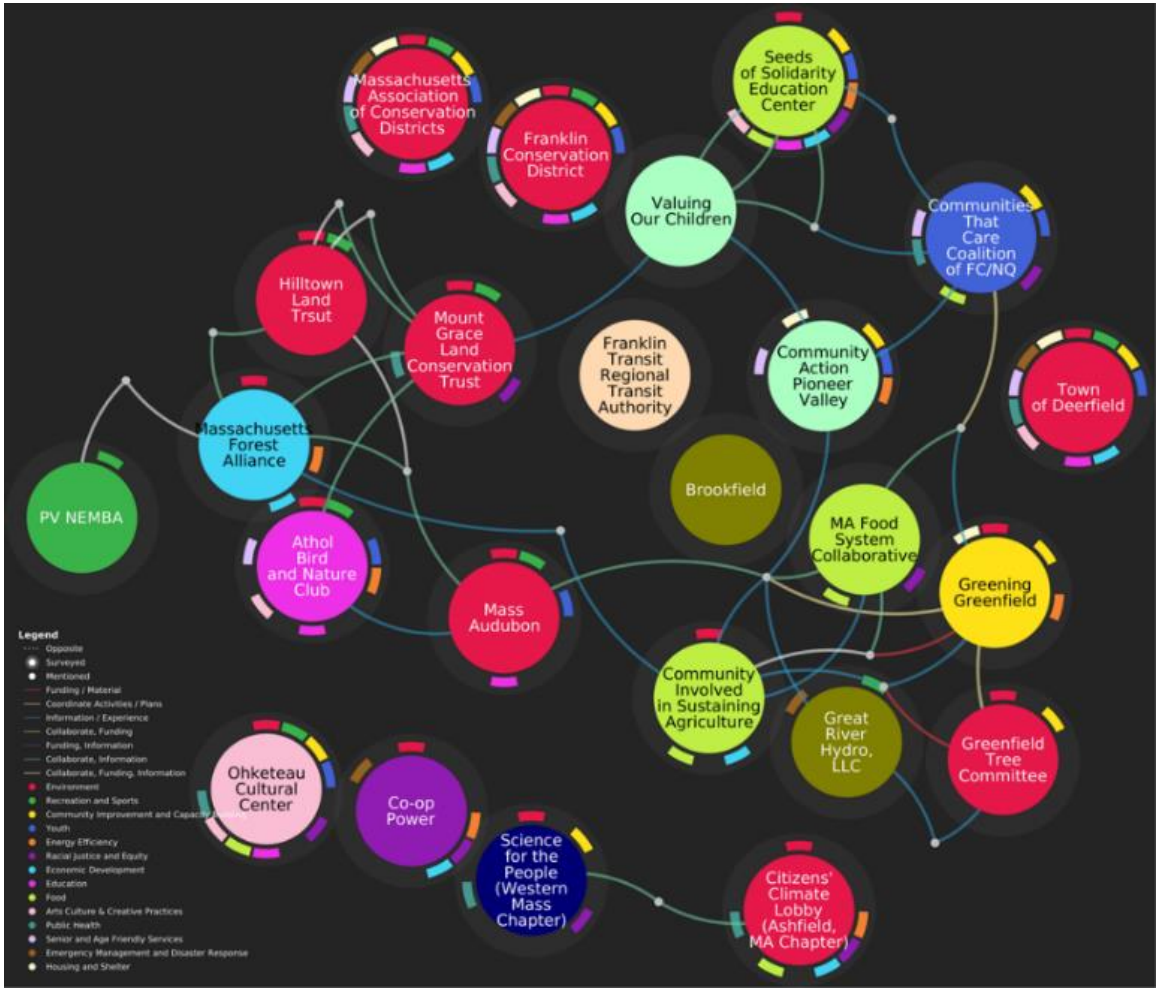

Figure 17 Network Map - Sector Types (Filtered)

Engagement Types (Network Map)

Aside from determining the primary focus of the organization, we also surveyed how they worked. This was again split into two parts, a primary form of engagement represented by the main color of the bubble, and all forms of engagement participated in, represented by the colored tabs surrounding the bubbles (See figure 18). There were six different types of engagement, each matching a color on the map. Looking at primary focuses we can see that many groups focused on education or conservation.

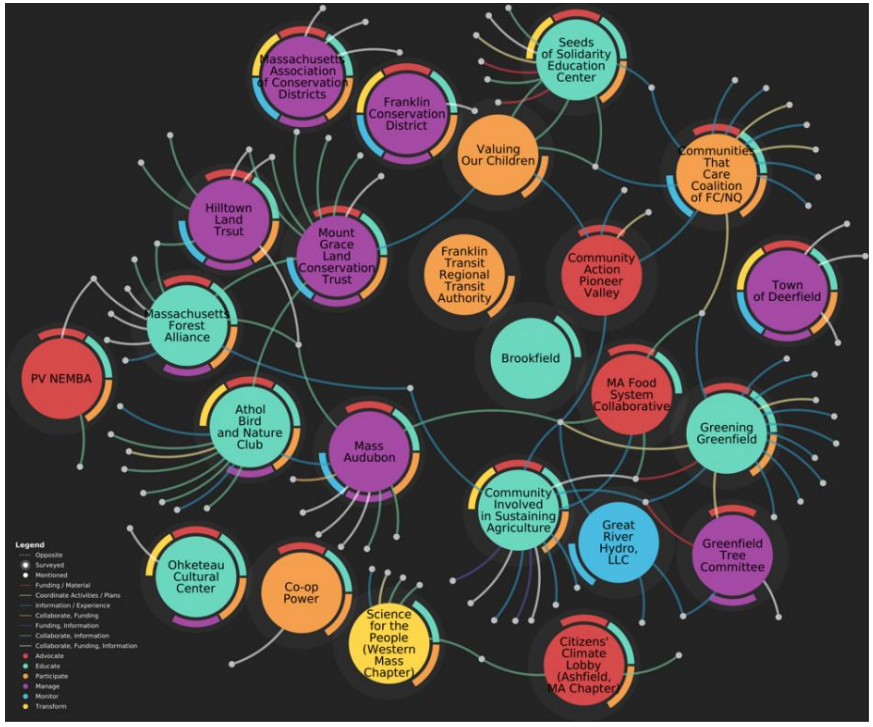

Figure 18 Network Map - Engagement Types

Table 4 Engagement Types

Engagement Type	**Primary**	**All**
***Manage**, conserve, or take care of local environment*	35%	40%
***Educate** the public about land-use policies*	30%	75%
***Advocate** and/or plan for land-use policies*	15%	80%
*Convene or **participate** in work that impacts land-use*	15%	75%
***Monitor** the quality of the local environment*	5%	30%
***Transform** local environmental systems*	0%	25%

Engagement Types (Bubble Graph)

As with primary focuses, participation in conservation efforts and educating were popular forms of engagement, however, advocacy also found a place with 80% of organizations listing it as one of their forms of engagement (See table 4). The fact that nearly every group took part in advocacy speaks to its importance to the groups of Franklin County, but the fact that it was relatively small as a primary focus tells us that it works best as a supplement to the other ways an organization engages. However, it was also interesting to note how few groups focused on monitoring the environment and transforming environmental systems (See figure 19). While this is consistent with the data from organizations' primary forms of engagement, this indicates a lack of these types of engagement within our network. While it is possible groups who participate in these types of engagement were simply not represented in our survey respondents, it is also possible they are less popular or less accessible.

Figure 19 Bubble Graph - Engagement Types

Types of Organization Activities

Additionally, we asked for organizations to choose from a list all the activities they engage in (See Appendix D). We then asked them to choose a primary activity from the same list. What we found was that much of the work in Franklin County is focused on Climate Resilience, which tells us that this topic is of a large concern, however, there were only a few organizations who chose this as their primary activity meaning this was not the most important activity for many groups. The most common primary activities were "Forest / Woodland" which made sense given the rural forested landscape of Franklin County, and "Racial Justice and Equity" which shows that this topic is a priority in the area. Also of note was that of the least popular activities both overall and as primary activities, a large portion were water related, although streams, rivers and canals were one of the most popular secondary activities.

Where Effort is Focused (Category)

We then asked organizations to rank the effort they put into various broader categories. We represented each category as a bubble with each one sized to the average amount of effort for that category. From this we found that "Climate Resilience", "Public Health", and "Equity, Diversity, and Racism" were the categories with the most focus (See figure 20). On the other hand, categories such as "Housing and Development", and "Urban Sustainability" had significantly less focus. This could be due to the rural nature of Franklin County, however, it also represents an opportunity for groups with an emphasis on these activities to enter Franklin County.

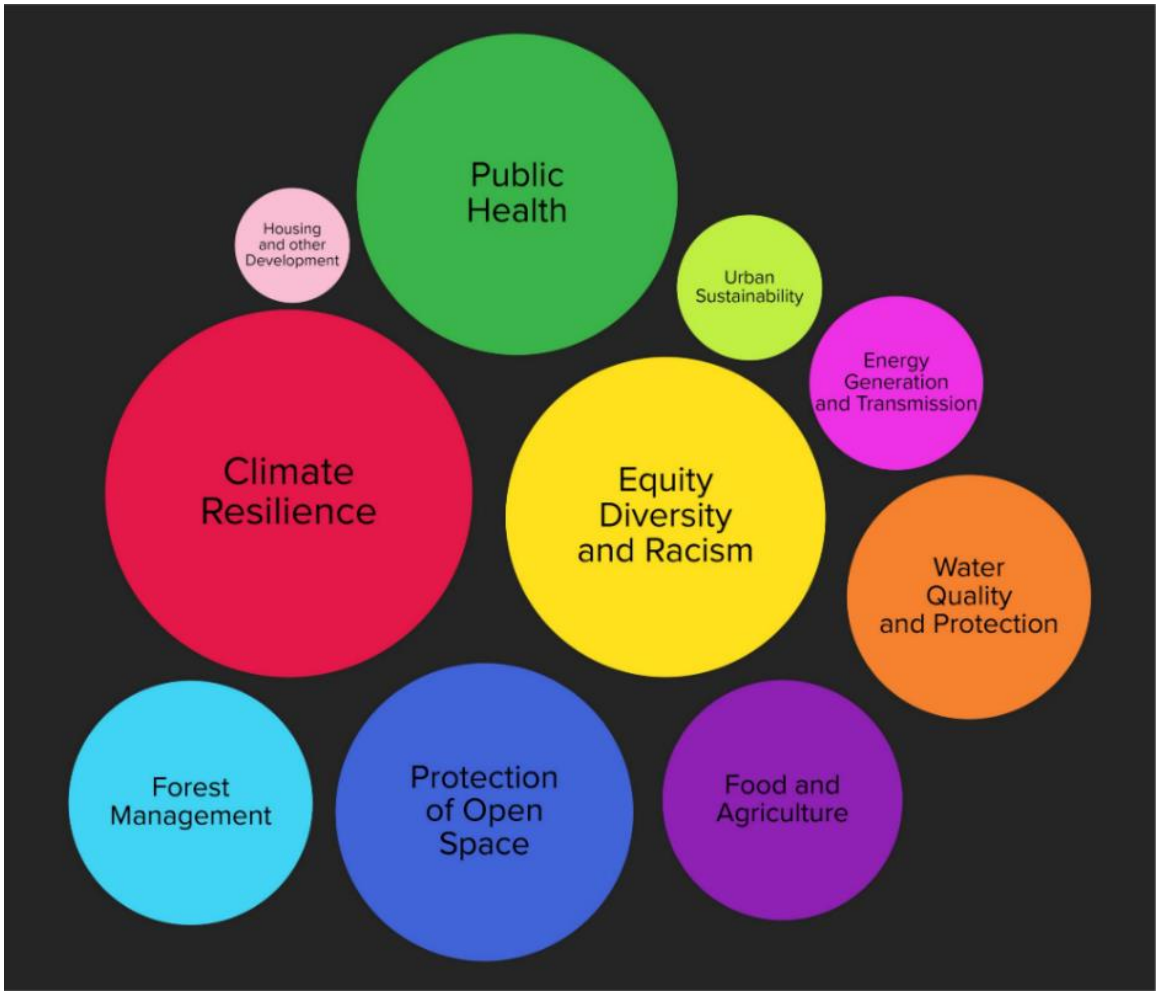

Figure 20 Bubble Graph - Effort Categories

Where Work is Focused (City)

This plot highlights where the organizations work within Franklin County. We can see that most organizations work countywide and that the seven towns in light green also have a heavy presence of land use groups notably Greenfield which is the largest town in Franklin County (See figure 21). Although it was surprising to see some towns only have one organization present, Franklin County is relatively small and is home to some of the smallest towns in Massachusetts, so this was to be somewhat expected.

Findings Summary

Franklin County is a diffusely populated, rural area. The land use organizations in Franklin County are surprisingly collaborative, the network of collaboration is well-connected with only a few isolated organizations. There is a large focus on the environment, and most of the work in these areas involve educating and advocating. There is also a focus on the people as well, with a high focus in areas such as racial justice and public health.

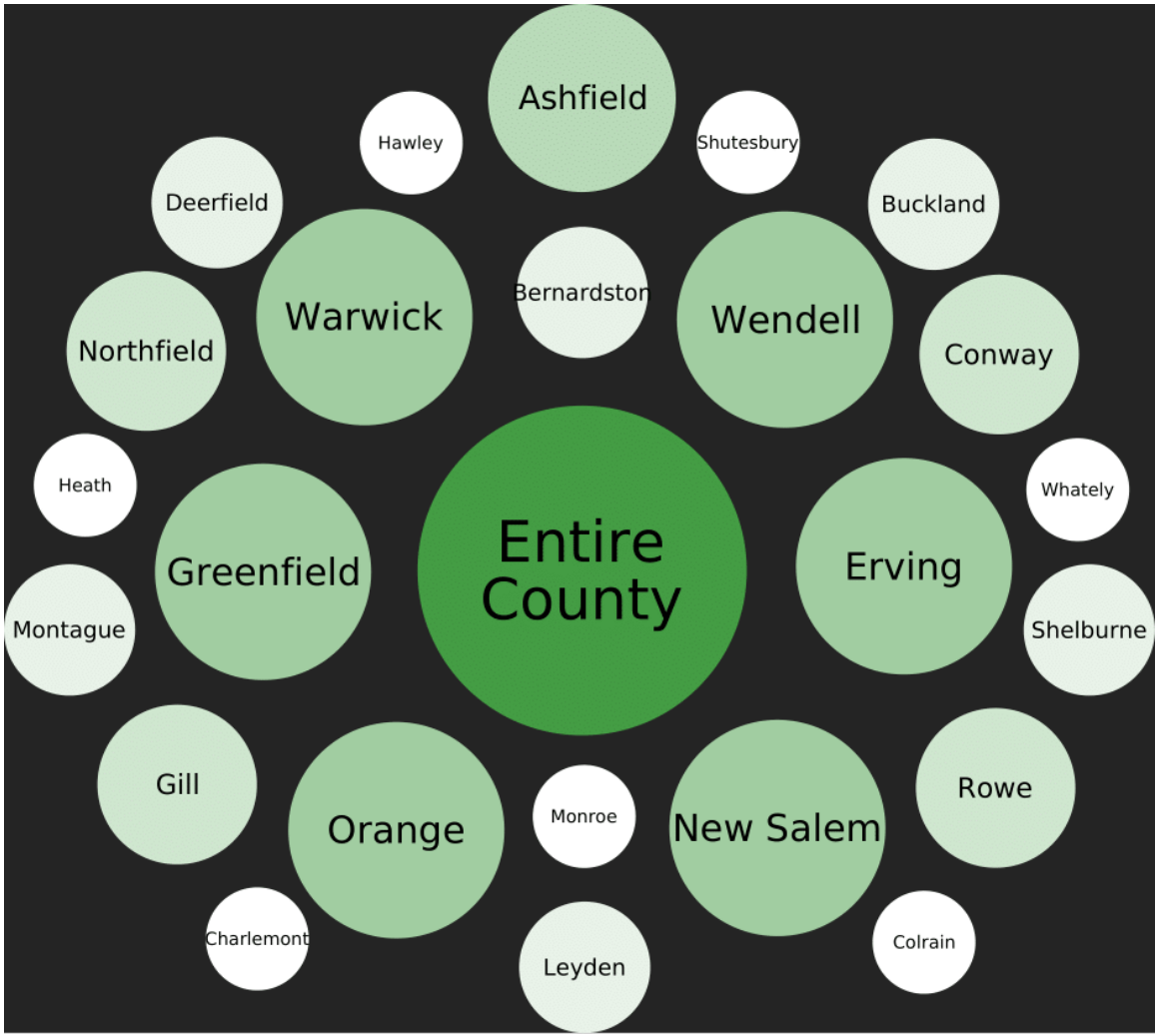

Figure 21 Bubble Graph - City

Analysis of Process

Scalability

A big focus of this project was scalability. Throughout this process, each aspect of this project must be scalable since Franklin County is not the final goal of the project. Ideally this network map will be brought to a statewide level. Yet, we do not think the current methods for this project are scalable to that degree assuming there to be 10 times more information and number of organizations. This is due to multiple concerns.

The most significant issue with scalability is the need for manual data cleaning in organization names in the collaboration section of the survey. The user is asked to type into textboxes to enter organization names they collaborate with. This is the most important part of this survey, but it was completely user generated "random" text that machines cannot automatically match together. This means it needs manual work for each organization mentioned to match its name with the names of organizations that currently are in the list. For example, respondents used acronyms and abbreviations that represented the same group. These entries, although referring to identical organizations, could not be compared unless we manually formatted them to be the same.

We suggest that in a scaled version of this project, the users are provided with a search box to select from a known list of organizations. If an organization is not found, the user should also be provided with a checkbox for "organization not listed" prompting a new textbox for them to add the group. The new organizations should be added to the known list of groups to improve the user experience for future respondents. We provided a working version similar to this method at the start of making the survey but decided to revert to an open response textbox so users who are not technologically inclined can also use it without additional guidance. We suggest changing it back while revising the instructions to guide the user on how to search and add organizations they work with. This way, the most manual-intensive part of the survey will no longer require manual matching of each entry, which will improve the project by eliminating human error.

We strongly recommend this method to prevent manual work overload when too many organization relationships are entered for manual data cleanup to be feasible. For each entry we needed to match each new organization with the entire list of organizations we had on record to see if they meant the same organization. When we manually processed the user generated data for making the NodeList and EdgeList in the MasterList, there were 17 versions created. Each corrected the former version just to eliminate data errors we did not find previously. Each iteration is increased manual labor that will only intensify once this method is implemented at a larger scale.

A simple calculation: if working with 20 responses, and each proposed 5 organizations that they work with, only 20*5 = 100 new organizations need to be matched with all entries in the list of 100 organizations we already have, which will be 20*5*100 = 10,000 comparisons. However, if working with 200 responses and a list of 1000 organizations, 200*5*1000 = 1,000,000 comparisons are needed. Whole document searching and other tools cannot replace manual checking because user entered data will contain misspelled words, acronyms, and alternative/inconsistent names, etc., and that it will come with a great margin of human error.

Another issue that we had was that we needed to manually track organizations' progression within our process

pipeline instead of having it automated. This meant we had to manually check each organization's status individually and therefore generated a lot of data inconsistency including human mistakes and file version conflicts. Sending organizations survey links with different unique identifiers could let the system know who answered which survey and can help reduce manual work by allowing the organization's information to update automatically. If we did this to keep track of organization progress, we will also be able to automate linking up organizations from the list of organizations and the list of survey responses.

Data Limitations

Despite having a good response rate on the survey and plenty of information to analyze, there are still limitations to the data we collected. To start, there are without a doubt more than 91 land use groups in Franklin County, MA. The 91 organizations we sent surveys out to were just the organizations we were given, found, or were mentioned in the survey. This is important because it creates an incomplete network map. In an ideal scenario, every land use group in Franklin County would take the survey listing all known collaborators. This would create a complete network map. As it stands, we have groups that look like islands on the network map, that very well could work with already known or other land use groups, that simply have not taken the survey. This means we do need to be careful assuming a lack of communication for these organizations. This is important because one of our research questions is whether there are any gaps that show a lack of collaboration in any particular geographical location. With the data we currently have, it is difficult to answer this question definitively.

Important Takeaways

Here are a few key takeaways from the methods. The network map is especially sensitive to response rate, so it is important to make getting responses a priority. We attribute our surprising response rate to the weekly reminder emails that we sent to organizations which gave no response. There were also several people who reached out to inquire more before taking the survey and following up with each of these people proved very fruitful. Conversations with organization representatives showed us the difficulty of communicating our goals and intentions effectively to total strangers over email.

Additionally, scalability becomes an issue when considering addressing the questions of the same percentage of organizations on the scale of the whole of Massachusetts with further explanations. Steps should be taken to eliminate space for confusion in the communication with organizations. It is important to maintain a professional and welcoming public appearance, and to communicate effectively. We learned this lesson our first attempt at distributing the survey, where we accidentally lost all the formatting, graphics, and hyperlinks. With a malfunctioning format and unclickable links, our first impression with many organizations made us look somewhat illegitimate. Organizations are less likely to click links from sources perceived as illegitimate, and this is detrimental to the response rate and the accuracy of the network map.

In its current state, scaling our method to the statewide level would require either significantly more time or significantly more people. As the number of organizations grows, the number of connections grows exponentially. This means the amount of manual labor required to process the connections will also grow exponentially. The survey questions

which asked respondents to name collaborators was a simple text box, so respondents could name an organization however they saw fit. For example, two respondents could list the same organization, but one might use an acronym and the other the full name, so the response data for this question required manual cleaning to make it consistent. We recommend a searchable drop-down of the organization names be used instead of a plain text box to eliminate inconsistency and make it possible to automate. If this part of the process could be automated, the method would become far more scalable, and additionally it then could be possible to create a system which automatically updates the geographic and network maps as new responses come in.

Our final recommendations are this: send frequent reminders, present a professional digital presence, and communicating effectively. Additionally, it may be possible to restructure the survey to fully automate the system, which will make scaling to Massachusetts a much easier process.

This project shows the enormous potential of our sponsor's MILLURS initiative. Having an easily accessible visualization of the collaboration networks across the state of Massachusetts could allow organizations to find and collaborate with other like-minded groups on larger projects. Organizations could discover unattended sectors and fill those gaps so that the land can be used more effectively. Land use groups who are just starting out would be able to quickly find beneficial connections, as well as organizations to take example from. Essentially, organizations will be able to plan how they want to fit into the network and make connections which may have otherwise been missed. While this is not all that the MILLURS initiative could accomplish, it will certainly be a useful tool for land use organizations to help them better take care of Massachusetts and its people.

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Appendix A: Interview Preamble

We are a group of students from Worcester Polytechnic Institute in Massachusetts. We are conducting interviews with land use planning organizations to learn more about their experiences with land use policymaking. Our goal is to assess the degree of collaboration between relevant organizations on land use decision making, and your insights will be extremely useful.

Your participation in this interview is completely voluntary and you may withdraw at any time. If you would like, we would be happy to include your comments anonymously; however, it would be useful for our stakeholders to see the responses from other organizations.

If interested, a copy of our results can be provided at the conclusion of the study.

Your participation is greatly appreciated.

Contact Info Here

Appendix B: Interview Questions for STEW Map Creators

1. What lead you to creating STEW Map?
2. What sets STEW Map apart from similar concepts?
3. How do you think using STEW Map to show information is helpful?
4. What do you see as the Purpose of STEW Map?
5. What is the best implementation of STEW Maps?
6. How important do you think conservation is, and does STEW Map play a role in it?
7. Do you think mapping conservation groups could lead to greater collaboration?

Appendix C: Question Response Rates

Section 1

Question	Response Rate
Your Name*	100%
Your Phone Number	75%
Your Email*	100%
Are you a member of a group or organization?	100%

Section 2

Question	Response Rate
What is your group/organization name?*	100%
What is your website? (If applicable)	93.8%
What is your Twitter handle? (If applicable)	25%
Street Address	81.3%
Suite / Apt #	6.3%
What is your city?	93.8%
What is your state?	93.8%
What is your zip?	75%
What is your group primary phone number?	75%
What does your group work on? Please choose all that apply	100%
Specify Other	12.5%
If you had to choose just one activity, what would you say is your group's primary focus? Please select one	100%

Section 3

Question	Response Rate
Please describe the mission of your group. If you have a formal mission statement, please use that, otherwise use your own words to describe your group's goals. (255 characters or less)	81.3%
What is your group's vision related to sustainable and resilient landscapes?	87.5%

Does your group engage in any of the following in Franklin County, whether in rural, suburban, or urban areas? Please select all that apply	100%
Of these functions what is your primary activity? Select one of the options from below	93.8%
Does your group measure progress towards sustainable and resilient landscapes?	93.8%
If yes please list metrics that your group tracks	43.8%
Is your group concerned about plans or decisions that may result in conflicts among competing goals for energy generation systems, forest and open space protection, and/or housing development?	100%

Section 4

Question	**Response Rate**
In which cities and towns in Franklin County does your group's work focus?	100%
What is the broadest geographic scope of your group or your organization's activities?	68.8%
In the last 5 years what are the ways that your group's work engages with sites or activities that impact land-use? Please choose all that apply	100%
Specify other	18.8%
Of these, which is the primary way your group's work engages with sites or activities that impact land-use? Please select one	100%
Specify other	6.3%
Energy generation and transmission	93.8%
Food and agriculture	93.8%
Public health	93.8%
Climate resilience	93.8%
Equity, diversity, and racism	100%
Housing and other development	81.3%
Forest management	81.3%
Protection of open space	87.5%
Water quality and protection (rivers, lakes, etc.)	81.3%

Urban sustainability	75%

Section 5

Question	**Response Rate**
Please add up to 10 groups with which you work	87.5%

Section 6

Questions	**Response Rate**
What is your group's legal designation? Please choose the most appropriate response.	93.8%
How many full time staff does your group have?	93.8%
How many part time staff does your group have?	93.8%
How many members does your group have?	87.5%
How many volunteers does your group have?	81.3%
Please estimate the total number of volunteer hours per month contributed	75%
What year was your group founded	81.3%
Are you willing to have information about your group/organization included on publicly accessible web-based map? The information that will be shared will be limited to: name and contact information for the group (not your personal information), organizational mission, type of organization and focus of work, where the organization works, size of organization (within categories of ranges of staff). An example of what this can look like is here, from the New York Stewardship Mapping project	100%
Please select if you would like more information about our project, including opportunities to participate in future workshops about visions for future land use and landscapes in Massachusetts to achieve sustainability and climate resilience goals.	100%
Is there anything else you would like to tell us about your group or this survey?	31.3%

**Required Questions*

Appendix D: Types of Organization Activities in Recent 5 Years

Activity Type	All	Primary
Climate Resilience	57%	9%
Racial Justice and Equity	43%	17%
Food System	43%	13%
Forest / Woodland	35%	17%
Stream / River / Canal	35%	4%
Park	35%	0%
Watershed / Sewer Shed	30%	4%
Community Garden	30%	0%
Ecosystem Management	26%	4%
Sustainable Energy	26%	4%
Freshwater Wetland	22%	0%
Urban Farm	22%	0%
Street Tree	17%	4%
Green Buildings and Rooftops	17%	0%
Lakes and Ponds	17%	0%
Waterfront / Beach / Shoreline	17%	0%
Bike Paths / Greenway / Rail	13%	0%
Building Grounds	13%	0%
Neighborhood Planning	13%	0%
Residential Housing	9%	9%
Transportation	9%	4%
Botanical Garden / Arboretum	9%	0%
Commercial Developments	9%	0%

Public Right of Way	9%	0%
Smart Growth / Affordable Housing	9%	0%
Brownfield	4%	0%
Brownfield Redevelopment	4%	0%
Ground Water Protection	4%	0%
Salt Marsh	4%	0%
Storm Water Management	4%	0%
Vacant Land	4%	0%
Waste System	4%	0%
Wastewater Treatment	4%	0%