Resilience in New London, New Hampshire

COLBY-SAWYER COLLEGE
COMMUNITY-BASED
RESEARCH PROJECT

2020

Contents

Executive Summary

The 2019-2020 Community-Based Research Project focuses on improving resilience in the town of New London to promote a thriving and well-prepared community. To begin, we gathered information from our three main stakeholders: The town of New London, New London Hospital, and Colby-Sawyer College, as well as many others to understand current initiatives and future plans. We then identified areas where the community could improve resilience to both thrive day-to-day and prepare for potential disturbances. Overall, we investigated three systems that interconnect and support the community: food, water, and energy. The structure of this report further divides these systems into subtopics that contribute to the resilience of New London.

The resilience of the local food system can be strengthened by working to ensure that all community members have access to healthy, local produce. Many stakeholders such as the New London Hospital, the Kearsarge Lake Sunapee Food Pantry, the Kearsarge Food Hub, and the Warner Public Market are addressing this issue of food insecurity by providing fresh produce to local families in need. We are helping to lay the groundwork for the Main Street Garden Project - a new initiative at Colby-Sawyer College to grow produce that will supplement these existing initiatives. As evidenced during the Covid-19 pandemic, food insecurity can happen to anyone when there is a disruption to the food system. We recommend that more land in New London be utilized for food production to provide the town with a buffer from disturbances to the food system supply chain. This should be accomplished from many angles including the conservation of potential agricultural land, the encouragement of home "Victory Gardens," and the implementation of edible public spaces into the town landscape. Education surrounding home food production and healthy eating will help to reach the goal of ending food insecurity in the area. We created educational materials to help guide community members towards personal food security and resilience. We recommend that the town, hospital, college, and community work together to provide educational opportunities to increase the resilience of the local food system.

Supplementary Materials in the Appendices

- A baseline of New London's food, water, and energy needs
- Reference Materials for Creating an Energy Descent Action Plan
- A list of educational institutions in the United States that have divested from Fossil Fuel Companies
- The Carbon Underground Top Ten Coal and Oil/Gas Companies
- Data compiled from the community survey

Our recommendations for the town's water system focus on stormwater runoff. The runoff from precipitation events directly affects the quality of the town's drinking water, groundwater, and surface water. We recommend that the town, hospital, and college work to implement low impact development techniques to minimize damaging stormwater runoff and provide more effective filtration of runoff as it enters the surface and groundwater. Specifically, we recommend that Colby-Sawyer College use low impact development techniques to address the issue of stormwater runoff at the entrance to Chargers Road. This site can serve as a model for the rest of the town.

To tie together many of the initiatives outlined in the report, we recommend that the town works with Colby-Sawyer College and the New London Hospital to create an Energy Descent Action Plan. This plan will help to guide New London away from fossil fuel dependence and towards a more resilient and vibrant local community. Town committees must ensure close communication with the greater community. We conducted a greenhouse gas inventory for the New London municipal buildings and the New London Hospital and complied the emissions data from Colby-Sawyer College. This information provides a baseline from which to measure future sustainability initiatives. We recommend that this inventory be expanded upon to include more aspects of the town and that it be updated annually to measure progress. The energy system is highly susceptible to weather disturbances such as ice storms. We recommend that New London take a proactive approach to dealing with power outages through the utilization of New Hampshire Senate Bill 286 to form a Community Power Program. We recommend that Colby-Sawyer College divests from fossil fuel companies and creates an investment policy to guide the college's investments towards socially and environmentally responsible companies. This is an important next step for the college to align its practices with its values.

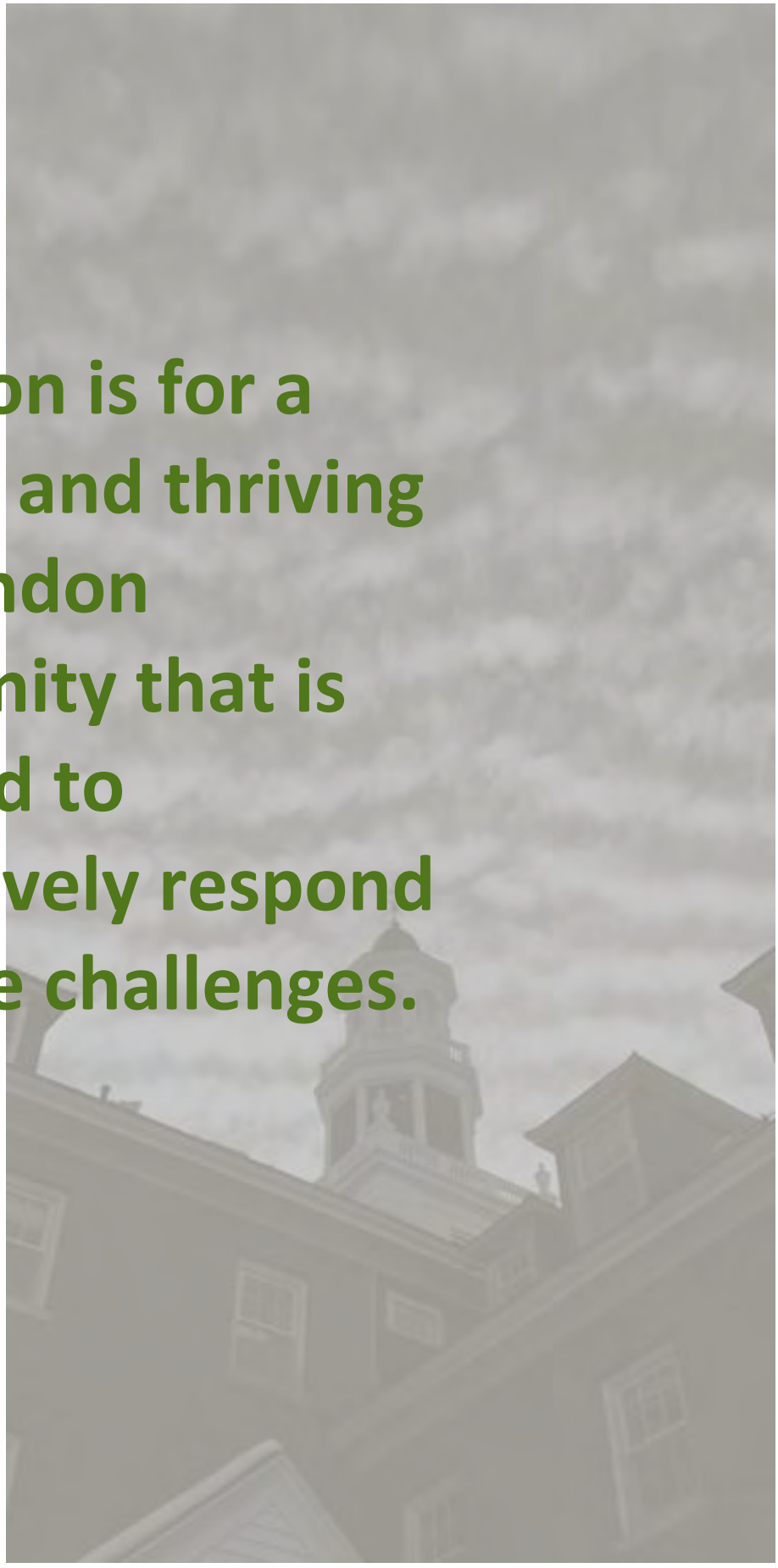
We recommend that the town of New London, New London Hospital, and Colby-Sawyer College consider each of these initiatives as the town works to implement the updated Master Plan. Below is a table that summarizes each recommendation, the stakeholders involved, and the resilience indicators to measure the progress of the initiative. The appendix of this report includes many documents that may be useful for stakeholders to reference or utilize in the further implementation of these recommended initiatives.

Table of Recommendations

	Recommendations	Stakeholder(s) Involved	Resilience Indicators
Main Street Garden	Continue writing and applying for grants to fund the project.	Colby-Sawyer College	Amount of funding received
	Continue communication with community partners, including the New London Hospital, Kearsarge Lake Sunapee Food Pantry, Kearsarge Food Hub, Warner Public Market, and Willing Hands.	Colby-Sawyer College	Percent of local food insecure households
	Solidify distribution methods as the garden's crop yield increases.	Colby-Sawyer College	Number of people the Main Street Garden produce reaches
	Solidify a storage method and location.	Colby-Sawyer College	Pounds of produce stored on the Colby-Sawyer campus
	Prioritize the connection between community members and the Main Street Garden.	Colby-Sawyer College	Number of classes and majors across campus involved Number of internship and volunteer opportunities filled by students and community
	Willing Hands extends distribution and pick-up to include the Kearsarge-Lake Sunapee Region.	Willing Hands	Number of distribution and pick up points in the Kearsarge-Lake Sunapee Region
	Reach out to local businesses to "adopt" a plot of the Main Street Garden.	Colby-Sawyer College	Number of local businesses "adopting" a piece of the Main Street Garden
	Provide Wellness Points to employees who volunteer at the Main Street Garden	New London Hospital	Number of New London Hospital employees that volunteer at the Main Street Garden
Food Education	Host hands on workshop events through the UNH Extension Office and independently, keeping in mind students, community members, and those facing food insecurity.	Colby-Sawyer College	Workshops offered on campus
	Continue to prioritize educating patients about the power of healthy food as preventative care and as medicine.	New London Hospital	Number of educational workshops, educational events, as well as written and virtual materials offered to patients

	Increase accessibility to food-based educational materials through New London's website.	Town of New London	Food-based educational materials added to town website
	Create a weekly meal plan highlighting crops from each season.	Colby-Sawyer College	The creation of weekly meal plans and their distribution to participants in the local food security programs
Agricultural Land Protection	Form an Agricultural Commission to guide town planning towards benefiting farms.	Town of New London	Existence of an Agricultural Commission in New London
	Educate homeowners on the benefits of conservation easements.	Town of New London, ASPLT	Percent of conserved open space land in New London
	Plant edible public spaces around municipal buildings, the hospital, and Main Street.	Town of New London, New London Hospital	Square meters dedicated to edible public spaces in New London
	Educate homeowners on the benefits of home "Victory Gardens." Provide educational materials to help homeowners begin a garden.	Town of New London Colby-Sawyer College	Percentage of residents with home gardens Average number of days of food supply per household
Stormwater Management	The introduction of Low Impact Development Sites into the current infrastructure to help promote stormwater management	Town of New London Colby-Sawyer College New London Hospital	Frequency of damage to infrastructure and flooding
Energy Descent Action Plan	Hold informative and interactive events to engage community members.	Town of New London	Number of community members attending events
	Create an EDAP with clear steps and a vision for the future.	Town of New London	The existence of a strong EDAP that involves the community
	Reduce the greenhouse gas emissions in the town by transitioning to renewable and decreasing energy demand.	Town of New London, Colby-Sawyer College, New London Hospital	$MTCO_2e$ emitted per year as measured by greenhouse gas inventories
Greenhouse Gas Inventory	Continue to monitor greenhouse gas emissions.	Town of New London New London Hospital	Yearly monitoring of greenhouse gas emissions
Energy Emergency Management	Utilize a Community Power Program to contract with a local third-party energy	Town of New London	Recovery time after a power outage

	provider to improve communication with service providers during an emergency.		
	Join a regional committee focused on community power to implement a home battery program.	Town of New London	Reduced dependency on the grid Recovery time after a power outage
	Improve communication between the municipality and residents regarding emergency planning.	Town of New London	Number of residents contacted regarding emergency planning
	Initiate a neighborhood check-in program during emergency events.	Town of New London	Number of older residents partnered with a younger community member to check in during an emergency event
Sustainable Investment	Form a Committee on Investor Responsibility.	Colby-Sawyer College	The existence of a Committee on Investor Responsibility Diversity of members of the committee
	Divest from top 200 fossil fuel companies by 2035.	Colby-Sawyer College	% of holdings invested in fossil fuel companies
	Develop a policy for ESG investing.	Colby-Sawyer College	Existence of policy to guide ESG investing
	Adhere to the policy for ESG investing by 2050.	Colby-Sawyer College	% of holdings adhering to the ESG policy
	Sign up for the Sustainability Tracking, Assessment & Rating System (STARS) to guide further refinements to the plan, provide feedback, and publicize initiatives.	Colby-Sawyer College	Number of STARS points earned



Our vision is for a resilient and thriving New London Community that is prepared to innovatively respond to future challenges.

Our Vision for New London

The year is 2050, and it is a perfect summer evening on Main Street, New London. You just finished a day of work at the New London Hospital and are walking back to your home. Looking around, you appreciate the positive change New London has accomplished in the last 30 years since your graduation from Colby-Sawyer College. The town of New London and surrounding communities created an initiative to become more resilient, and these advancements have increased the overall charm of New London. As you walk home, you reach down to pick a ripe, sun-warmed cherry tomato from a garden bed in front of the New London Inn. The tomato plants are just one of the many crops growing along Main Street. These gardens were planted to fight food insecurity and improve community awareness of healthy and local food choices. Bees buzz off the tomato plant you just ate from and fly down the street, heading toward the Main Street Garden that Colby-Sawyer College began many years back. This garden started small but has grown to be part of a community-wide initiative to provide access to healthy, local food for all members of the community. Just last week, you volunteered to help harvest a crop of kale from the garden that would be brought to the local food pantry. This evening, you hear jovial voices from up the hill as New London Hospital and Colby-Sawyer Students host a workshop on preserving home-grown food at the Main Street Garden. Many community members now have their own gardens in their backyard, and the Saturday Farmers Market brings the whole town together when Main Street is closed to vehicle traffic. The town has never felt more connected.

The sun catches the roof tops, allowing you to admire the solar panels that adorn almost all the buildings in town. With the help of various energy initiatives, New London has been able to transition to renewable energy. The town hall even has a small windmill out front to exemplify the transition away from fossil fuels. A stranger in an electric car stops to let you cross the road as they pull into the Pizza Chef parking lot to grab dinner and recharge their car on one of the new charging stations. You wave as you walk by and continue your venture home. You look to your left as you walk by Colby-Sawyer College. With a new sign out front and an outdoor classroom in the green space, the entrance to Chargers Road looks inviting. The space contains gardens, permeable walkways, trees, and drainage ponds that help control stormwater. This space has inspired the college to reduce impervious surfaces across all of campus and has even inspired other locations in town to do the same; the parking lot no longer fills with water after every rainstorm. As you near your driveway, your partner opens the door and your dog, Tater, jumps out to greet you. As he runs across the yard, he weaves between berry bushes before pouncing at your feet. The sun sets over New London as another summer day comes to a close.

Background

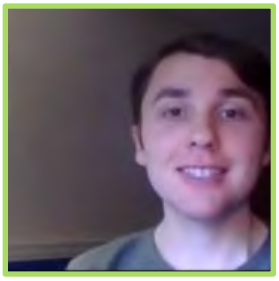
Who Are We?

We are the members of Colby-Sawyer College's Community-Based Research Class. This class is comprised of third year Environmental Science and Studies students including Abigail Castriotta, Lucy Hayward, Cassandra Lashier, Cameron Lynch, Jacob McCormack, Amy Stockburger, Ethan Sweet, and Jacob Winn. The course provides real world experience as we work with our stakeholders to improve local resilience. This semester has brought unexpected changes with our transition to remote learning due to the Coronavirus outbreak. Despite the disturbance to our routine, we have carried on with our project with a new urgency. Now more than ever, we believe in the importance of resilience in town planning. Below is a virtual group photograph from our remote learning spaces.

Amy Stockburger

Jacob McCormack

Jacob Winn



Abigail Castriotta

Community-Based Research Class 2019-2020

Lucy Hayward

Ethan Sweet

Cameron Lynch

Cassandra Lashier

The 2019-2020 Resilience Project

The focus of the 2019-2020 Community-Based Research Project is resilience. A resilient town is one that both fosters a thriving living environment and is prepared for potential disturbances. Both aspects influenced our approach to this project. Throughout this academic year, we have worked with our three main stakeholders; the town of New London, the New London Hospital, and Colby-Sawyer College; as well as the local community to gain a better understanding of the current baseline, existing resilience initiatives, and potential opportunities to strengthen our systems. We created and distributed a resilience survey to measure residents' and businesses' ability to respond to disturbances as well as their support for sustainability projects in the town. This survey was distributed via mail and email and we received 232 total responses comprised of 197 homeowners, 28 businesses, and 7 property renters. Questions were divided based on these three categories. With this information, we have developed recommendations to improve the resilience of the food, water, and energy systems in New London. We are working on projects to fill the gaps in resilience that we identified through our research and have formed recommendations for the continuation of these initiatives and the development of others into the future.

Amid these uncertain times surrounding the Coronavirus, we are taking time to reflect on the successes and failures of our local and global systems. Community members are reaching out to check in on one another and offering to venture out for essential supplies when their neighbors are unable to leave the house. Local businesses are finding innovative ways to meet the needs of customers while practicing safe social distancing. In looking at what has worked during this crisis, organized or otherwise, the successes could be recorded in town plans to store this knowledge for the future. We have also noticed weaknesses in our systems during this pandemic. Grocery store shelves are becoming bare as the supply is unable to meet changing demands. This gap in resilience demonstrates that our communities need more localized systems to act as a buffer to outside disturbances. If yards were utilized as small "Victory Gardens" and residents were able to preserve their own food, there would be less need for a rush to the grocery store to stock up on non-perishables. While we did not focus specifically on health pandemics in our research this year, the impacts of the Coronavirus illustrate the results of an external disturbance and remind us that internal resilience will promote social and personal wellbeing.

As the town of New London works to update the Master Plan, we recommend that resilience be incorporated as a core element of this document. Having resilience as the foundation for all town decisions will ensure environmental, social, economic, and personal wellbeing in New London. The 2011 Master Plan offers many opportunities for resilience that can be expanded upon in the updated version. While communicating with stakeholders and

reaching out to community members this academic year, we have been astonished by the creativity, initiative, and insight used to solve problems in New London and in the surrounding region. Our outline for a resilient future, will capitalize on these qualities. With a clear and strong plan, New London will be able to effectively harness the innovation of the community to respond to future challenges with resilience.

What is Resilience?

Resilience is the capacity of a system to absorb disturbance and reorganize to retain the same function, structure, and feedbacks (Walker & Salt, 2012). Systems have inputs, outputs, and a network of components that interact through the exchange of energy, resources, and information (Meadows, 2009). Towns such as New London are systems with connections between municipal functions, businesses, residents, and resources. Each of these components helps to serve the town's purpose of being a safe and thriving community. This report focuses on three systems; food, water, and energy; that our stakeholders rely on every day. Like most towns, New London is dependent on inputs of resources from outside of the town. The successful inflow and outflow of these resources is essential to maintaining day-to-day function. An example of a beneficial input and output would be the clean flow of water through a watershed in which the town is situated.

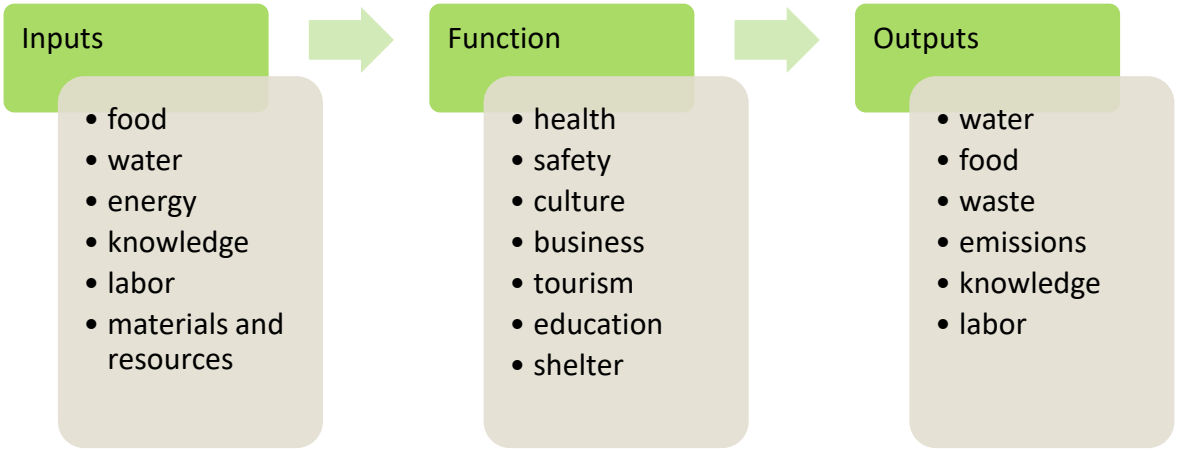


Figure 1. The elements of the town's system.

The key component in a resilient system is the capacity to self-organize and adapt to changes (Walker & Salt, 2012). This means that when a part of the system changes, the system can reorganize without collapsing. New London is prone to many outside disturbances, such as ice storms, supply chain disruptions, and power outages. Employing its self-organizing capacity, New London would respond to these changes based on a set of existing connections, stored

resources, and a web of knowledge (Walker & Salt, 2012). These adaptive responses would provide a buffer to lessen the impact of external disturbances. Towns are subject to internal shocks as well. Systems grow within thresholds and are constrained by the resources and energy available to them. When actions exceed these thresholds, the system will no longer be supported and it will collapse (Walker & Salt, 2012). If a town has exceeded development capacity or over-used an essential resource, it must reorganize to operate again within these thresholds.

Resilience should also be considered on a smaller, personal scale. As a community, we cannot tackle monumental issues unless personal resilience is built into the lives of individuals. Our class is discovering this firsthand as we deal with the Coronavirus pandemic and are faced with the challenge of reorganizing our system to complete this project remotely. We have each been tasked with adapting our way of life to respond to this unexpected disturbance. To get through this challenge, we must strengthen our web of resources and learn from our failures and successes. If each member of our community practices personal resilience, we will be able to contribute to the rebuilding and strengthening of the greater community during this time of crisis.

Sustainable and resilient practices must be viewed as two sides of the same coin; however, a sustainable practice does not inherently mean that a practice is resilient and vice versa. Sustainability is the responsible use of resources to meet the needs of current and future generations (World Commission on Environment and Development, 1987). Acting in a sustainable manner will mitigate future disturbances to the town. For example, using our water resources responsibly will lessen the probability that New London will have to cope with a strained water supply in the future. Resilience is the ability to absorb a disturbance through preparation and adaptation. For example, a home with a rainwater catchment system will be less dependent on the town's water supply, and therefore less affected if there was a disruption in supply. In a similar way, home gardens and edible landscapes will reduce the shock if supply lines are disrupted, and low impact landscape design can help absorb the potential damage of large precipitation events. Recognizing that disruptions are inevitable, the town must build resilience into its plans, resources, and connections so that the community is able to navigate change.

Resilience to What?

The primary step in securing the resilience of our community is understanding the potential risks to systems in New London. Severe precipitation events, ice storms, energy disruptions, food shortages, and pandemics are all examples of disturbances that New London

has experienced in the past or is experiencing now. The New London community must assess these potential risks to better prepare and adapt for the future.

Severe Precipitation

Precipitation events are projected to continue to increase in severity and frequency in the Northeast United States due to climate change. In the last decade, more extreme precipitation events have occurred than in the last century combined and are projected to more than double in frequency by the end of the century (Sustainability Institute at the University of New Hampshire, 2020). For New London, annual precipitation is projected to increase from 46 inches to 55 inches by the end of the century under a high emission climate change scenario .

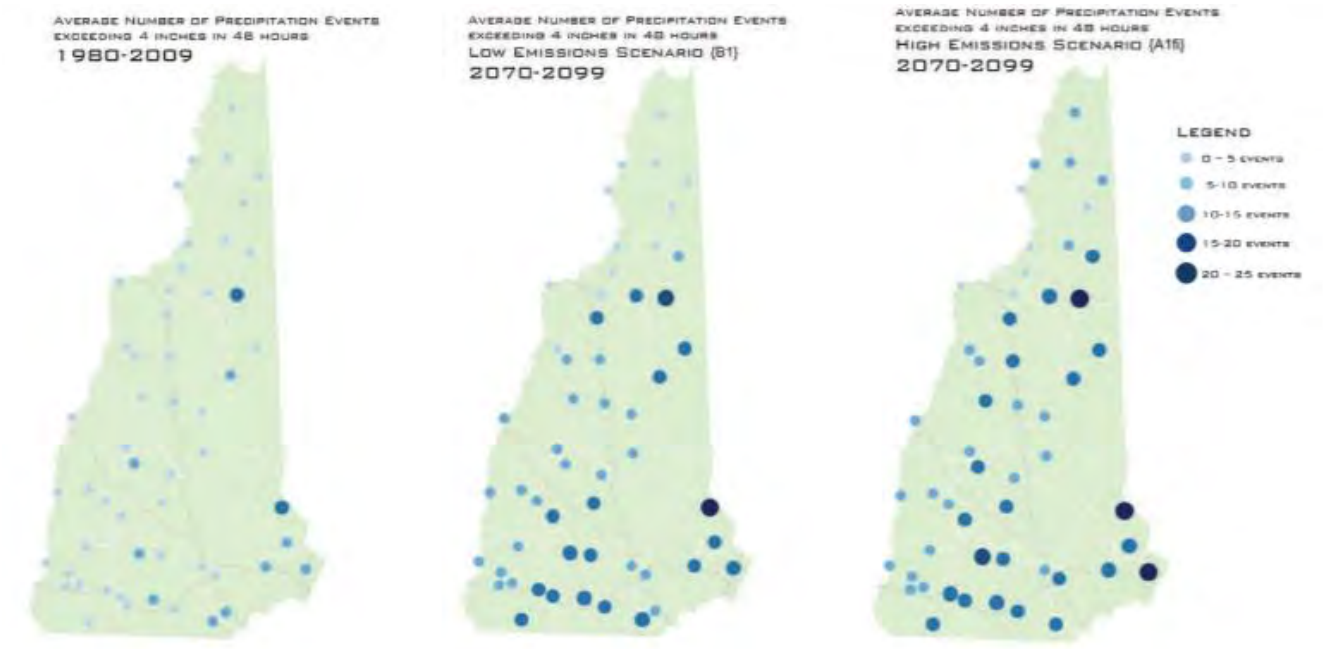


Figure 2. Images of New Hampshire representing the current average frequency of extreme precipitation events (left), an increase in extreme precipitation under a low emissions scenario (center), and an increase of precipitation under a high emissions scenario (right) (The Sustainability Institute at the University of New Hampshire, 2014).

This increase of precipitation will translate to more stormwater runoff, causing strain on the current stormwater infrastructure in New London. Residences and businesses may experience an increase in the frequency and severity of flood damages. In some places, culverts will flood, and roads will wash away. An increase in sudden stormwater runoff will affect surface and ground water, polluting the water resources that a community may depend on for drinking, recreation, or commercial use. To better prepare for this increase in precipitation, local

communities should assess whether their current infrastructure and landcover can withstand an influx of stormwater.

While heavy precipitation may increase during some periods, droughts will also become more frequent in New Hampshire. Short-term summer droughts will begin to occur annually instead of every 2-3 years (New Hampshire Climate Change Policy Task Force, 2009). Furthermore, warmer temperatures can cause surface water to evaporate faster. This will decrease the water supply available during peak usage summer months for agriculture, homes, and businesses. With these changes in precipitation, more fossil fuels may be required to import water to communities, furthering the climate change feedback loop (The Sustainability Institute at the University of New Hampshire, 2014). Communities should address the root of the problem by reducing their greenhouse gas emissions that contribute to climate change and extreme weather.

Drought caused by climate change can affect New Hampshire farms

Damage in Concord, NH from a extreme precipitation event in 2006

Figure 3. Examples of the effects of severe precipitation changes (Parkington, 2006; Hunt, 2016).

Ice storms

Ice storms are a particularly dangerous precipitation event caused by the layering of warm and cold air, which results in rain freezing on contact with a surface (Spector, 2014). New London's geographical position makes the town especially susceptible to severe ice storms. New London is one the towns with the highest elevation in the state, and it is surrounded by numerous lakes and ponds, which evaporate to create more precipitation. The town also rests on the top of a hill where high wind speeds and frigid winter temperatures are not uncommon (Graves, 2014). The combination of these factors leads to more precipitation, freezing, and ice coverage.

In 1998 and 2008, much of the Northeast United States and Southeast of Canada experienced severe ice storms. An average of four inches of ice accumulated during these times

resulting in roads, powerlines, trees, houses, and vehicles being completely covered. These toppled trees and damaged infrastructure left many people without power for days and, in some cases, weeks. Many people were unable to leave their homes while others were forced to leave theirs for extended periods of time (Page, 2018). The estimated total damage cost of the ice storm of 1998, the more severe storm, was well over three billion dollars (National Weather Service, 2008). This amounts to greater than five billion dollars in today's economy.

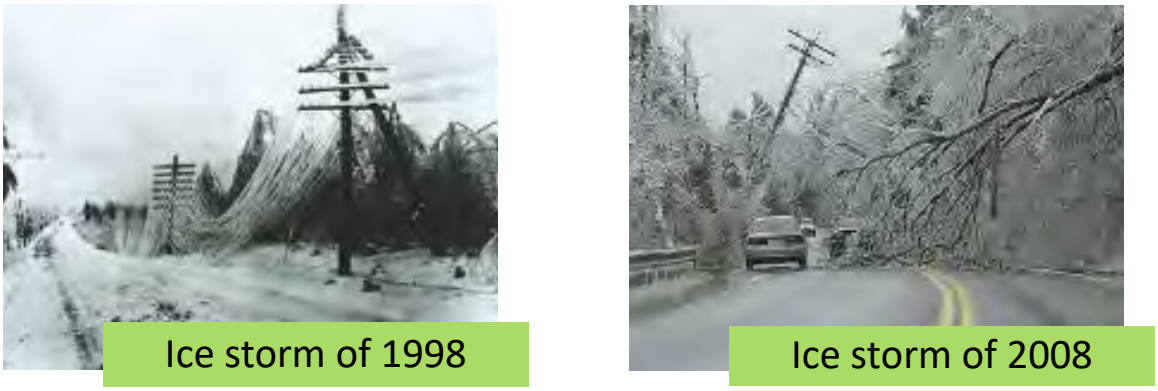


Figure 3. The ice storms of 1998 and 2008 (How it Works, 2012; Pirro, 2008).

Devastating ice storms may seem like anomalies, but climate change is causing weather to become more severe and unpredictable. Some winters may be colder, longer, and have a greater frequency of storms, while others may be mild and warm (Gibbens, 2019). With climate change only predicted to worsen, New London can expect to see more frequent and severe ice storms (New Hampshire Climate Change Policy Task Force, 2009). Thus, if the region were to experience another extreme ice storm, the town could expect to see higher ice accumulations and greater damage (Runkle & Kunkel, 2017). The town should strengthen the resilience of its systems to ensure that residents have an adequate food supply, electricity, and running water during a severe ice storm (Midwestern Regional Climate Center , 2012).

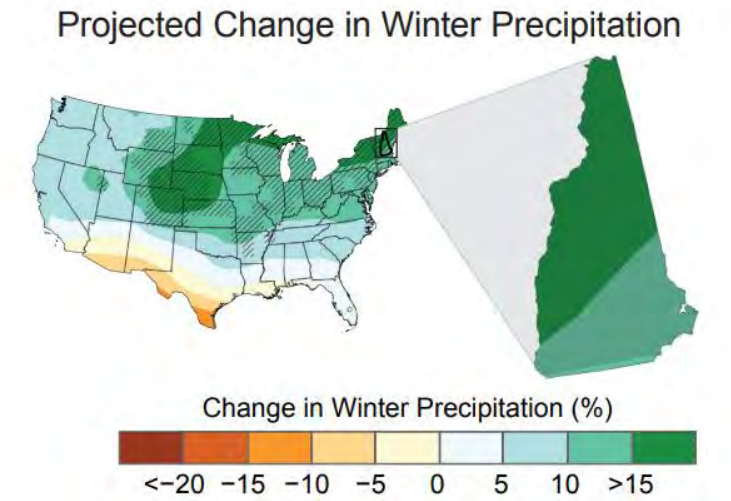


Figure 4. Change in Winter Precipitation for Mid-21st century (Runkle & Kunkle, 2017).

Energy Disruption

New London, like most towns in the United States, is heavily reliant on fossil fuels for many necessities including energy, transportation, and food production. Although fossil fuels are relatively inexpensive now, prices will inevitably rise as the supply of oil continues to diminish. Oil reserves are being discovered less frequently and, when they are discovered, they are smaller in size. In 1940, the average size of an oil reserve was 1.5 billion barrels and by 2004, the average size was just 45 million barrels (Hopkins, 2008). With less oil available for discovery, companies are resorting to extracting oil using more expensive and energy-intensive practices (Hopkins, 2008). This is an indication that the steep decline of cheap, accessible oil is near (Hopkins, 2008). If New London continues a business-as-usual path as oil grows scarcer, the town should expect major disturbances that will negatively impact the local economy and every-day life. New London must work now to reduce its dependence on fossil fuels to be better prepared for changes to come.

Additionally, burning fossil fuels exacerbates the global climate feedback loop. The more fossil fuels we burn, the more we should expect to experience severe weather disturbances (Intergovernmental Panel on Climate Change, 2014). These severe storms have the potential to disrupt the residential power supply, as the town has already experienced on many occasions. The centralized nature of the current energy system leaves the town vulnerable to disturbances that might occur elsewhere, such as the electricity blackout of 2003. This disturbance occurred because a high-voltage powerline brushed against overgrown trees and shut down. Approximately 50 million people in the Northeast United Stated and Southern Canada were left without power for two days. Having an energy system so reliant on energy that is produced in large-scale facilities before being distributed to localities makes a town very susceptible to disturbances anywhere along the line of transmission as illustrated in figure 5 (United States

Environmental Protection Agency). Prioritizing community control over the local energy system and ensuring that homes and business are equipped with backup power sources is vital in ensuring that the system functions smoothly.

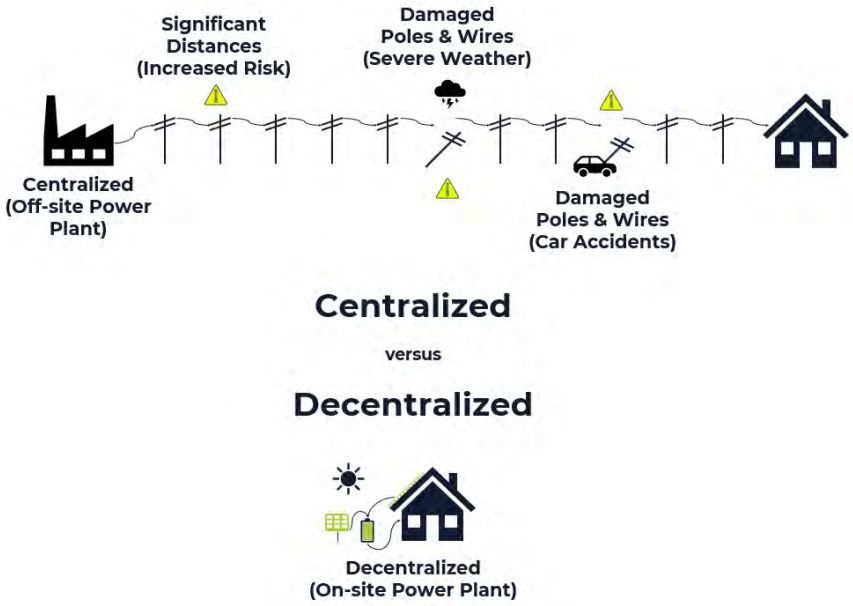


Figure 5. A visualization of a centralized vs a decentralized power source (Energy Blockchain Network, 2018).

Food Shortage

A system's efficiency and sustainability can be measured in part by its required energy input. In the United States, 16% of the national energy budget is dedicated to food-related industries. In a ratio of energy invested to energy derived, an average of 13 units of energy must be invested into the food system to derive a single unit of energy, as shown in figure 6 (University of Michigan, 2019). This ratio makes it clear that the national food system is operating in an unsustainable manner. Further, most of the energy invested into the food system is in the form of fossil fuels. A system heavily dependent on fossil fuels is vulnerable to fluctuations in fossil fuel prices (University of Michigan, 2019). The cost of fossil fuels is predicted to become increasingly unstable, due to dips and flows of supply and demand. With the looming threat of peak oil, the resource will become scarce and oil prices will rise (Whipple & Andrews, 2020). Instability in price and availability of fossil fuels into the future jeopardizes the resilience of the food system (University of Michigan, 2019).

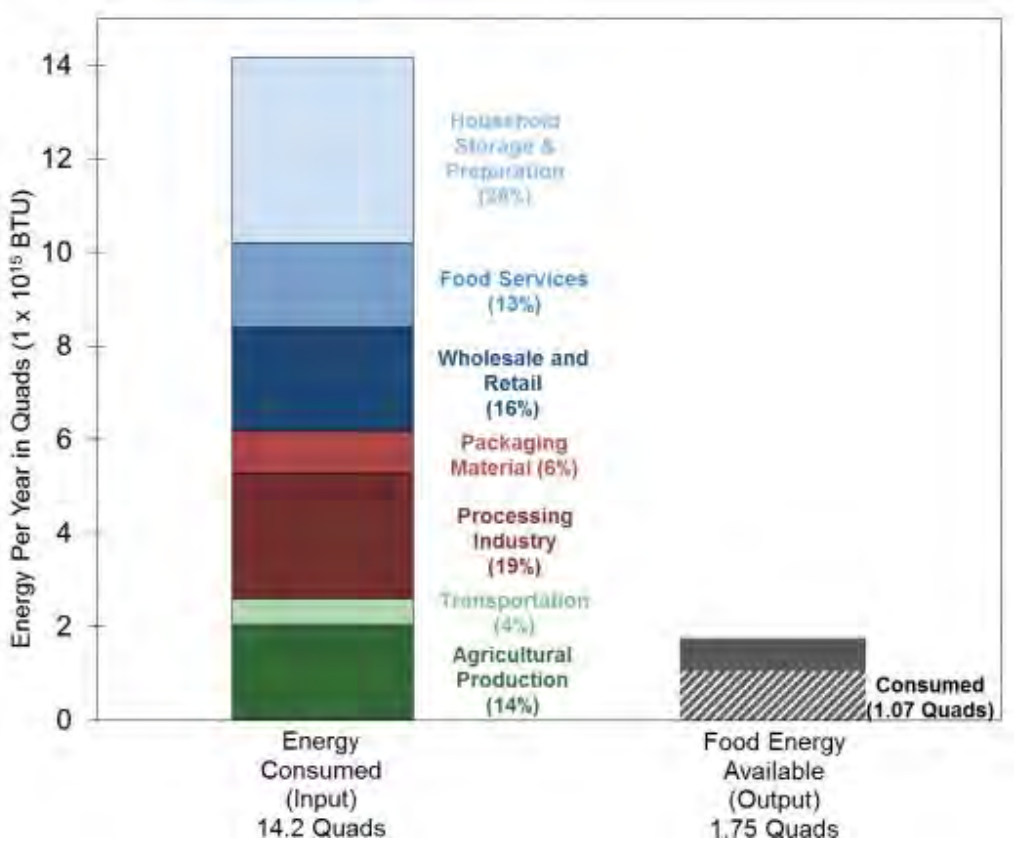


Figure 6. Energy consumed to energy available ratio (University of Michigan, 2019).

Considerable fossil fuel usage in the agricultural system results in the emission of greenhouse gases. In 2017, agriculture accounted for 9.6% of all U.S. greenhouse gas emissions, as seen in figure 7. By volume, this translates to 621 million metric tons of carbon dioxide equivalent emissions (United State Department of Agriculture, 2019). Greenhouse gas emissions are the driver of climate change which causes severe disruptions to the food system (Global Change, 2014). These disturbances leave all who are dependent on the global food system vulnerable to food shortages. Food shortages occur when there is not enough food to adequately feed a population, or when factors inhibit food from reaching consumers. The food system supply chain involves food production, processing, transportation, storage, and distribution; disturbances at any one of these points can cause food shortages. During times of disruption, the food system must reorganize to accommodate new demands and do so quickly to ensure a stable food supply for the population (Wolf, 2020).

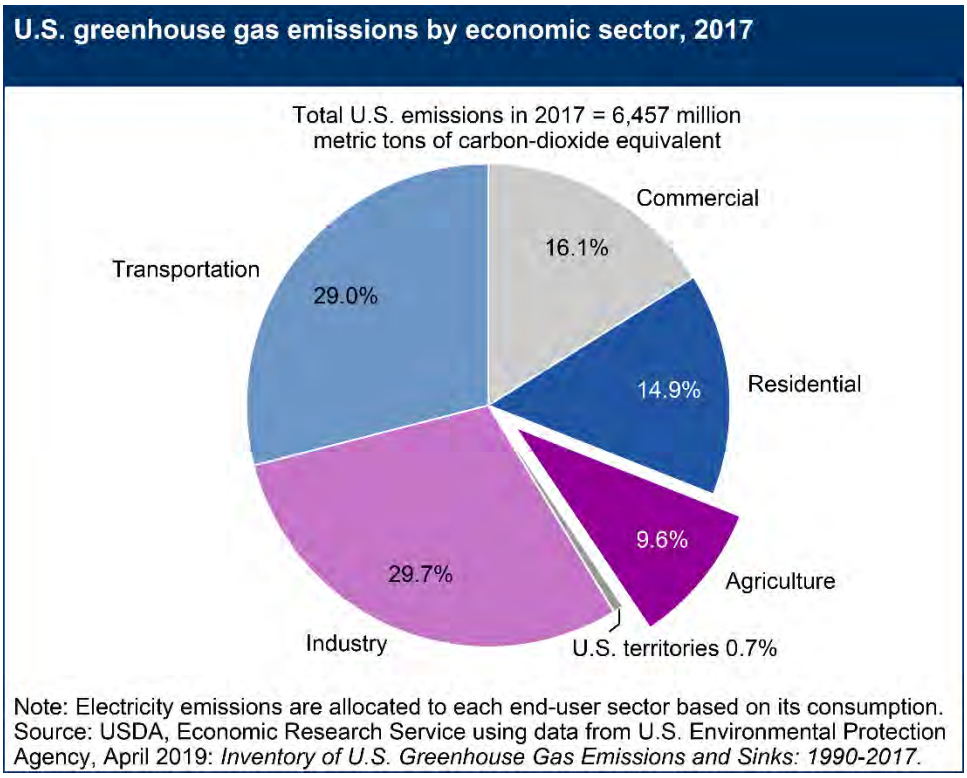


Figure 7. Greenhouse gas emissions in 2017 (United State Department of Agriculture, 2019).

Currently, the COVID-19 pandemic is creating a major disruption in the food system. Beginning with production, farmworkers must remain a safe distance from one another while planting and harvesting crops to minimize the risk of spreading the virus. This limits the number of employees that can work at any one time, lowering productivity (Schoichet, 2020). Border closures and quarantines will also restrict the travel of seasonal workers that help to grow, harvest, slaughter, and process food (Food and Agriculture Organization of the United Nations, 2020). Farmers and farmworkers are disproportionally vulnerable to a disturbance such as a pandemic. Roughly 30% of all farmers live below the poverty line and nearly 11% do not have health insurance (United States Department of Labor, 2016). Further, an estimated 48% of all farmworkers lack work authorization and thus are less likely to seek medical treatment (Farmworker Justice, 2014). With many agricultural workers unable to afford medical care, the food system becomes vulnerable, contributing to the risk of food shortages (Schoichet, 2020).

Transportation for the food system can be inhibited due to increases in oil prices as we approach peak oil, limits in international trade, and intensifying weather events (Hopkins, 2008; New Hampshire Climate Change Policy Task Force, 2009; Sternlicht, 2020). As oil prices increase, this additional strain will be felt by food distribution companies and price increases will likely be transferred to the consumer. Currently with the COVID-19 pandemic, international

trade has slowed. Thus, dietary staples that the United States relies on to be imported, such as legumes, rice, and other grains, may become more scarce (Sternlicht, 2020).

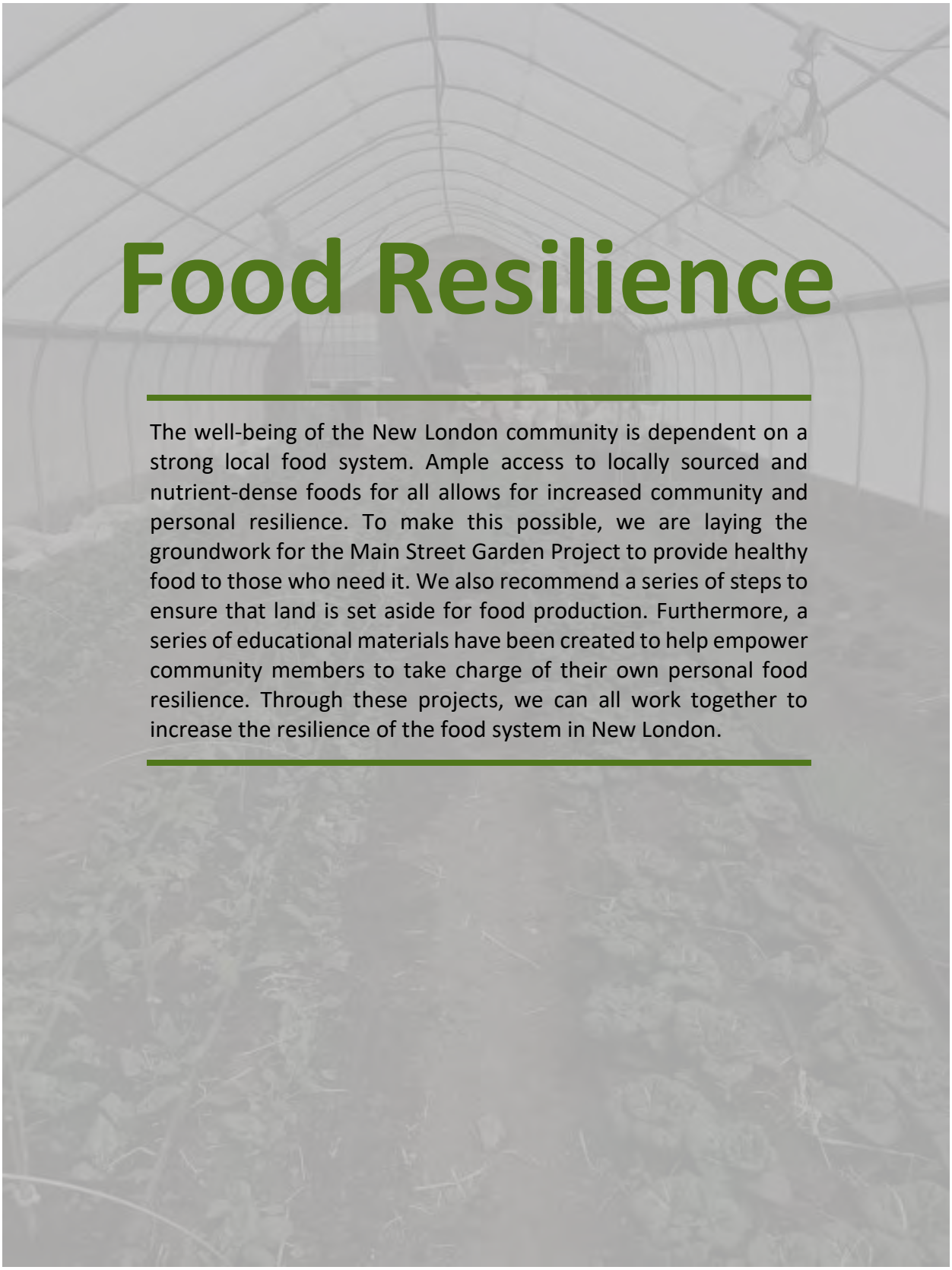
Intensifying weather events, such as ice storms and extreme precipitation events can inhibit road travel and the transportation of food from farm to table (New Hampshire Climate Change Policy Task Force, 2009). Inability to transport food increases the risk of spoilage and contamination (Cho, 2018). If food does not have a destination, or is unable to arrive there, farmers often have no choice but to discard of their crops. With major portions of the food system, such as restaurants, shut down during the COVID-19 pandemic, produce destined for these retail sites goes to waste. Sadly, it is often more expensive for farmers to reroute food to food pantries than simply let it rot in their fields. It is estimated that roughly $1.32 billion of food will go to waste from March to May 2020 (Cagle, 2020). The amount of food being wasted while people are simultaneously struggling to put food on the table highlights the lack of adaptability and resilience in our current food system. Communities can reduce their risk of food shortages by creating a localized food system that is less vulnerable to faraway disturbances (Weber & Matthews, 2009).

Pandemic

As we write this report, we are experiencing the effects that a global pandemic can have on society. COVID-19 is not the first pandemic that has swept across the world and we must recognize that it likely will not be the last. Compared to past pandemics such as the Swine Flu in 2009, COVID-19 has proven to be more deadly due to the ease in which it can spread unknowingly from one individual to another (Hickok, 2020). As countries around the world have implemented countermeasures to help reduce the impact of COVID-19, individuals have been encouraged to isolate themselves in their homes. In a world with constant interaction and accessibility, people are now limited to only leaving their homes for essential items such as food and toiletries and even then, they are putting themselves at risk of contracting the virus.

Aside from affecting individuals on a personal level, the pandemic also has negative impacts on many global systems, including the food system and the economy. As mentioned above, the global food system is vulnerable to changes in production, transportation, and food storage caused by the virus, all of which could lead to food shortages. Aside from the disruption of the food system, pandemics also have a detrimental effect on the economic system. Specifically, the town of New London relies on an influx of summer tourists to support the local economy. If the pandemic continues into the summer, businesses that rely on tourism to remain open may face the possibility of closing. As the largest institution in the town of New London, Colby-Sawyer College is a substantial component to the economic stability of the town (Annual Report for the Year Ending 2019, 2020). If the pandemic were to force the college to close, this would cause a great detriment to the town of New London in terms of tax income,

business, employment, and property value. The town of New London and its businesses will find a way to adapt and be resilient in the face of these changing circumstances. By following the recommendations outlined in this report, the town can become less susceptible to outside disturbances by meeting basic needs more locally.



Food Resilience

The well-being of the New London community is dependent on a strong local food system. Ample access to locally sourced and nutrient-dense foods for all allows for increased community and personal resilience. To make this possible, we are laying the groundwork for the Main Street Garden Project to provide healthy food to those who need it. We also recommend a series of steps to ensure that land is set aside for food production. Furthermore, a series of educational materials have been created to help empower community members to take charge of their own personal food resilience. Through these projects, we can all work together to increase the resilience of the food system in New London.

Main Street Garden

Food Insecurity

Ample access to food and essential nutrients is widely accepted as a basic human right. Food security can be defined as consistent "physical, social, and economic access to sufficient, safe, and nutritious food that meets ... dietary needs and food preferences for an active and healthy life" (Genuis, Willows, Alexander First Nation, & Jardine, 2014). Food insecurity, therefore, can occur when one or more of the above requirements is not met. Thus, food insecurity encompasses not only inaccessibility to food in general, but the inability to obtain healthy and nutritious food. In America, 11% of households experienced food insecurity at least some time during 2018 (United States Department of Agriculture, 2019). Food insecurity is studied annually by the United States Department of Agriculture (USDA). To measure food insecurity, the USDA analyzes data collected from the nationwide survey conducted by the U.S. Census Bureau. A total of 18 questions in the survey address issues of food availability, the financial ability to purchase food, and the affordability of balanced meals (United States Department of Agriculture, 2019).The staggering 11% of food insecure households in the United States shows a great weakness in the current food system.

Families experiencing food insecurity are often faced with a choice between paying for food or other necessities. Feeding America, a hunger relief organization that serves a total of 46.5 million Americans through a network of over 200 country-wide food banks and 60,000 food pantries, assesses the effects of food insecurity on program participants (Feeding America, 2019). In a 2014 study conducted by the organization, 66% of Feeding America participants have chosen between food and medical care, 57% have chosen between food and housing, and 31% have chosen between food and education. Additionally, a staggering 79% of participants purchase inexpensive, unhealthy food and 40% water down food or drinks in an effort to lower expenses (Feeding America, 2014).

Food insecurity can affect many aspects of personal health. Food insecure individuals disproportionally suffer from diet-sensitive chronic diseases, including diabetes, obesity, and heart disease (Gundersen & Ziliak, 2015; Hampton, 2007). Moreover, experiencing chronic hunger at a young age can lead to extreme and frequent activation of the body's stress response, known as early toxic stress. Early toxic stress has been linked to serious health effects in adulthood, including cardiovascular disease, cancers, asthma, and depression (Ke & Ford-Jones, 2015). Low nutrient intake in youth, particularly iron deficiencies, can result in lowered academic achievement and, as a result, lowered future economic prosperity (Ke & Ford-Jones, 2015). In addition, childhood food insecurity has been linked to delayed development, particularly in language building, motor skills, and behavioral difficulties (Chilton, Chyatte, &

Breaux, 2007; Ke & Ford-Jones, 2015). Childhood hunger has also been found to be a precursor for depression and substance abuse disorders later in life (Ke & Ford-Jones, 2015).

In the State of New Hampshire, food insecurity is a threat to the livelihood of many residents. As seen in figure 8, a staggering 57 of the 234 towns and cities in New Hampshire are at high or highest risk of food insecurity based on population density and percentage of families below the poverty level (Wauchope & Ward, 2012). As of 2017, 8.6% of people in Merrimack County struggled with limited access to nutritionally adequate foods (Feeding America, 2019). At the town level, New London is at moderate risk for food insecurity according to the Children's Alliance of New Hampshire. Nearby towns in the Lake Sunapee area face high and highest risk for food insecurity. It is our community's responsibility to aid in the fight against food insecurity to help our region thrive.

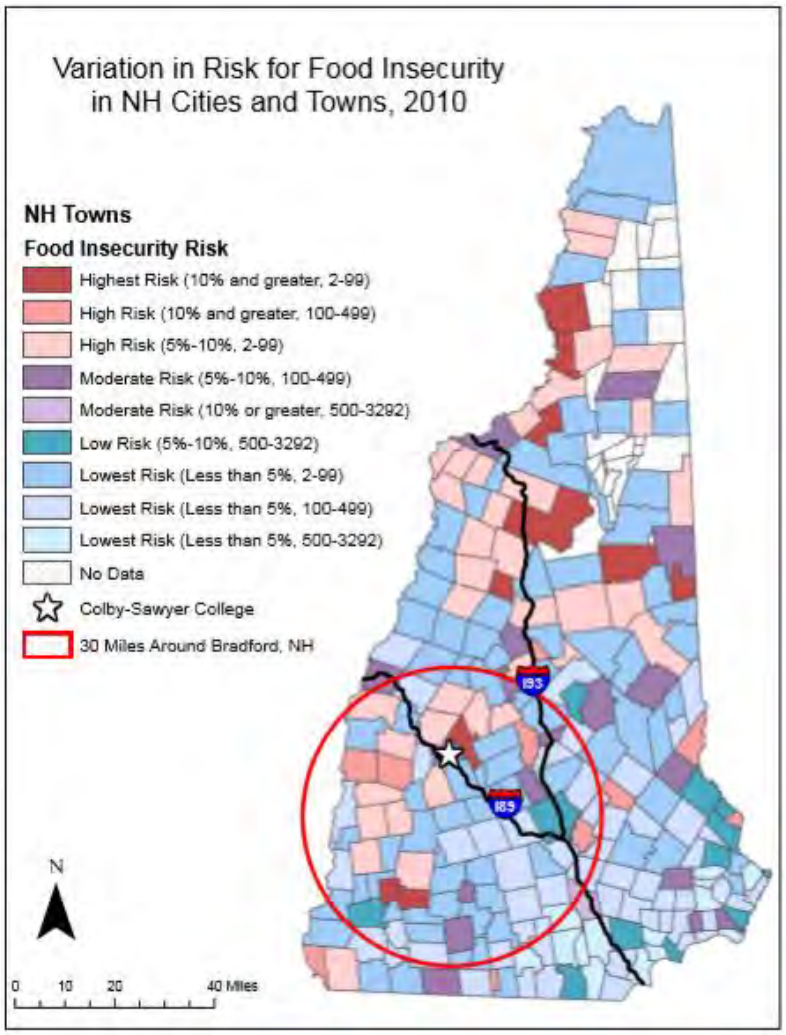


Figure 8. Risk for Food Insecurity in New Hampshire Cities and Towns (Community-Based Project 2019, 2019).

Access to healthy food throughout the year provides great personal health benefits. Individuals with increased access to healthy foods, for example Supplemental Nutrition Assistance Program (SNAP) participants, report better health, three or fewer sick days per year, and one to two fewer doctor visits per year in comparison to food insecure individuals not participating in a food assistance program (Christian & Partha, 2015). On average, Americans spend close to 20% of their income on healthcare costs, while in comparison only spending 10% of their income on food (Steeves, 2013). Healthy food should be used for preventative care and as a form of treatment to some ailments. For example, antioxidants, commonly found in berries and dark leafy greens, are known to protect against cell damage (Olsen & Ware, 2018). B-vitamins, commonly found in legumes and whole grains, are essential to red blood cell development and reduce the risk of heart disease (Harvard T.H. Chan School of Public Health, 2020). Common foods; including turmeric, broccoli, and cauliflower; can even be used to help fight cancers (Sarich, 2020; Harvard Health, 1995). Access to nutrient dense foods is essential to personal health and resilience.

The Coronavirus and Food Security

The COVID-19 health pandemic is exacerbating already significant food insecurity issues. Families are suddenly faced with having to provide three meals a day for all family members while schools switch to remote learning. Nearly 30 million children across the country depend on school meals and are now facing potentially inadequate nutrition at home (Turner & Kamenetz, 2020). As previously discussed, income is a major determinant of whether healthy food is an option for individuals and families. As unemployment rises to nearly 15%, savings are being spread thin to cover basic needs and more families are struggling to put healthy food on the table (Cohen & Hsu, 2020).

We will all feel the repercussions of the virus in the form of disruptions to the global food system. Empty grocery store shelves and limited food choices have already become a common occurrence, but food system disruptions will continue long past the end of this pandemic. Border closures and quarantines will restrict the travel of seasonal workers that help to grow, harvest, slaughter, and process food. Limited access to animal feed will further affect the meat and dairy supply. Trade disruptions will affect the supply of food from all sectors, including fishing – one of the most traded food commodities (Food and Agriculture Organization of the United Nations, 2020).

The global food system simply is not prepared to respond to a disturbance of this magnitude. The lack of adaptability in our food system during this crisis is highlighted by the amount of food being wasted while people are simultaneously struggling to put food on the table. Farmers producing food destined for restaurants, schools, and other closed industries are

being forced to dispose of their supply (Lush, 2020). Crops are being plowed under and 5% of the country's milk supply is being discarded (Yaffe-Bellany & Corkery, 2020). Farmers are attempting to donate this excess supply to food banks, but storage capacity is limited and many people simply lack the knowledge or willingness to cook vegetables at home (Lush, 2020). We must find effective ways to respond to these changing circumstances and learn from our mistakes to form a more resilient food system for the future.

Local Food Security Initiatives

New London Hospital

The New London Hospital works to combat food insecurity in the area through their Food Prescription Program. The hospital works with local partners to provide fresh fruits and vegetables to families and individuals that the hospital has identified as food insecure. Partners in this program include Spring Ledge Farm, Beaver Pond Farm, Sweet Beet Market, Claremont Farmers Market, Newport Farmers Markets, and, as of recently, the Market Baskets in Claremont and Warner, New Hampshire. The Food Prescription Program uses a "coupon" system, in which participants of the program can redeem their coupon for produce at local food providers (C. Bardier, Personal Communication, November 14, 2019). In 2019, the hospital provided a total of 560 coupons to food insecure community members, equivalent to $11,200. In January of 2020, the hospital distributed 50 coupons, equivalent to $1,840 (Bardier, 2019). It is important to note, however, that needs are destined to fluctuate immensely during the COVID-19 pandemic, and local initiatives are already seeing the effects.

Kearsarge Lake Sunapee Food Pantry

The Kearsarge Lake Sunapee (KLS) Food Pantry, located in New London, serves nine surrounding towns to help those facing food insecurity. To do so, the KLS Food Pantry serves 10-20 families twice weekly, with individuals suggested to return on a biweekly basis. Needs fluctuate throughout the year, with an influx during school vacations and summer months, as children return home without school-provided meals (Bill Ross, Personal Communication, February 12, 2020). The KLS Food Pantry expects to see an increased need for food assistance in the upcoming weeks as New Hampshire's COVID-19 cases increase. The KLS Food Pantry is working to be proactive, helping families before they must utilize the food pantry for assistance. The Food Pantry has joined the Kearsarge School District in their new Kearsarge Kares: Friday Food Backpacks program which provides food to local families in need during this time. Many families with school-age children previously relied on school-provided meals, and now must supply up to two additional meals per child every day. To help, the KLS Food Pantry is donating food to this initiative (Kearsarge Lake Sunapee Food Pantry, Personal Communication, April 15, 2020).

Kearsarge Food Hub

The Kearsarge Food Hub distributes fresh food "baskets" to families in Bradford. Currently, 16 families are supported through this initiative. The Kearsarge Food Hub funds this initiative through monetary donations and grants (Kearsarge Food Hub, 2020). In response to rising food insecurity during the Coronavirus pandemic, The Kearsarge Food Hub is now working with the Bradford Elementary School to provide fresh produce to seven local families with school children. Furthermore, they are working to support those utilizing the Bradford Food Pantry by donating fresh produce and other necessities. They have also partnered with Kearsarge Kares: Friday Food Backpacks program, donating fresh produce to help supplement their nutrition programs (Kearsarge Food Hub, 2020).

Warner Public Market

The Warner Public Market is another local organization working to reduce food insecurity in the area. They are currently partnering with the Simonds Elementary School to provide heathy produce to students and their families. The Warner Public Market is working to establish a partnership with the Kearsarge Kares: Friday Food Backpack program to ensure that students have healthy food at home (S. Bower, Personal Communication, February 29, 2020). In response to the pandemic, Warner Public Market has received donations that have allowed them to more than double their orders from local farmers. This additional food has been used to supply over 500 pounds of fresh food and dozens of bars of soap through the Warner Area Food Pantry (Warner Public Market, 2020).

Willing Hands

Willing Hands, based out of Norwich, Vermont, works to reduce food insecurity in the Upper Valley region of New Hampshire by growing produce and serving as a distributer of locally produced food to food pantries and similar organizations in the area (S. Cavin & J. McCracken, Personal Communication, March 5, 2020). Since 2004, Willing hands has distributed over 5 million pounds of fresh produce to those facing food insecurity throughout the community (Willing Hands, 2020).

Willing Hands, like many other initiatives, is working to increase their positive impact during the COVID-19 pandemic. To do so, they have partnered with the Dartmouth Hitchcock Population Health Team as well as the Upper Valley Haven to host a "Virus Safety Training Virtual Meeting" to keep other local food insecurity initiatives working safely together during these challenging times. Willing Hands is also working to secure more food sources, financial funds, and volunteer power to help those in need (Willing Hands, 2020).

What Is Colby-Sawyer College Doing to Address Food Insecurity?

While community food needs may fluctuate throughout each year, a consistent gap in access to healthy crops during the winter has been identified by the New London Hospital. Many of the farms and markets that accept the Food Prescription coupons close in the winter or have limited hours. Further, many farmers choose not to grow many of the crops that store well into the winter because they do not provide as high of a return on investment as crops such as lettuce and spinach. In general, winter crops require more space to grow than common summer crops and often can only be planted once per growing season. This reduces the number of plants a farmer can cultivate on a plot per season, resulting in reduced profits (Denckla, 2003). Many winter crops, such as varieties of potatoes and squashes, are high in starch. Such crops pose an avoidable health risk to prediabetic and diabetic individuals requiring starch regulation (C. Bardier, Personal Communication, November 14, 2019). Healthy, low starch, winter crops should be increasingly prioritized to ensure year-round health.

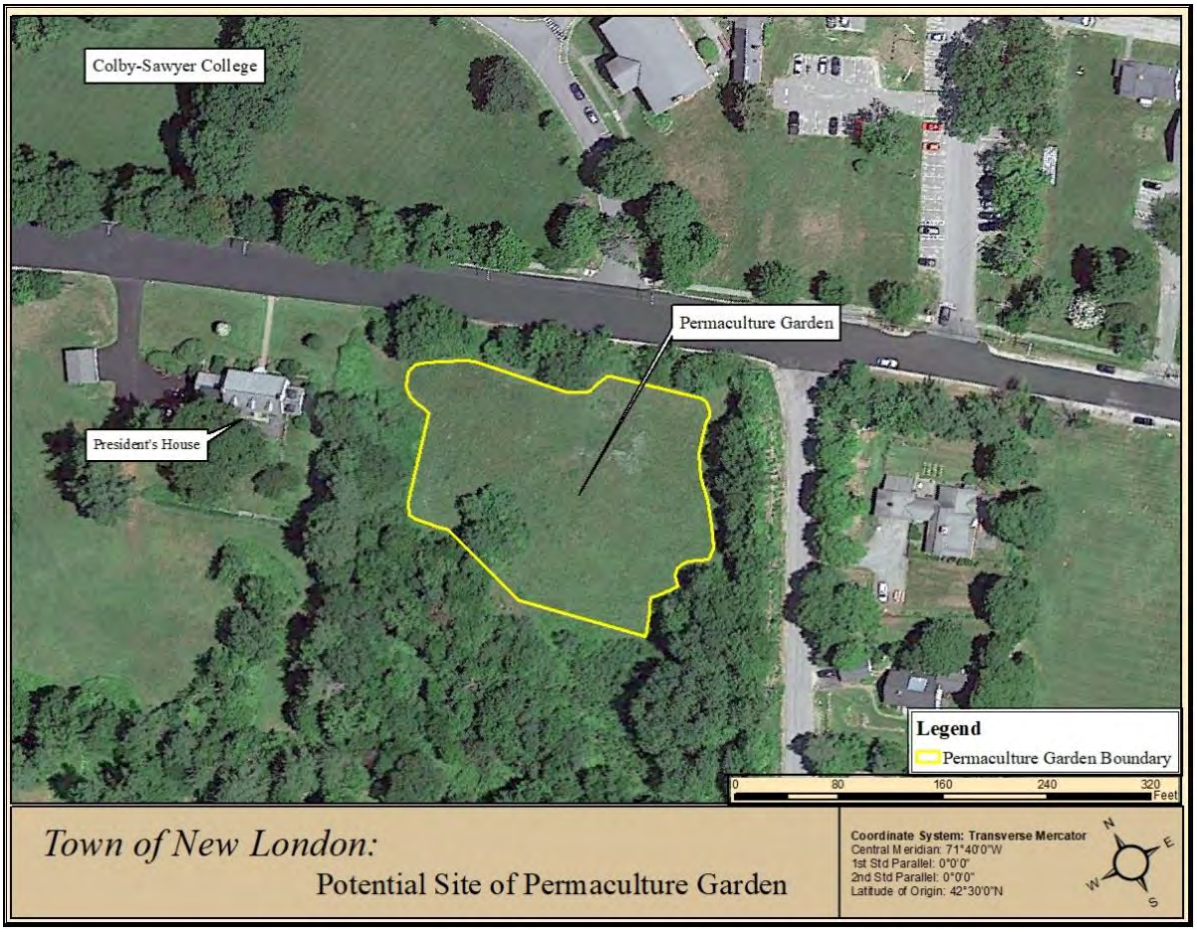


Figure 9. Site of the Main Street Garden.

Recognizing this region's need for accessible and healthy winter crops, Colby-Sawyer College is establishing a garden on Main Street in New London to supplement the existing food security initiatives in the area. The Main Street Garden will be a 0.8-acre plot of land located across from the Colby-Sawyer campus and adjacent to the President's house as pictured in figure 9. The operation will be split up into three phases, in which production size and range of crops will increase. Phase 1 of the Main Street Garden begins with laying the groundwork for the continuation of the project. In the fall of 2019, four rows were established to begin growing crops in the spring of 2020. Volunteers and interns will assist in maintaining the garden. This first phase should allow ample opportunity to raise donations that will be allocated to future development of the project. After one growing season, there should be enough feedback to assess the long-term success of the project, as well as the opportunity to increase financing and implement curricular changes that support the garden initiative. Much of the emphasis in Phase 2 of the project will be on expanding the growing area, as well as utilizing the garden as an educational tool. This phase may also involve working with the New London Hospital to develop educational workshops focused on building personal food security. Another intern will likely be added during this phase dedicated to the purpose of maintaining the garden as well as managing volunteers. In Phase 3 of the project, a long-term plan for the initiative will be developed. The possibility of including an unheated high tunnel for growing season extension will be explored in this phase (Malan, 2019).

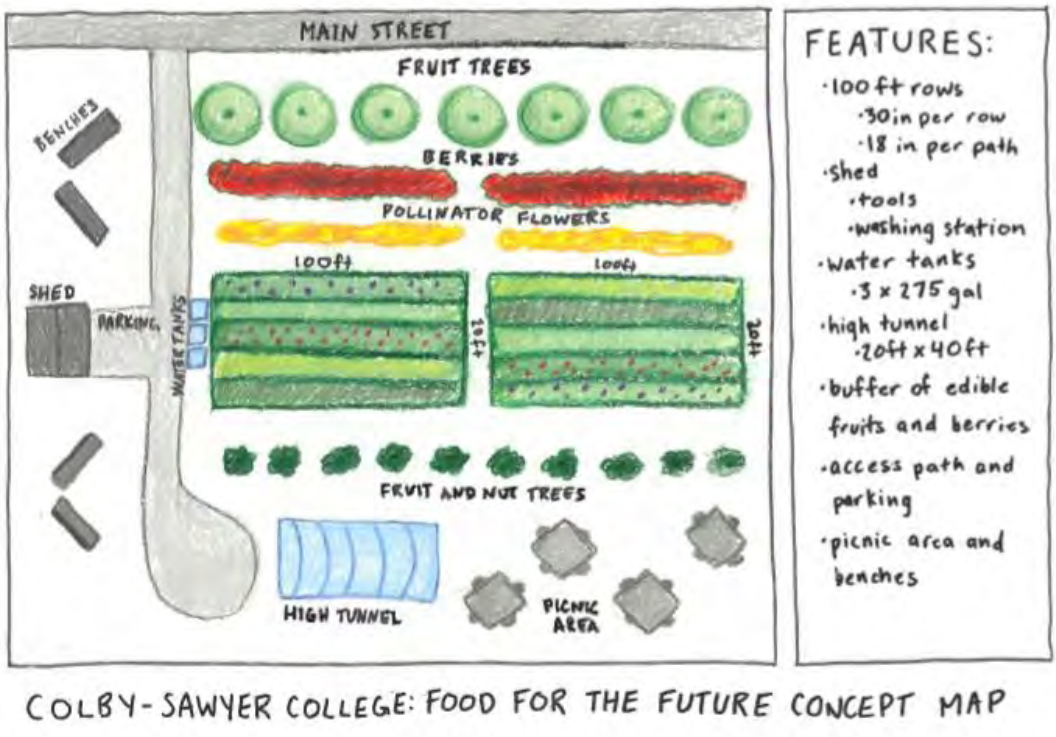


Figure 10. Concept map for the Main Street Garden.

To address rising food insecurity during the Coronavirus pandemic in the spring of 2020, the Main Street Garden is being prepped to yield double the produce originally planned for the 2020 season. Onions, beets, cabbage, and winter squash will be grown in eight 100-foot rows. These new crop choices are the result of the seeds available and changing budget. This produce will be supplied to the food security initiatives in the area working to ensure that there is healthy local food available during these challenging times.

Moving Forward

Partnerships and Distribution

We have worked to develop a plan to ensure that the food from the Main Street Garden is available to those who need it into the future. Throughout the planning process, we have communicated with stakeholders to better identify our community's needs and learn from those who are already working to fight food insecurity. These partners will each aid in unique aspects of the distribution plan, allowing produce to reach those in need in an efficient manner. As the project grows, we recommend that Colby-Sawyer remain in close communication with these community partners to give and receive up-to-date information regarding desired crops, yield amounts, and distribution preferences.

New London Hospital

Moving forward, produce from the Main Street Garden will be donated to existing distribution sites that accept the New London Hospital's Food Prescription coupons. Specifically, the Main Street Garden will help to fill the identified gap in winter produce that stores well for longer periods of time. In communication with the hospital, we have also identified a gap in healthy, low starch crops that are well suited for prediabetic and diabetic patients that participate in the Food Prescription Program (C. Bardier, Personal Communication, November 14, 2019). By donating these crops, the aim is to decrease program costs for the hospital and allow for even more community members to benefit from the Food Prescription Program through further expansion. We recommend that the New London Hospital continue to help as many community members with the Food Prescription Program as possible by continuing to increase the number of recipients and broadening the ways in which people can be considered for the program.

Kearsarge Lake Sunapee Food Pantry

The Kearsarge Lake Sunapee (KLS) Food Pantry will act as an additional means of distribution for the Main Street Garden. Distribution through the food pantry will allow the produce to reach a wider population of community members. This centralized pick-up location would be especially beneficial for those with limited transportation or mobility. As the Main

Street Garden increases production, the Kearsarge Lake Sunapee Food Pantry recommends Colby-Sawyer College establish partnerships with additional food pantries throughout the region (Bill Ross, Personal Communication, February 12, 2020). This may be possible through a partnership with Willing Hands and a coordinated pick-up of the garden produce with their delivery truck, as discussed below.

Willing Hands

The Main Street Garden could partner with Willing Hands in the future as a means of distributing produce to even more community members in need. In meeting with members of Willing Hands, we received valuable information that will help us with the storage of crops in the future. If the Main Street Garden becomes productive enough, interns will have the option of meeting the Willing Hands distribution truck in Claremont to distribute the garden crops throughout the area. In looking at the map of the Willing Hands distribution points, we noticed a gap in the Kearsarge/Lake Sunapee area. Many of the towns in this area have levels of food insecurity of greater than 10% of the population (Wauchope & Ward, 2012). We recommend a continued conversation with Willing Hands to discuss the feasibility and benefit of widening their distribution and collection range to this area.

Kearsarge Food Hub

We will work with the Kearsarge Food Hub to distribute produce to families with food insecurity beyond the borders of New London. The winter produce from the Main Street Garden will be a supplement to their fresh food “baskets” for food insecure families in Bradford. Furthermore, Sweet Beets, the Market outlet for the Kearsarge Food Hub, accepts the Food Prescription “coupons” from the New London Hospital. In supplying Sweet Beets with winter produce for the purpose of reducing food insecurity in the area, the Hospital will not have to reimburse Sweet Beets for produce purchased with the Food Prescription Program coupons and will be able to direct those funds to expanding their program.

Warner Public Market

Produce from the Main Street Garden will be brought to Warner Public Market as another means of distribution. Specifically, the Main Street Garden will provide produce for Warner Public Market in the winter months to supplement their partnership with the Kearsarge Kares program. This will help to secure a steady supply of produce for food insecure families with school-aged children in the area.

Food Storage

Phase 1

One of the hurdles facing the Main Street Garden project is creating a system in which fresh produce can be stored. Using the Main Street Garden Proposal created by Professor Leon Malan, we were able to gain an understanding of crop yields for each phase of the Main Street Garden project. Along with the help of Willing Hands, we were able to create estimations on storage space needed for each phase of this process. Willing Hands uses bins to store produce, each weighing approximately 45 pounds when filled with crops and having a volume of 2.5 cubic feet (Cavin, S. & McCracken, Personal Communication, March 5, 2020). Table 1 summarizes that for Phase 1 of this project, upwards of 68 cubic feet will be needed to store onions, beets, kale, and carrots.

Crop	Growing Space	Potential Yield in Pounds	Estimated Cubic Feet
Onions	50 ft	100-150	5.5 - 8.25
Beets	50 ft	50-80	3 - 4.5
Kale	50 ft	30-50	30 - 50
Carrots	50 ft	60-90	3.5 - 5
TOTAL	***200 ft***	***240-370 pounds***	**~42 - 68 cubic feet**

Table 1. Estimations of yield and storage space for Phase 1 of the Main Street Garden Project.

Phase 2

Moving forward, we would like to expand the Main Street Garden to facilitate a larger production of produce. In the future, we hope to grow two 100-foot rows of greens to sell to Parkhurst Dining, Colby-Sawyer College's Dining Hall Service Provider. These greens will take up a significant amount of storage space and an arrangement with Parkhurst as to where the greens will be stored needs to be made. Calculations regarding the space needed to store produce during Phase 2 account for different storage scenarios that may take place. In total, this phase could produce close to 1,000 pounds of produce, which will require around 220 cubic feet of storage. Even if all the greens were able to be distributed soon after harvest, approximately 150 cubic feet of storage space will be required for the rest of the vegetables. The full assessment of potential yields and storage space requirements can be seen in table 2.

Crop	Space	Potential Yield in Pounds	Estimate Cubic Feet
*Greens (Romaine)	100 ft	180 - 220	30 - 37.5
*Greens (lettuce mix)	100 ft	100 -140	30 - 40
Beans (Dry beans)	200 ft	60 - 110	3.75 - 6.25
Onions	100 ft	200 - 300	11.25 - 17.5
Beets	100 ft	100 - 160	5.75 - 8.75
Kale	100 ft	60 - 100	60 - 100
Carrots	100 ft	120 - 180	7 to 10
TOTAL	***800 ft***	***820 - 940 pounds***	**150- 220 cubic feet**
		Without Greens	**90 - 142.5 cubic feet**
		Just Greens	**60-80 cubic feet**

Table 2. Estimations for Phase 2 of the Main Street Garden; in this phase we hope to increase crop production.

Table 3 outlines the ideal humidity and temperature requirements for each type of produce. Storing produce at the right climate helps to ensure that it remains fresh for a longer period. There are many different methods that can be utilized to achieve the storage conditions required in table 3. One storage option would require multiple refrigerators that can be individually adjusted to suit the climate requirements of the produce stored in them. In order to store all the produce, aside from the greens (due to timing of harvest) and beans (due to their climate requirements), a space of 140 cubic feet would be needed based on calculations from table 2. Given that the average size of a refrigerator is 20 cubic feet, seven refrigerators will be needed to store the produce in Phase 2 of the project. Refrigerators would be easy to install and allow for climate control between each unit. The downsides to this option include the overall cost and the lack of energy efficiency of running seven refrigerators.

Crop	Humidity	Temperature (F)
Onions	65-70%	38
***Greens (Romaine)**	95-100%	32
Kale	95-100%	32
Carrots	95-100%	35
***Greens (lettuce mix)**	98-100%	32
Beets	98-100%	32
Beans (Dry beans)	Dry	Cool

Table 3. Optimal Storage Humidity/Temperature for Phase 2 Crops (Denckla, 2003).

We recommend that Colby-Sawyer College provide a space on campus to store produce harvested from the Main Street Garden. A storage facility will allow produce to be available year-round to those who need it. Stakeholders will gain a source of produce to support their

food insecurity programs without having to find room for extra storage. Preparing for the future, a room that can accommodate the storage requirements of Phase 2 should be attained. Some prospective buildings that may offer the best conditions for storage are the Sawyer Fine Arts Center and the Reichhold Center. Both buildings have empty basement rooms with few windows that could be utilized and are easily accessible from community parking spaces. Becoming a storage facility for produce grown on campus will allow Colby-Sawyer College to become a true model of food resilience.

Funding

Funding for Phase 1 of the Main Street Garden project will be pulled from the Environmental Science Cargill Fund and will cover implementation costs and stipends for two to four interns. By 2021, a long-term plan must be established for financing the project and the Natural Resources Conservation Service (NRCS) grant should be applied for to secure funding for a high tunnel (Malan, 2019). We have begun working with Catherine Hogan, Colby-Sawyer College's grant writer, to form a solid proposal and search for suitable grants. We recommend that Environmental Studies and Science students or students in the Sustainable Food System class, continue to work closely with Catherine Hogan to secure funding as the project grows and evolves.

Supplemental income in Phase 2 may be acquired through the sale of summer greens to Parkhurst Dining. This would provide an additional $1,728 to $2,272 for the Main Street Garden project (Malan, 2019). We also recommend reaching out to local businesses to "adopt" a plot in the garden. Window stickers for local businesses could be designed by graphic design students to proudly display support for this local initiative. The financial stability of this project will be strengthened through a collective community effort.

Engaging the Colby-Sawyer College Community

The purpose of the Main Street Garden project should extend to providing a learning opportunity for the Colby-Sawyer College community. Given that this project is multidisciplinary in the fact that it combines sustainable farming with nutrition, Colby-Sawyer College should develop courses that integrate both environmental programs (environmental science and studies) and the health programs (nursing, public health, and exercise science). This is a connection between two fields of study that must be recognized because the health of the environment and the health of community members are interdependent.

In 2019, the Community-Based Research Project conducted a comprehensive analysis of the institution's role in the larger food system. Part of this analysis indicated the need for an increase in course offerings that promote healthy and sustainable food (Community-Based

Project 2019, 2019). The Community-Based Research Project suggested the creation of a Perspectives on Food first-year symposium, and this recommendation was implemented. We suggest that this course be offered every year instead of every other year to give incoming students the option to take the class. Starting in the fall of 2020, the college will also be offering a Sustainable Food Systems class which will provide a hands-on experience for students in the Main Street Garden. Our vision is to continue the growth of food-focused programs and classes at Colby-Sawyer College.

We have identified two colleges that have done an exemplary job integrating classes and areas of study that focus on food and food systems. Several courses at The College of the Atlantic in Maine would be suitable for Colby-Sawyer College to implement including the Art and Science of Fermenting Foods (College of the Alantic, 2020). This course is focused on the molecular biology of fermented foods. This could be beneficial because it would allow students to learn about the fermentation and preservation of food grown in the garden. This newfound knowledge could be transferred to the community by workshops that teach other students and community members how to preserve food. Colby-Sawyer could also follow the example of Unity College in Maine and create a beekeeping course that would be responsible for installation of beehives at the two college gardens (Unity College). These hives would allow for increased garden productivity. We recommend incorporating these two opportunities because they align with Colby-Sawyer College's focus on interdisciplinary studies and the benefits would extend beyond the college campus.

In response to COVID-19, a greater emphasis on the connection between illness and nutrition should be addressed in the health majors at Colby-Sawyer College. Public Health classes could also contribute to the Main Street Garden by developing low-cost and nutritious meal plans that utilize the vegetables grown in the garden. The college's Principles of Nutrition course could utilize the Main Street Garden and Permaculture Garden to gain a better understanding of the importance of fresh produce in a healthy diet. The garden will serve as a living and working classroom for students to work with the community to incorporate healthy, seasonal, and local produce into their eating habits.

Engaging the Greater Community

Colby-Sawyer College is fortunate enough to be part of a tight-knit community that extends the boundaries of the college. The Main Street Garden will flourish with the help of community volunteers to share knowledge, resources, and time. Furthermore, by involving the community in the project, the Main Street Garden will be a living classroom that will allow community members to practice the skills needed to maintain their own home gardens. We recommend that in Phase 2 of the Main Street Garden project, a schedule be developed to coordinate community volunteers. Following the example of Willing Hands, volunteers could

sign up for two-hour time slots to work in the garden under the direction of an intern (Jim & Sara, Personal Communication, March 5, 2020). The New London Hospital should incentivize employee volunteer time by awarding their Wellness Points to those who participate in the garden project. Collaboration with Kearsarge Food Hub, Warner Public Market, and the KLS Food Pantry could also be used to coordinate volunteers and publicize the arrangement. We also recommend that the members of the Main Street Garden project reach out to the Kearsarge Regional School District to provide a volunteer opportunity for students. Engaging these students would provide them with knowledge about gardening that they could utilize at home. Following these recommendations for volunteer opportunities would prompt connections throughout the New London community around a meaningful initiative.

Agricultural Land Protection and Utilization

Why is the Protection and Utilization of Agricultural Land Important?

Food insecurity can spread beyond economic constraints to temporarily affect all members of a community during a disturbance event. An extreme weather event or a pandemic that disrupts the supply chain can limit an entire community's access to food. A community is vulnerable to such disturbances if their food system is centralized and beyond local control. A centralized food system is dependent on distant, large, industrialized farms, rather than small, local farms. Thus, increasing local agriculture and food production greatly increases the resilience of the community. While is it difficult to enforce the use of land for agriculture, preserving viable agricultural land helps to make local food production more feasible.

Protecting New London's open spaces and viable agricultural lands will provide the community with several diverse opportunities illustrated in figure 11. Agricultural land conservation enables an increase in local food production by making land more affordable for farmers. In the event of a disturbance that inhibits the transportation of food from farms to distant communities, locally produced food becomes vital to sustain the community. Local food production also reduces the number of miles food must travel from farm to consumer translating to fewer resources required and less greenhouse gases emitted. Buying local also supports businesses in the community. One's sense of place as well as one's personal connection to food consumed is developed while supporting local food production (Grubinger, 2010).

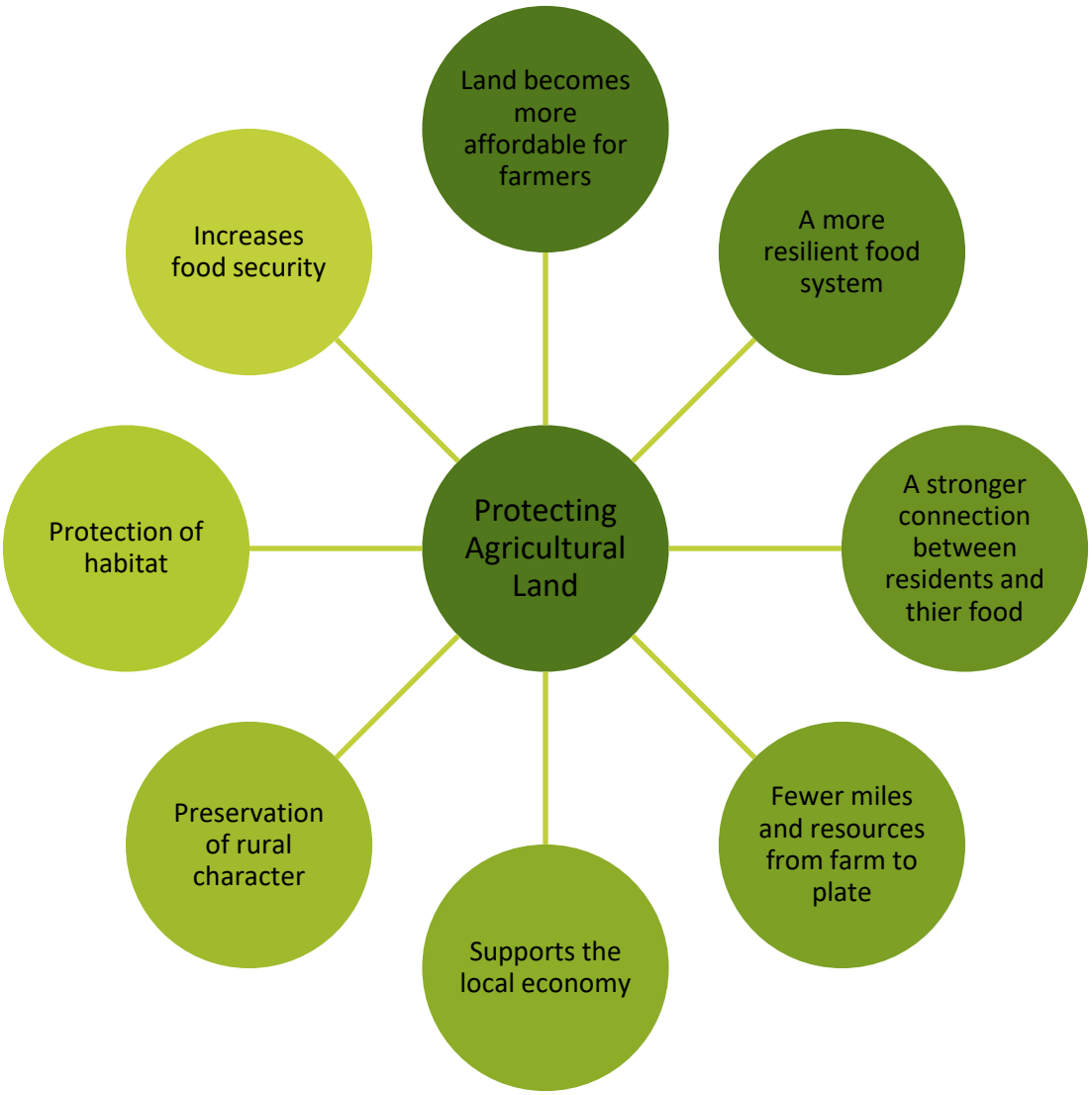


Figure 11. The benefits of protecting agricultural lands in New London.

Conservation of open spaces and agricultural lands provide benefits beyond local food production. Highly important to New London as well as towns across New Hampshire, is the preservation of the town's rural character (New London Planning Board, 2011). Rural towns take pride in the scenic value and the rustic charm their open agricultural lands provide. Open spaces and agricultural lands help to attract tourists, further aiding the local economy (University of New Hampshire Extension, 2018). In fact, each acre of open space that is not developed has the ability to provide up to $1,500 of economic benefit for the local community and the state in its entirety (Research Systems Group, 1999). Environmental benefits of agricultural land include the absorption and filtration of water, protection of habitat, and travel corridors for wildlife. Overall, it is essential that New London prioritizes the protection of these

valuable lands, both potential farm sites and those which already exist, to improve the resilience and wellbeing of the local community.

New London is home to a variety of small food producers and home gardeners but, overall, the town's population remains heavily dependent on distant food sources. Spring Ledge Farm is the largest food producer in town with roughly 60 acres currently in production (P. Landry, Personal Communication, October 10, 2019). In response to a town-wide survey distributed by our Community Based Research Project, nearly 65% of respondents reported having a home garden and dedicate an average of 242 square feet to growing produce (figures 12 and 13). This home food production provides for an average of 11% of food growers' diets (figure 14). Home gardens add to local food production and contribute to the town's overall resilience. While Spring Ledge Farm and a variety of other small food producers do provide local food, dependency on the centralized food system could be lessened with more land in town dedicated to growing produce.

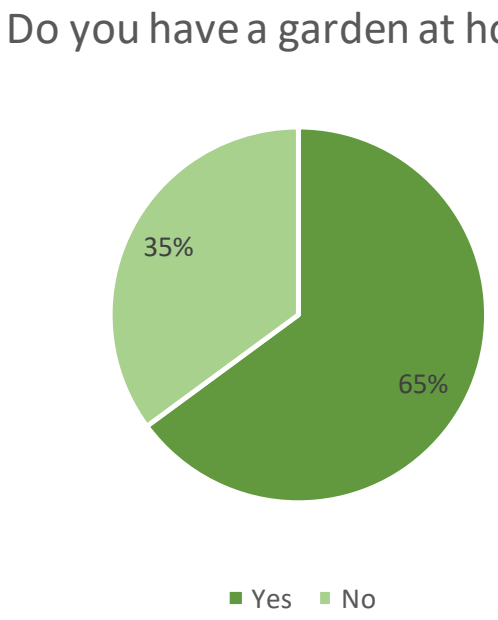


Figure 12. Percent of survey respondents with a home garden.

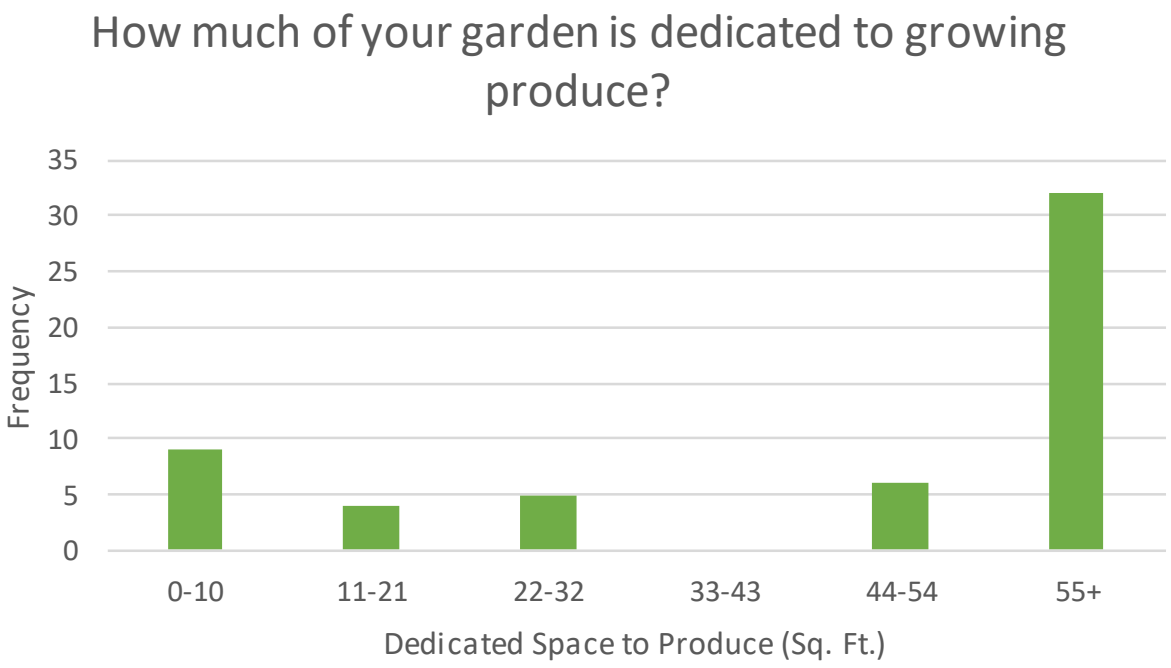


Figure 13. Space in square feet dedicated to growing produce at homes with gardens.

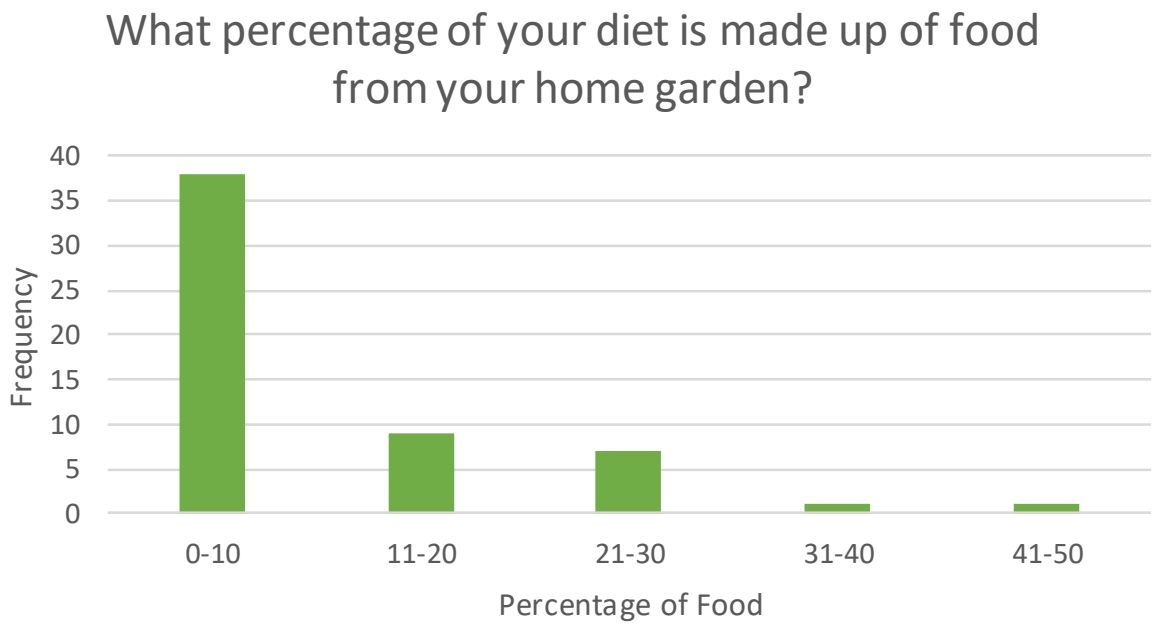


Figure 14. Percentage of diet made up of home-grown food.

From a historical lens, utilized agricultural lands in New London have decreased since the 1940's (New London Planning Board, 2011). This sudden reduction in local food production in the late 1940's can be partially attributed to the decline of the Victory Gardens Movement

following World War II. Beginning in the spring of 1942, the United States government enforced food rations as a result of the developing war, and many Americans turned to home food production to fill the gaps (Schumm, 2014). In 1942 alone, an estimated 15 million American families planted home Victory Gardens to lift the burden from commercial farmers. By 1945, an estimated 20 million families had planted Victory Gardens, producing a collective eight million tons of food, close to 40% of all fresh fruits and vegetables consumed in the U.S. during this time period. However, with the end of the war came the end of the Victory Gardens Movement and a rapid decline in home food production (Growdy-Wygant, 2013). Since this unifying time period in history, small-scale agriculture across the nation has declined, and the town of New London is no exception (Ganzel, 2007). As a society, we must learn from this historically successful movement. Following a model similar to that of the Victory Garden Movement, New London can increase its local food production and become more resilient.

Figure 15. World War II Victory Garden poster (Morley).

The current pandemic demonstrates the importance of emergency management in the food system. The COVID-19 pandemic has left many industries strained, working to provide additional supplies for the nation during these uncertain times. The food system is in crisis, as many laborers that keep our food system running are now unable to work. Farmers are halting production, transportation workers are struggling to keep up with demand, and much of

international trading is at a standstill. Consumers are thus left with quickly emptying shelves and many questions regarding the future of the food system (Torero, 2020). According to the responses from the community survey, the majority of the New London population has a week's worth of food in their homes at any given time. Furthermore, the majority of the New London population relies on grocery stores for their food, particularly the New London Hannaford. This is not the most effective system during a disturbance because if roads are unusable or stores are closed, residents may not have access to fresh, healthy food. In these uncertain times, home food production will alleviate some of the risk of food shortages. Revival of the Victory Garden Movement could serve our current society in many of the same ways it was able to do so during WWII. Growing more of our own food at home will lower our reliance on strained grocery stores and reduce the need for the town to distribute meals ready-to-eat (MREs). Now more than ever, every bit of food production is vital in securing the nation's food supply. Victory Gardens, regardless of their size, can play a significant role in addressing the current COVID-19 crisis.

What Lands Should Be Protected?

The first step in protecting and enabling the production of agricultural land is to map conditions best suited for agricultural use. Geographic Information Systems (GIS) was utilized to create a map that highlights the prime agricultural conditions based on the following criteria: slopes less than 15%, soil deemed as prime agricultural soil by the USDA, contained no commercial zoning, and no wetlands. The goal in creating this map was to highlight the parcels of land that should be conserved for agricultural purposes so we also excluded parcels that are already conserved, parcels with agricultural land smaller than one acre, and parcels smaller than four acres. These parameters use information from New London's current zoning ordinances (Town of New London, 2019). Using these parameters, we were able to create a map representing the tax parcels in New London that may contain agricultural land worth conserving for the future. Out of New London's 13,600 acres, 400 fit the potential agricultural conservation definition we designed.

As seen in figure 16, tax parcels such as Colby-Sawyer College and Lake Sunapee Country Club contain two of the largest tracts of land best suited for agricultural purposes (22.8 acres and 88.4 acres, respectively). These two parcels represent just a fraction of land that is currently utilized for purposes other than agriculture. Even though Colby-Sawyer College is not being utilized for food production, there are open spaces between dorms that still have agricultural potential. These spaces could be converted into growing spaces, and for these reasons, Colby-Sawyer College and other institutions with opens spaces are still included in figure 16. The land that is highlighted in this map represents ideal agricultural land that we recommend as a priority for agricultural land conservation.

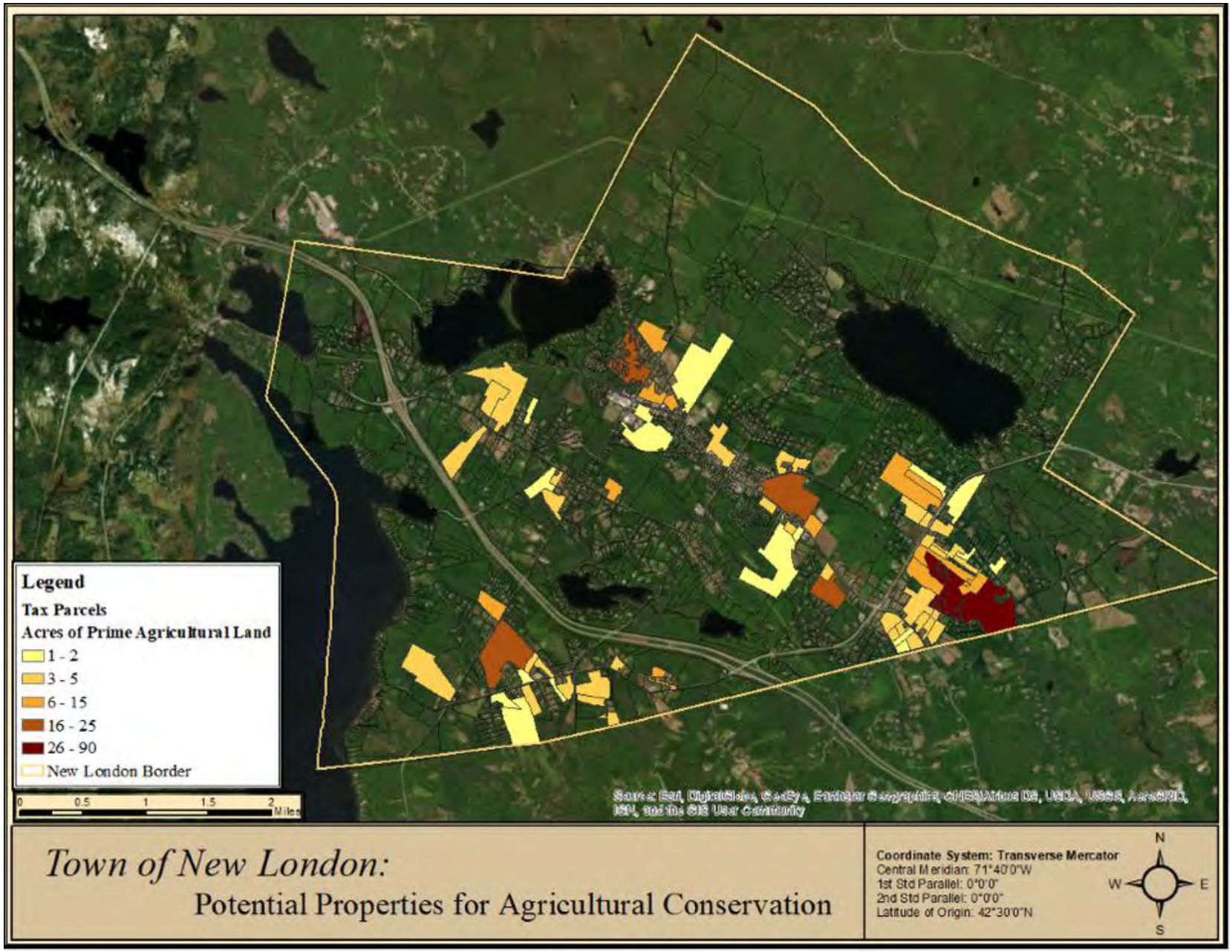


Figure 16. Map of Prime Agricultural Land in New London based on Tax Parcels. Darker parcels indicate a greater area of prime agriculture open space within that parcel.

We recommend that a second map be created that utilizes these same parameters but includes all open space instead of the open space that is also designated as prime agricultural land. We recognize that produce can be grown on soils that are far from prime qualifications and suggest that the town look into protecting these as well.

The Ausbon Sargent Land Preservation Trust (ASPLT) is a non-profit 501(C)(3) organization based in New London that works "to preserve the rural landscape of the Mt. Kearsarge/Ragged/Lake Sunapee region" through trusts and easements. The 152 properties protected under this organization total 12,060 acres of land. Of these 152 properties, six were either donated to or purchased by ASPLT and are under their ownership (Ausbon Sargent Land Preservation Trust, 2015). Currently, the ASPLT is working to purchase the Messer Family Farm, a 143-acre parcel identified in figure 18 as containing agricultural land prioritized for protection. This parcel contains 22 acres of open field that will be leased to Spring Ledge Farm for continued agricultural use (The Ausbon Sargent Land Preservation Trust, 2020).

The town of New London has also taken steps to ensure that land is available for agricultural production. Currently, New London prioritizes cluster development, which allows for a portion of a plot to be developed, while the remaining area is kept as open space or has the potential to be used for agriculture. Further, if development of prime agricultural land is proposed, New London's Planning Board can waive this right in the name of protecting these valuable lands (Town of New London, 2019).

Recommendations

New London and its community members are already making great strides to conserve land. We recommend that the town and its residents act now to protect land specifically for agricultural purposes and utilize the land available for food production. There are two routes that the town can take to conserve its viable agricultural land: regulatory protection and voluntary protection. Protecting open space and prime agricultural land will help to secure spaces for food production in the town, but there are other methods for encouraging productive land use. These methods include the participation of organizations and community members in creating edible public spaces and home "Victory Gardens."

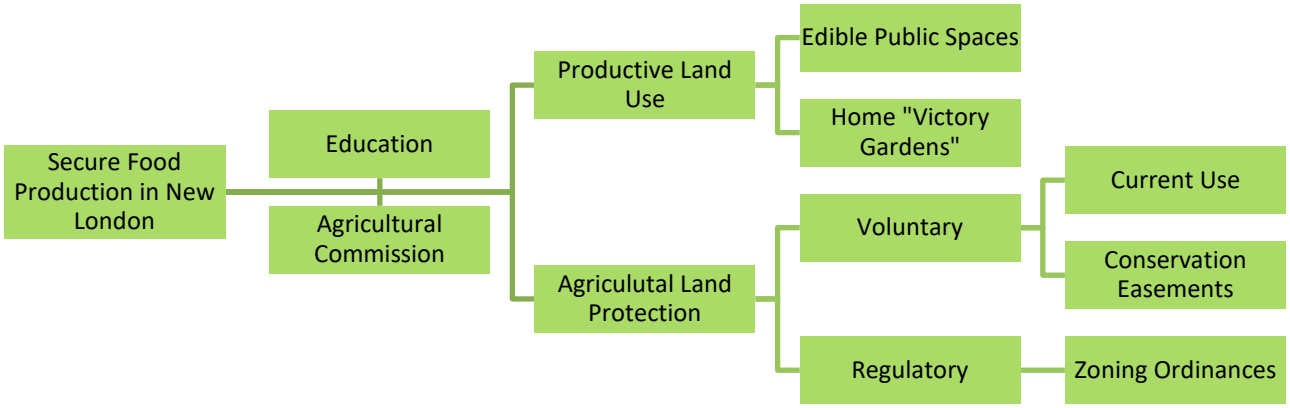


Figure 17. Methods for promoting secure food production in New London, New Hampshire.

Regulatory Protection

Regulatory protection is typically achieved through zoning ordinances. New London already utilizes cluster development zoning as a method for preserving open spaces in the town. Farming should be encouraged in the open spaces and the developer or homeowner's association should consider conserving the land with the Ausbon Sargent Land Preservation Trust. Some towns utilize agricultural protection overlay districts to protect farmland. These overlay districts offer benefits to farmers who participate in the district's provisions and discourage non-farming uses (Zoning, 2002). While agricultural protection zoning ordinances are an option, we believe they would be the least fitting method of agricultural land protection for New London given the patchwork of open space farmland throughout the town.

Given that an agricultural zoning ordinance may not be a good fit for New London, we recommend the formation of an agricultural commission to guide town planning towards options suitable for farming. Agricultural commissions act as educators and advisors to keep farming viable (Bittermann, 2010). This commission would be able to promote best practice farming and offer advice to other municipal boards, including the zoning board, on how to ensure that their initiatives are farm-friendly (Agricultural Incentive Zoning, 2008). Furthermore, the commission could work to encourage the productive agricultural use of open space in cluster developments by partnering farmers with homeowner's associations or working to inform the developers of the benefits of putting the open space in a conservation easement with the ASPLT. New London could work with other local towns to create a regional agricultural commission to make better use of resources and encourage communication among local farms.

Voluntary Protection

Voluntary land conservation is widely used in the town of New London although not always specifically for protection of agricultural lands. We recommend that qualified landowners in New London consider placing their land under conservation easement or donating the land to ASPLT. We recommend that the ASPLT require some prime agriculture land to be kept open for agriculture similar to their open space requirements for viewsheds. The enrollment of land in Current Use also helps to protect agricultural land while encouraging productive use of land through tax incentives. The Current Use option should be encouraged for homeowners looking for a less restrictive way to help protect their land. We have developed an educational handout for homeowners explaining the incentives of conservation easements and Current Use enrollment. We recommend that New London and the ASPLT continue to educate homeowners on the financial and resilient benefits of protecting current and viable agricultural land.

Edible Public Spaces

Land protection initiatives are essential to ensure long-term agricultural vibrancy, but the town should also engage in measures to promote the productive use of all workable land in town, conserved or otherwise. As shown in figure 16, much of this suitable land is located around Main Street and surrounding developments. This could be perceived as an issue when the objective is to preserve large pieces of productive land as many towns aim to do. For residents of New London, this could be an opportunity for edible public spaces, home “Victory Gardens”, and community development.

Many areas in the center of New London are suitable for small pockets of food production. In realizing the social, ecological, and economic importance of local food production, towns across the world have begun incorporating edible public spaces in their town landscape. Incorporating food production into heavily used sections of the town will foster a community conversation around local agriculture (Morley, Farrier, & Dooris, 2017). In Todmorden, England, edible landscaping has been centered around heavily used spaces such as municipal buildings and the hospital. This approach has created a greater relationship between community members and town officials while fostering a greater sense of ownership and positivity (Morley, Farrier, & Dooris, 2017). Edible public spaces are beginning to pop up in Brattleboro, Vermont (figure 18). A group of dedicate volunteers in the city partner with local business owners to plant a “Help-yourself Garden” on the property. Signs encourage visitors to pick what is ripe and leftover produce is distributed once weekly at a small stand (Chiarello & Weiland, 2019). In Norway, Maine the SNAP-Ed and Center for an Ecology-Based Economy teamed up to initiate an Edible Main Street project with the aim of increasing exposure to

healthy fruits and vegetables. While this project has helped to make healthy food available for the community, it has also provided food insecure families with the education needed to grow their own food and make healthy choices. Each planter is outfitted with a laminated book that explains growing tips for the plants and ways to use the plants in the kitchen. Volunteers who maintain the planters are also able to increase community engagement in the project by initiating conversations with passers-by (Maine SNAP-Ed, 2017). Similar SNAP-Ed programs have spread to other towns in Maine (figure 19) (Thompson, 2018).

Figure 18. Herbs ready to pick at an Edible Brattleboro garden (Chiarello & Weiland, 2019).

Figure 19. Edible Main Street Planters in Thomaston, Maine (Thompson, 2018).

New London could implement aspects of these benchmark projects to increase access to fruits and vegetables, improve awareness around healthy eating, and provide an educational opportunity to support food security. A simple first step could be planting fruit trees and berry bushes around municipal buildings. This could then be expanded upon by planting raised beds outside of businesses and around the town common. This food will be available for community members and visitors to pick while walking in the Main Street area of town and will promote a shared responsibility for food consumed. In New London, an edible public spaces project will require enthusiastic volunteers who are willing to cooperate with business owners and town officials to plant produce in the most suitable areas. A volunteer schedule can be coordinated for maintenance of the small gardens. We recommend forming a partnership with the New London Garden Club as a knowledgeable resource.

Home "Victory Gardens"

There is no size requirement for a productive parcel of land – produce can even be grown in containers on the front step. We recommend that all New London landowners, no matter the size of their parcel, grow a portion of their own food. When planting in a small space, there are a few considerations that will help to produce the greatest yield. Plants that can grow vertically, such as beans, peas, tomatoes, squashes, and cucumbers help to maximize growing space. Succession planting should also be taken into consideration; late season crops

can be planted on the same patch of soil after early succession crops are harvested. High-yield crops such as lettuce, radishes, and kale are also great options for small gardens (Small-Space Gardening, 2020). We created an educational PDF, Victory Garden Revival: Starting A Home Garden, to serve as a framework for beginning a home garden. The New London Garden Club could help promote this initiative by hosting a “most beautiful edible garden” contest to encourage productive home gardens and hold workshops to further educate community members about how to begin a small garden.

A Community Effort

The production of food in New London is dependent on the cooperation of the entire town. Town officials must ensure that zoning and regulations are favorable for farmers. Ausbon Sargent Land Preservation Trust must continue to protect viable agricultural land and potentially make open space requirements for lands with prime agricultural soils. Local organizations and Colby-Sawyer College should work to educate homeowners about making the most productive use of their land, conserved or otherwise. Landowners should work to produce their own food and place their land under Current Use or conservation easements if possible. As a community effort, the town of New London will be able to create a more resilient and sustainable local food system that will act as a buffer to outside disturbances to the food supply chain.

Food Education

Filling the Gap with Food-Based Education

The food-based initiatives discussed thus far; the Main Street Garden, the protection of agricultural lands, and "Victory Garden" revival; must begin with community education. Community members are more apt to support and engage in these initiatives when they understand their importance in creating a resilient, local food system. Benefits of such a system, as discussed in previous sections, include: a stronger local economy, access to nutritious foods, a healthier and more food-secure community, a greater connection between the consumer and their food, and less resources required for transportation. With such an abundance of benefits, it is essential that the community works to educate one another regarding both the importance of, and how to achieve, a more localized and hands on food system.

Furthermore, education is a critical component of these initiatives themselves. While providing fresh fruits and vegetables to food insecure families is beneficial, teaching those families how to cook with the produce makes a far greater impact. As Catherine Bardier, Director of Wellness and Population Health at the New London Hospital explained, the ultimate goal in addressing food insecurity is not to continuously provide families with healthy produce but to foster an environment where they do not have to rely on the food assistance programs (C. Bardier, Personal Communication, November 14, 2019). This is achieved through education. In teaching families how to grow crops themselves, they will become more self-sufficient and empowered. Home garden education extends to the agricultural land protection recommendation as well. While simply telling homeowners to protect their land will not increase food production in the town, when those same homeowners are educated on growing crops, they can utilize that skill to become more personally resilient.

During this COVID-19 pandemic, food education is a high priority issue. With children out of school who typically rely on school lunches, families must find ways to provide healthy and nutritious food at home. To help, the Kearsarge Food Hub is preparing produce to be distributed to these families identified by local schools. Feedback from the project has indicated that while grateful to receive the produce, many families are unsure how to prepare and cook the produce they are given. We were contacted by the Kearsarge Food Hub for help creating educational materials to address this roadblock.

What Are We Doing About It?

Our original plan for providing food education to the community was to host a workshop at Colby-Sawyer College to encompass a variety of food-related topics through a hands-on approach. However, we had to adapt this plan after the Coronavirus outbreak and the shift to remote learning. Reassessing the situation and recognizing the new threats to food security during the outbreak, we created a series of educational materials to help people become more food resilient in the face of this outbreak and on a day-to-day basis. When possible, we recommend that these materials be shared with those receiving help from the food security initiatives in the area to help participants take charge of their personal food security.

Winter Produce Weekly Meal Plan

Addressing the need for education focused around the preparation of the produce Sweet Beets currently has available for families, we created a Winter Produce Meal Plan. This plan was distributed on "Sweet Beets Eats" community Facebook page, the Kearsarge Food Hub Website, and through the Kearsarge Food Hub weekly newsletter. The plan was also shared with the New London Hospital to be distributed via their website. This information is easily accessible for families who need recipe inspiration. This meal plan highlights winter produce, is low-cost, and contains easy, flexible recipes. Included is a shopping list that compiles all the ingredients needed for the week. We recommend that future Main Street Garden interns create a low-cost meal plan for each season highlighting the produce that may be provided through the food security initiatives during that season.

Teas, Ciders, and Other Beverages

Teas and ciders can be soothing for the mind and body. During this global health crisis, people may be looking for ways to improve their health and boost their immune system. This compilation of drink recipes can be distributed along with the meal plan to provide supplemental health benefits.

Victory Garden Revival: Starting a Home Garden

To help encourage home gardens, we created a Victory Garden Revival educational PDF. This document lays out the basics of preparing a garden site, cultivating and caring for plants, and saving seeds for the next season. Nutritional values for each crop are also provided. Kearsarge Neighborhood Partners is a new initiative that will help 10-20 families in the area establish a home garden during the summer of 2020. This document will help to guide these

families through the project. We recommend that this document be distributed along with produce from the Main Street Garden. This will help families that receive produce from the food security initiatives in the area start their own gardens.

Home-grown Guide to Growing, Storage, and Preservation

This educational guide is an easy-to-use reference for home gardeners. It focuses on food storage and preservation which are essential in ensuring year-round use of home-grown produce. During this Coronavirus outbreak, those with a store of vegetables and preserved food are less susceptible to the disruptions in the food supply chain. Storage and preservation allow a home garden to sustain a family year-round.

Harvesting Crops

This one-page guide lays out when to harvest each crop based on the hardiness zone in New London. This PDF can act as a supplemental material to the Victory Garden Revival and the Home-Grown Guide.

Canning

Canning is a form of food preservation that may be intimidating to some. This guide provides basic information on canning that may be useful for those looking to preserve a wider array of fruits and vegetables for the winter months.

Fermentation

Fermentation can be a great way to preserve foods, while even boosting their nutritional content. This guide provides tips and recipes for anyone interested in learning more about the art of fermentation.

Produce Vinegar Wash

To address the concern of carrying germs from the store into one's home through food purchases, we created a reference guide to sanitizing produce using everyday products.

Home Remedies: Homemade Hand Sanitizer

Given the shortage of hand sanitizer during the Coronavirus pandemic, we created a quick reference guide for a homemade hand sanitizer recipe.

Further Recommendations

We recommend that the town of New London make these educational materials available to community members through their website, email distribution, or for pick-up at town offices. Colby-Sawyer College can also do their part by sharing this information with students through their website. This would help to foster healthier eating habits among Colby-Sawyer students and inspire students to learn to cook for themselves. Colby-Sawyer students could also carry this information with them back home to inform a wider array of people. We also recommend that Colby-Sawyer College communicate with the University of New Hampshire Extension Office to host workshops for the community and students on food growing, preserving, and cooking. Invitations to these events should be communicated to the families that utilize the food security programs in the area.

In addition, we recommend that Colby-Sawyer College incorporates food education into other majors as well. Public Health, Nursing, and Biology are all majors that could easily incorporate food and nutrition-based education into their curriculum. Further, we recommend the college offer food system-oriented minors which could also open new doors for students. Suggested minors include food systems or nutrition sciences which would pair well with health-related majors already offered at Colby-Sawyer. Our vision is for Colby-Sawyer College to be known as a “hub” for food-based education in the region, bringing together and showcasing local initiatives helping to fight against food insecurity. We recommend that Colby-Sawyer continues to work with their partners such as the New London Hospital, Kearsarge Food Hub, Kearsarge Lake Sunapee Community Food Pantry, Kearsarge Neighborhood Partners, Warner Public Market, Willing Hands, and many others to help further initiatives through the distribution of educational materials along with produce.

Water Resilience

Towns must support the natural flow of the water system to ensure that precipitation does not cause damage and that the resource is able to support the needs of the population. Stormwater should infiltrate properly to avoid contamination of water resources and flooding damages. Low impact development techniques and reducing impervious surfaces can help achieve this objective. Furthermore, stormwater can be utilized at the source through rainwater catchment systems.

Stormwater Management

Why Are We Concerned About Stormwater Runoff?

Stormwater is defined as precipitation that has the potential to replenish surface water and groundwater sources. In terms of resilience, we are particularly interested in stormwater runoff, a form of surface water that does not infiltrate into groundwater. This type of stormwater has the potential to cause damage in the form of erosion, flooding, and pollution if not properly managed (Peterson, Stone, Houle, & Roseen, 2009).

One parameter affecting stormwater runoff is the average precipitation in an area because once the infiltration of precipitation into the ground exceeds its threshold, stormwater runoff occurs. On average, the annual precipitation for the town of New London is 46 inches (United States Department of Agriculture, 2010). Scientists predict that climate change will impact precipitation levels into the future and models have been created to project the impacts that emissions scenarios will have on precipitation in this area. Under a low emissions scenario, climate change is expected to cause a 17% increase in annual precipitation resulting in an annual mean of 54 inches by the end of the century. Under a high emissions scenario, precipitation could increase up to 20% resulting in an annual mean of 55 inches in the same time frame (The Sustainability Institute at the University of New Hampshire, 2014). Extreme precipitation events are also projected to increase in severity and frequency with climate change. By 2050, the precipitation amounts produced in these severe storm events is expected to increase by 15% (Runkle & Kunkle, 2017).

When determining the effects of stormwater, developmental impacts such as surface perviousness must also be addressed. Surface perviousness measures the capacity of landcover to absorb water and is used to quantify the effect of precipitation on stormwater runoff. Water is capable of infiltrating pervious surfaces but is incapable of infiltrating impervious surfaces, such as pavement. Impervious surfaces are usually manmade and, when they are introduced, the threshold for infiltration decreases. Runoff from these impervious surfaces may cause an accelerated oversaturation of nearby pervious surfaces. An increase in runoff can also cause the flow of rivers, streams, and stormwater infrastructure to increase in velocity and discharge, leading to erosion and other damages. While natural infiltration allows sediment, roots, and microbials to filter and break down pollutants that enter the soil, impervious surfaces prevent pollutants from being filtered. This ultimately causes a concentration of pollutants to collect in watersheds, harming surrounding ecosystems (Peterson, Stone, Houle, & Roseen, 2009).

As the town of New London continues to develop, the negative effects of these impervious surfaces are visible. Stormwater has fewer areas to infiltrate into the ground, causing increased damage to infrastructure, roads, parking lots, and properties. Results from the community resilience survey shown in figure 20 and figure 21 show that approximately 42% of businesses and 17% of homes in New London experience flooding one or more times per year. This flooding may cause damage to these homes and displace occupants while businesses experiencing flooding may have to temporarily close. As the effects of climate change continue, the town's already strained stormwater management systems may be not be able to handle the influx of water and these negative effects may be exacerbated. To develop a more resilient stormwater system, the town of New London must ensure that infrastructure can handle the influx of stormwater so that precipitation can infiltrate and turn into groundwater. This would not only reduce the amount of water current infrastructure would have to accommodate, but it would also decrease the possibility of stormwater runoff damage to roads, sidewalks, and other infrastructure.

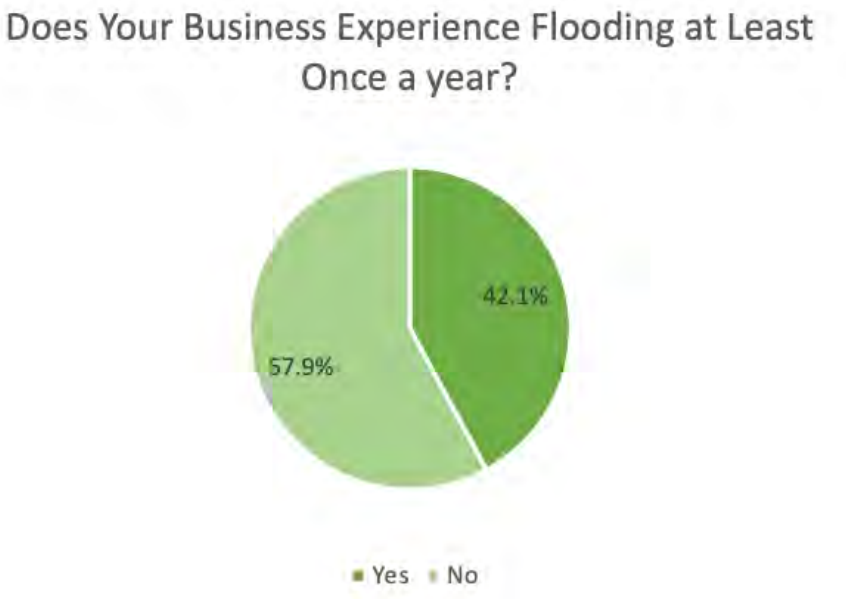


Figure 20. The percentage of businesses in New London that experience flooding annually.

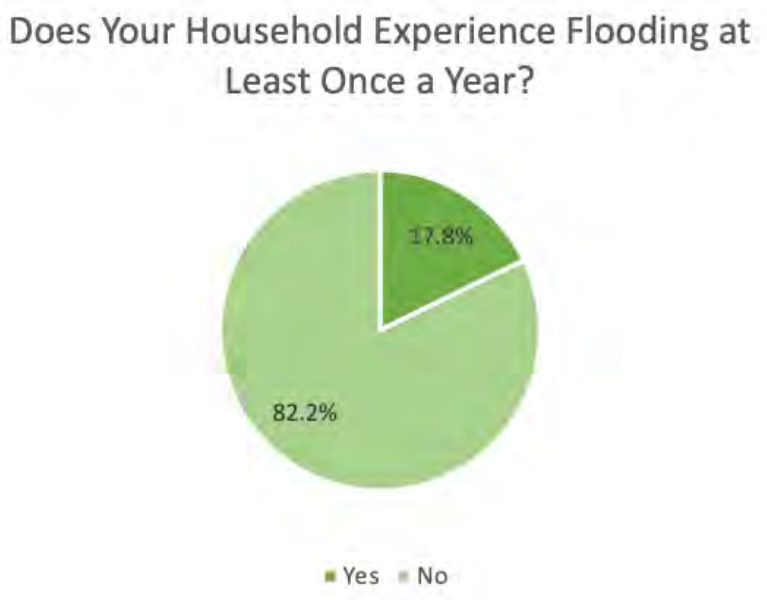


Figure 21. The percentage of households in New London that experience flooding annually.

What does Stormwater Runoff Look Like in New London?

To highlight the areas in New London that have a higher chance of stormwater runoff issues, the *Depth of Runoff Map* in figure 22 was created. Identifying these problem areas allows the total land area of New London to be broken up into different categories based on depth of runoff potential. Potential stormwater runoff in New London during a 100-year storm event was measured in this map using the hydrologic soil codes and landcover data set provided by the USDA, precipitation predictions data from Cornell, and the Soil Conservation Service's Curve Number Method. As seen in figure 22, Main Street and Newport Road are areas of concern, as they have the most substantial levels of stormwater runoff. The Extreme Precipitation Analysis tool from Cornell allows us to predict the amount of precipitation in New London over the course of a 1, 10, 25, and 100-year storm event (The Sustainability Institute at the University of New Hampshire, 2014). Typically, a 100-year storm event has a 1% chance of occurring in any given year. Current projections provided by the Sustainability Institute at the University of New Hampshire predict that this likelihood of a 100-year storm event may more than double by the end of the century (The Sustainability Institute at the University of New Hampshire, 2014).

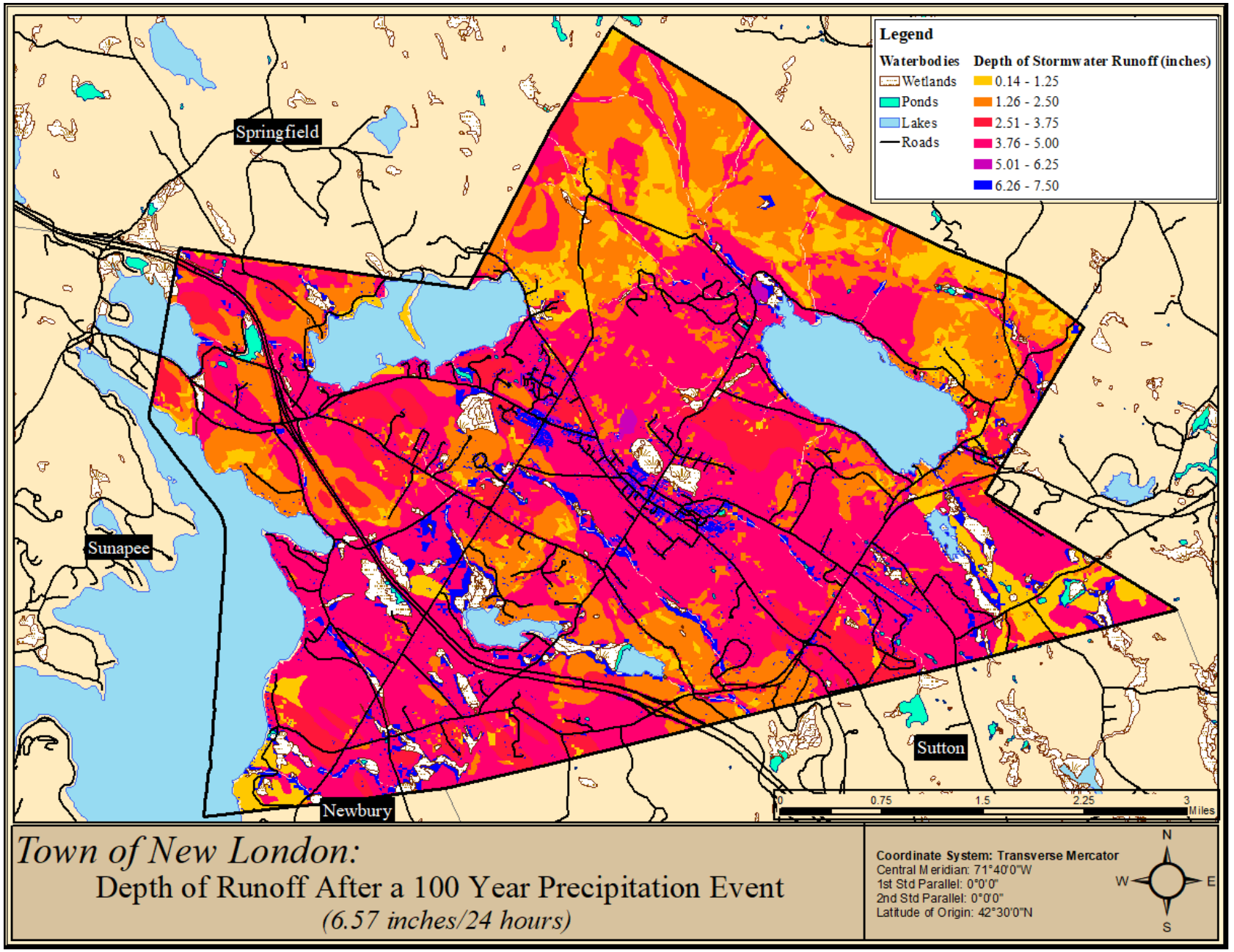


Figure 22. Projected depth of stormwater runoff in a 100-year storm event.

To understand the threat of a 100-year storm event on New London's infrastructure, we conducted an analysis over the Main Street/Newport Road area of New London. This analysis used storm drain locations along with other factors such as slope and water accumulation to calculate the catchment basin of runoff for each drain. The Hydrology Toolbox in ArcGIS was used to create the data seen in figure 23. With this software, along with the stormwater runoff data seen in figure 22, the volume of runoff flowing to each storm drain was predicted.

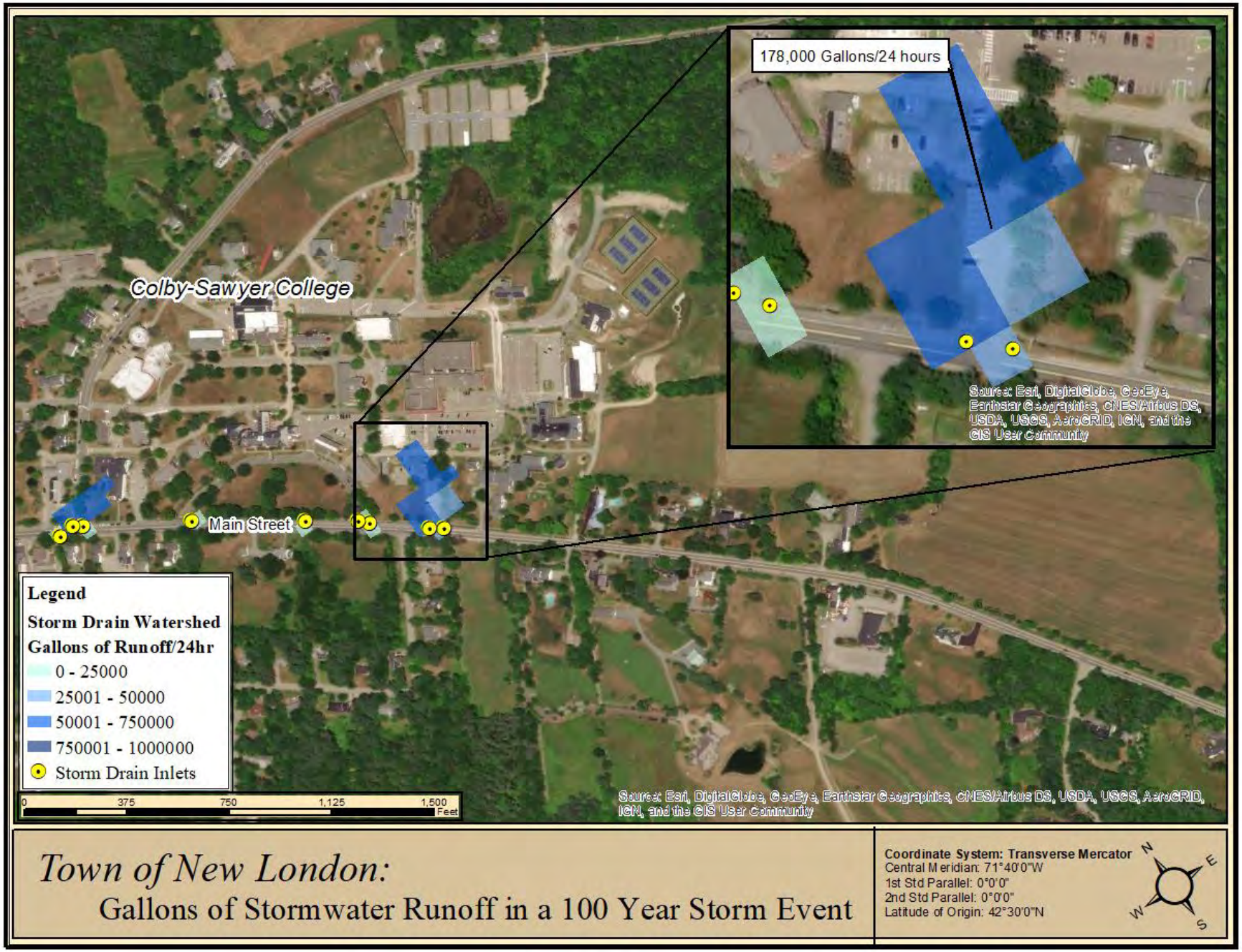


Figure 23. The catchment basins of two stormwater drains on Chargers Road during a 100-year storm event.

Two storm drains were chosen for further analysis due to their location on Colby-Sawyer's campus and their significant influx of stormwater. These storm drains at the entrance of Chargers Road receive approximately 178,000 gallons of water in a 24 hour 100-year storm. To better understand the effect of this volume of water, a history of these storm drains was compiled using imagery from Google Street View (Google, 2018). The images in figure 24, demonstrate the accumulation of water on Chargers Road from 2008 to 2020. The impervious surfaces in the catchment basins of each of these storm drains contribute to the poor drainage on Chargers Road as seen in figure 24. Along with Chargers Road, the storm drain on the left receives runoff from both the Commuter Lot and the roof of the Reichhold Center. These impervious surfaces prevent any natural infiltration and diversion from occurring. Along with these impervious surfaces, the catchment basins for both drains are located on soil with a hydrologic soil classification of C/D which also contributes to poor drainage conditions. Hydrologic soil classification is determined by a scale of A-D, with a classification of "A" representing soil with great soil drainage, while "D" represents soil with poor drainage (United States Department of Agriculture, 1986). It can be seen in imagery dating from 2009 to 2020 that Chargers Road continuously deteriorates from the road's constant traffic and from the climate conditions in New London. Figure 25 displays the damage on Chargers Road and alludes to the maintenance that is continuously necessary at this location. This added cost of maintenance could be diverted by creating a landscape design in this location to help mitigate the amount of stormwater flowing into these two storm drains.

Figure 24. A History of Stormwater Runoff at the entrance of Chargers Road.

Figure 25. History of Damages on Chargers Road.

The roofs of buildings, such as the Hogan Sports Center, are impervious and are another major source of stormwater runoff. Utilizing GIS, we were able to estimate that the 48,800 square foot roof contributes roughly 200,000 gallons of runoff in a 100-year storm event. Water flow from the roof of Hogan Sports Center towards Susan Swamp is visualized by the blue arrows seen in figure 26. This stormwater runoff contributes to nonpoint source pollution of the swamp. Nonpoint source pollution can be difficult to control and can contain several pollutants. After rainwater flows from the roof of Hogan Sports Center, it travels across impervious surfaces such as Chargers Road collecting sediment, oil and toxic chemicals that are produced by automobile traffic. These pollutants can harm aquatic wildlife along with their surrounding ecosystems.

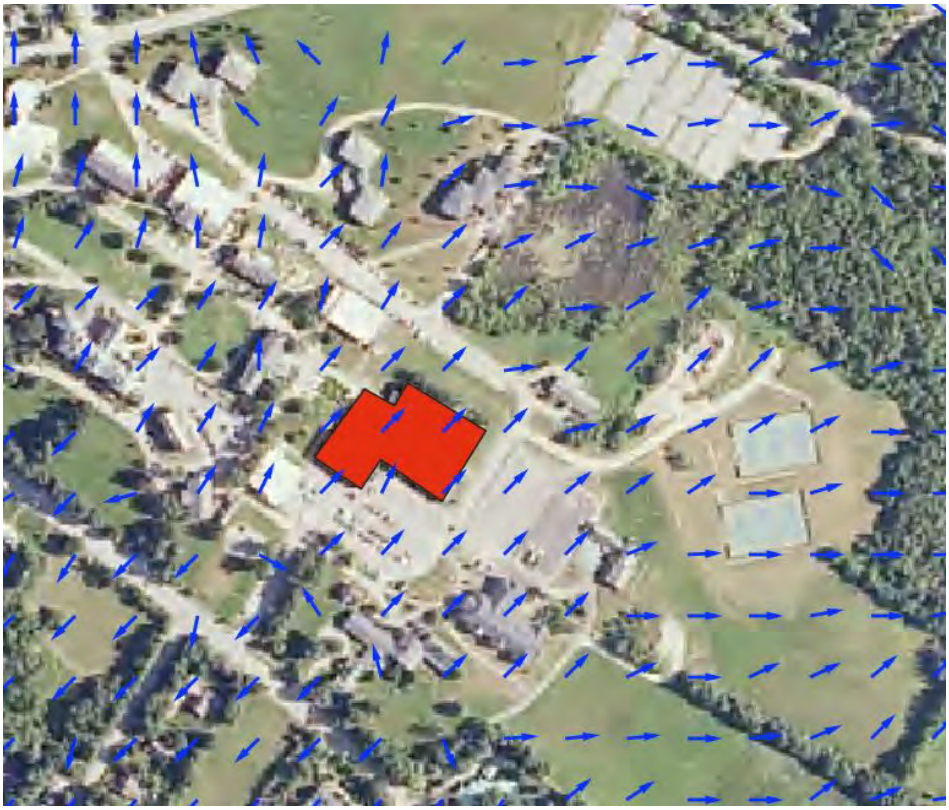


Figure 26. The flow of runoff based on the location of the Hogan Sports Center. The blue arrows represent the direction of runoff flow.

How Can Stormwater Runoff Problems be Addressed?

Low Impact Development

To address areas of concern on Main Street and Chargers Road, we recommend that our stakeholders implement low impact development (LID) techniques. Instead of fixing infrastructure as it breaks or fails, LID is a cost effective, proactive, and resilient approach to managing stormwater. Proactive approaches to managing stormwater minimize burdens on stormwater infrastructure and reduce pollutant flow into water sources. Approaches for infiltration and filtration of stormwater include reducing impervious surface cover; minimizing soil compaction; and introducing rain gardens, gravel wetlands, and porous pavements (Peterson, Stone, Houle, & Roseen, 2009). Unlike conventional stormwater management techniques which focus on piping water away from the site to a centralized water treatment facility, LID focuses on controlling stormwater by using small scale methods to treat stormwater near the source (New Hampshire Department of Environmental Services, 2018).

To simulate the positive impact that LID could have on Chargers Road, GIS was utilized to create predictions. With the data used to create figure 22, two new LID sites were digitized in

figure 27. These sites represent 0.65 acres of permeable soil with excellent drainage conditions. Currently, these sites are located on soil with poor drainage quality. Using GIS, the two proposed LID sites' soil quality was changed from having poor drainage quality (a hydrologic soil classification of C/D) to having great drainage quality (a hydrologic soil classification of A) (United States Department of Agriculture, 1986). This allowed us to quantify how soil quality could impact drainage. It was found that these proposed LID sites will decrease the overall runoff by 44,148 gallons, 19,440 gallons of which flow directly into the two storm drains on Chargers Road. Changes to one small area could significantly decrease the amount of stormwater the town's infrastructure processes.

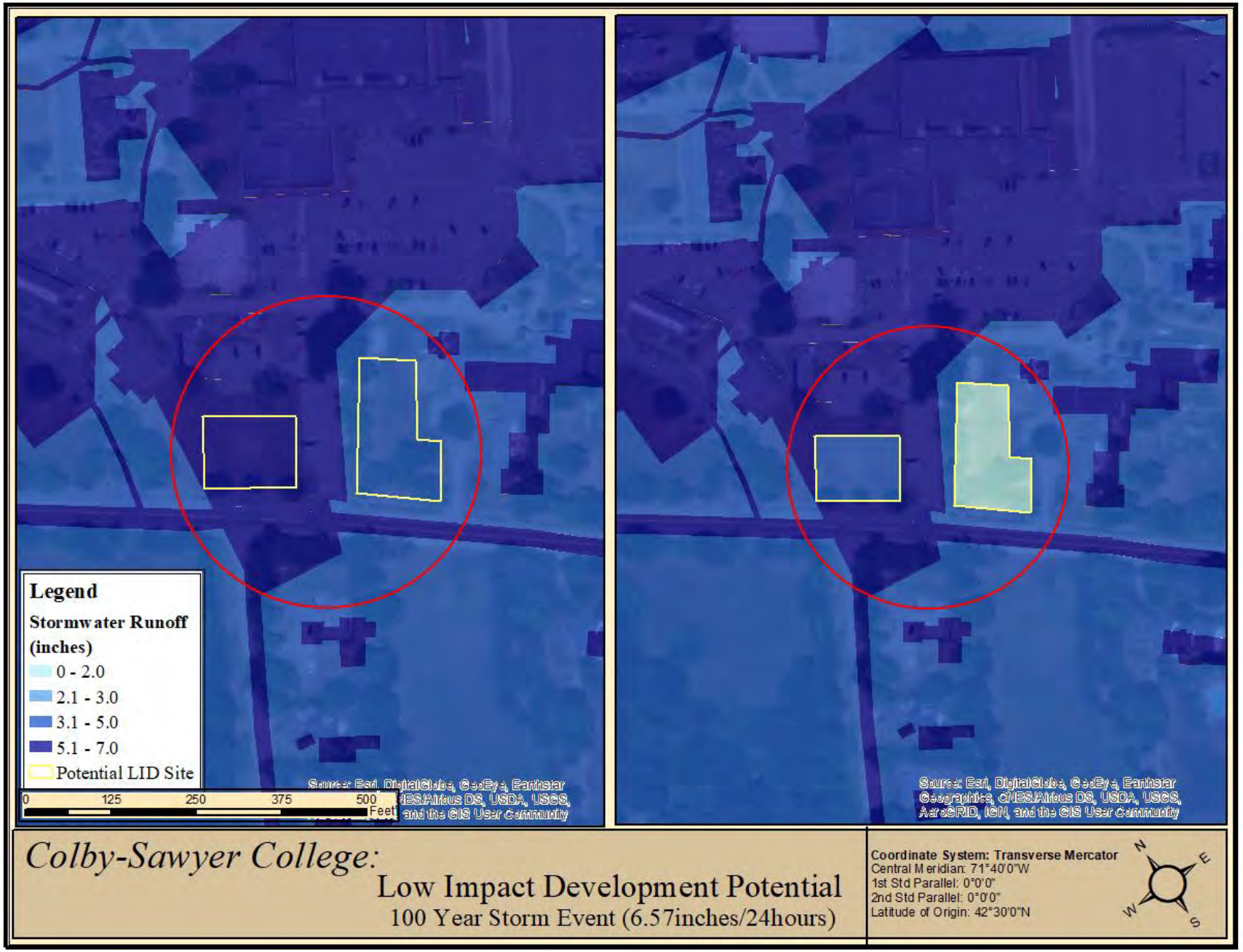


Figure 27. Introducing LID sites in the highlighted locations will reduce runoff.

Low impact development can cost less than conventional stormwater infrastructure due to the need for fewer catch basins and piping. Also, with less infrastructure required than traditional reactive practices, LID can decrease the cost of operations and maintenance. (New Hampshire Department of Environmental Services, 2018). For example, in order to prepare, implement, and develop the landscape for a conventional stormwater management project on a corporate scale, costs could exceed three million dollars. Yet, by implementing LID techniques, the project could cost as little as 2.7 million. This is a savings of close to $300,000 dollars in just the initial cost of the project. While this may be an example of a larger scale project than those we propose, the savings can be scaled to any smaller project. Even on a smaller scale, the maintenance costs would likely be significantly less than those needed to maintain a conventional stormwater management system in order to prolong the system's peak performance (EPA Environmental Protection Agency, 2012).

Porous asphalt will also help to reduce the impact on stormwater infrastructure, as paved surfaces make up most residential impervious surfaces (Zanoni, 2019). The unit cost of porous asphalt is approximately $2-$3.50 per square foot and 20-50% more expensive than traditional asphalt. The overall cost of a project when utilizing porous pavement will be cheaper than using traditional asphalt because stormwater management systems will not have to be installed to mitigate the runoff. In a system that uses porous asphalt, there is no requirement to install a stormwater management system, decreasing project costs (Zanoni, 2019).

Figure 28 represents a proposal for a LID site adjacent to Chargers Road. We recommend that Colby-Sawyer College uses this space to implement low impact development to serve as an example of the environmental benefits that this stormwater management practice can have on community resilience. This site would contain a permeable walkway by which students could walk to different outdoor study areas, permeable pavement at the entrance of the college and in the commuter parking lot, and an increase in natural vegetation that will help contain runoff. Introducing a space here would also allow another area for students to study and congregate outside of the classroom environment. Courses such as Water Resources, Soil and Water Chemistry, and Aquatic Ecology could also use this site to study the effects of LID techniques. This project could provide an opportunity for Colby-Sawyer College to introduce new signage to the entrance of Chargers Road as this road is heavily trafficked by community members to access Hogan Sports Center and the Susan Colgate Cleveland Library. This LID site would also attract prospective students touring the college as this space's visual appeal and educational aspects may provide a reason for students to choose to enroll at Colby-Sawyer College.

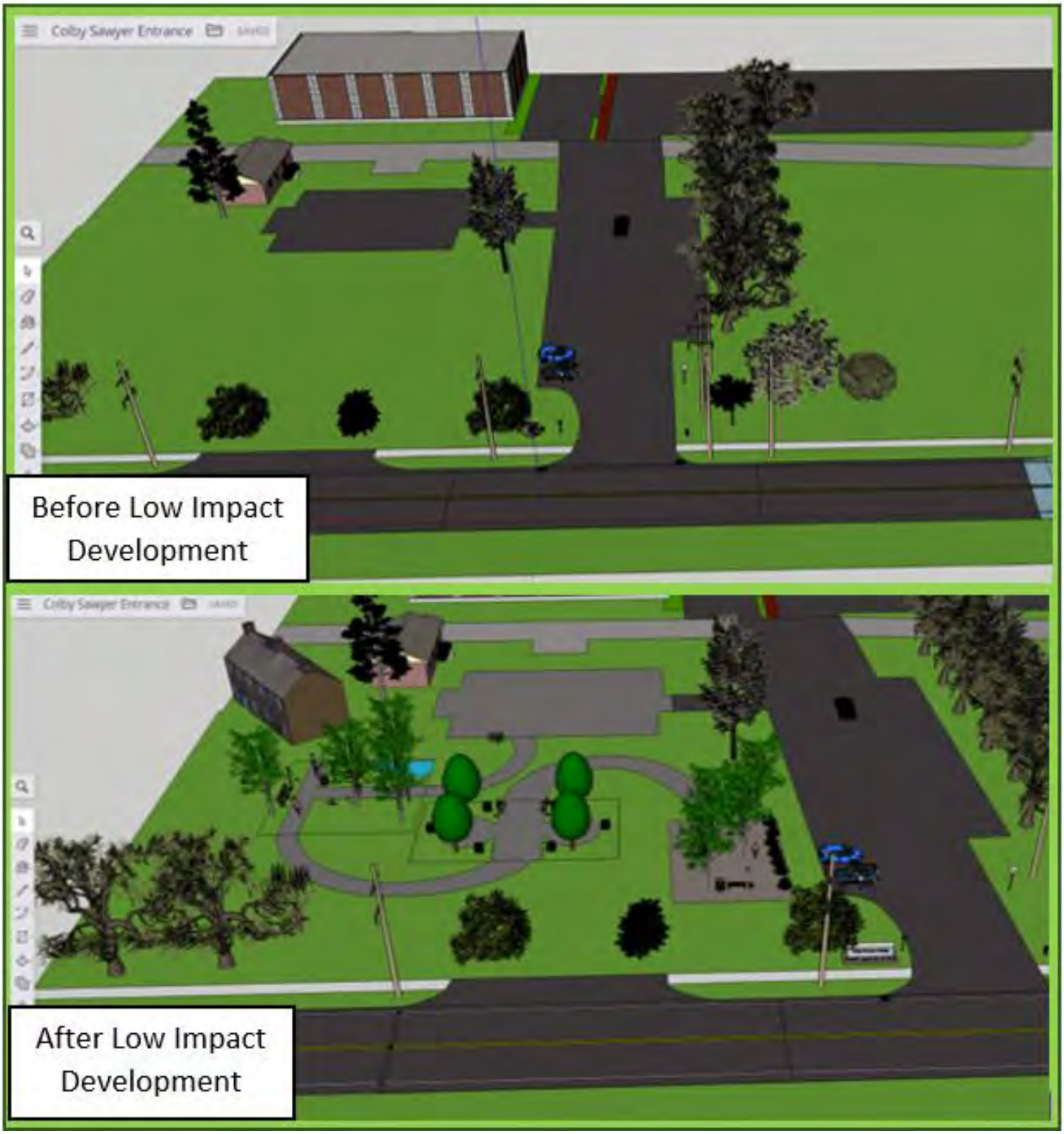


Figure 28. Before and after renderings of the proposed LID site.

Low impact development techniques can also contribute to collaboration and community engagement. This proposed site at Colby-Sawyer College would act as a template on which the town can base future stormwater management projects. An area which was once open and impractical could become more aesthetically pleasing with a diverse selection of native plants weaved between pathways and benches for community use. Stormwater catchments and natural water features could also be implemented to enhance community interaction and educational opportunities (Environmental Protection Agency, 2017). In many cases, LID projects require a multitude of stakeholders, thus the planning process is vital. The first step is to identify and engage partners in the project. Stakeholders can then design the site, find funding opportunities, and plan for future maintenance (Environmental Protection Agency, 2017). While this process may take time, implementing these LID methods would greatly benefit the community and the environment.

Rainwater Catchment

To further reduce the possibility of a surge to the stormwater infrastructure at Colby-Sawyer College, we recommend that the college install rainwater catchment systems in its facilities. Also known as rainwater harvesting, rainwater catchment systems are a form of low impact development that can benefit both the stormwater management systems and local water supply systems (Texas A&M Agrilife Extension). Rainwater harvesting is becoming an increasingly popular way to irrigate facilities and has been used in the towns of Wilmington and Hamilton, Massachusetts to demonstrate the positive impact that collecting rainwater has on the Ipswich River Watershed. This project provided 39 homes and two elementary schools with rainwater harvesting systems ranging from 200 to 8,000 gallons in size. A system at Boutwell Elementary School in Wilmington utilizes a $23,000, 8,000-gallon underground storage tank to provide irrigation for their sports field. This tank yields about 23,000 gallons of rainwater a month and accounts for 79% of the irrigation at Boutwell Elementary School (Mass.gov).

Colby-Sawyer College currently irrigates their sports fields with water supplied by the New London-Springfield Water System Precinct, the public water provider for approximately 36% of New London (New London Planning Board, 2011). The New London-Springfield Water System Precinct receives water from six gravel packed wells tapped into a stratified drift aquifer on Colby Point on Little Lake Sunapee. The precinct provides New London and Springfield with approximately 250,000 gallons per day (GDP) in the winter and 330,000 GPD in the summer (New London-Springfield Water System Precinct). This increase in demand in the summer is in part due to private and commercial irrigation across New London. During peaks in water usage, the precinct must occasionally issue water bans to their customers, creating limitations on how and when they can use their water (Thorp, 2019). Using fresh, treated water from the precinct to water the lawns at Colby-Sawyer is not a resilient practice, as this level of drinking water

treatment is not necessary to irrigate a sports field. The 200,000 gallons of water that flow from the roof of the Hogan Sports Center during a rain event could be utilized in place of the precinct. This will help reduce the water demand on the precinct during summer months, while also decreasing damage and pollution from stormwater runoff from the rooftop of the Hogan Sports Center.

Energy Resilience

The systems in the town of New London are dependent on energy and residents are reliant on energy in their everyday lives. Currently, the town's energy needs are largely fulfilled through the burning of fossil fuels. In this section, we investigate the energy demands of our stakeholders and specific ways in which each of our stakeholders can improve their energy resilience. An energy descent action plan should be a means of collaboration between our three stakeholders to reduce energy demand and transition to more sustainable and resilient energy options. The Greenhouse Gas Inventory section provides a baseline from which to measure the successes of initiatives such as an energy descent action plan. The Energy Emergency Management section addresses preparation and response to a disturbance to the energy system. The Sustainable Investment section proposes resilient and sustainable investment choices to further the college's commitment to a safe future for its students.

Energy Descent Action Plan

Why is an Energy Descent Action Plan the Best Path to Follow?

An energy descent action plan (EDAP) is a strategic outline to guide a community away from oil dependence, reduce greenhouse gas emissions, and adapt to change. As discussed in the "Resilience to What?" section of the introduction, changes in our climate, depletion of resources we depend on, and economic changes are inevitable (Hopkins, 2008). Communities have three options in the face of these challenges: to continue with business as usual, to unravel, or to participate in the transition to a more resilient society (Macy & Johnstone, 2012). Continuing with the same societal structure, dependencies, and habits may allow us to extend peak oil temporarily but will only leave us with further to fall in the long run. When we recognize these truths, it is easy to lose hope and our communities may begin to unravel in the face of unprecedented challenges (Macy & Johnstone, 2012). To participate in the transition is the most appealing and exciting option. In *The Transition Handbook*, Rob Hopkins summarizes this optimistic (and realistic) option well. He states that an energy descent is "the continual decline in net energy supporting humanity... The future scenario in which humanity has successfully adapted to declining net fossil fuel energy availability and has become more localized and self-reliant. It is a term favored by people looking towards energy peak as an opportunity for positive change rather than a disaster" (Hopkins, 2008).

A community on the energy descent path towards resilience and sustainability will be vibrant and connected through a common goal. Recognizing that renewable energy sources cannot replace what fossil fuels provide now, an EDAP must be a strategic plan that couples renewable energy use with overall decreased energy demand (Buckley, 2013). Many transition initiatives accept that we must produce 50% of our current energy use through renewable sources and decrease our current energy use by 50% (Buckley, 2013). The plan will rely on the skills, knowledge, and creativity of all sectors in the town. Community members will be energized by this meaningful and monumental task and feel compelled to contribute to the initiative. Workshops to teach and learn skills such as installing solar panels, building raised vegetable beds, canning food, and mending clothes will help foster a thriving local community (Hopkins, 2008). The results of the EDAP will be visual and tangible local solutions to global problems.

Local communities are beginning to recognize the benefits of energy descent and are incorporating these plans into town and regional planning. The Montpelier region has a full EDAP that addresses multiple aspects of the community including food, energy, transportation, heating, shelter, and lifestyle to create quantitative and qualitative goals for each sector. The

plan lays out multiple paths to follow, giving each community a choice depending on preferences and applicability (Buckley, 2013). Lebanon has an Energy Plan that is similar to an EDAP. This plan focuses more heavily on the implementation of renewable energy systems rather than the reduction of energy use in the city. Some goals of the plan include property tax exemption for renewable energy system implementation, sustainable grounds care, and the installation of numerous electric-vehicle charging stations throughout the city (Vital Communities, 2020). Keene, like Lebanon, does not have a formal EDAP, but rather a Climate Adaptation Action Plan. The report is broken into three sections: the built environment, the natural environment, and the social environment. Some of the report's goals include a sustainable building code, more public transportation options, and a 20% increase in local food production (City of Keene, 2007).

Figure 29. Examples of tangible local solutions that could be incorporated into an EDAP.

New London's vision is already on track to foster an energy descent action plan. Several initiatives and recommendations outlined in the 2011 Master Plan align with energy descent visions and could be organized into a successful EDAP. These include site-plan designs to allow maximum solar access, increased use of local and sustainable energy resources, and the building of a more walkable community (New London Master Plan, 2011). The New London Energy Committee is already considering many initiatives that could be cohesively integrated into an EDAP. The recent municipal solar array project is a great first step that will likely influence other solar projects and foster community interest in renewable energy. Weatherize

Kearsarge, a Kearsarge Climate Action initiative, has already made significant strides in making local homes more energy efficient and will be a good resource and partner in the EDAP (Vital Communities, 2020). The leadership of the students in the Kearsarge School District towards decarbonization illustrates that community members of all ages will be invested in this plan. Furthermore, results from the community resilience survey; shown in figures 30, 31, and 32; illustrate strong support among residents for local, renewable energy.

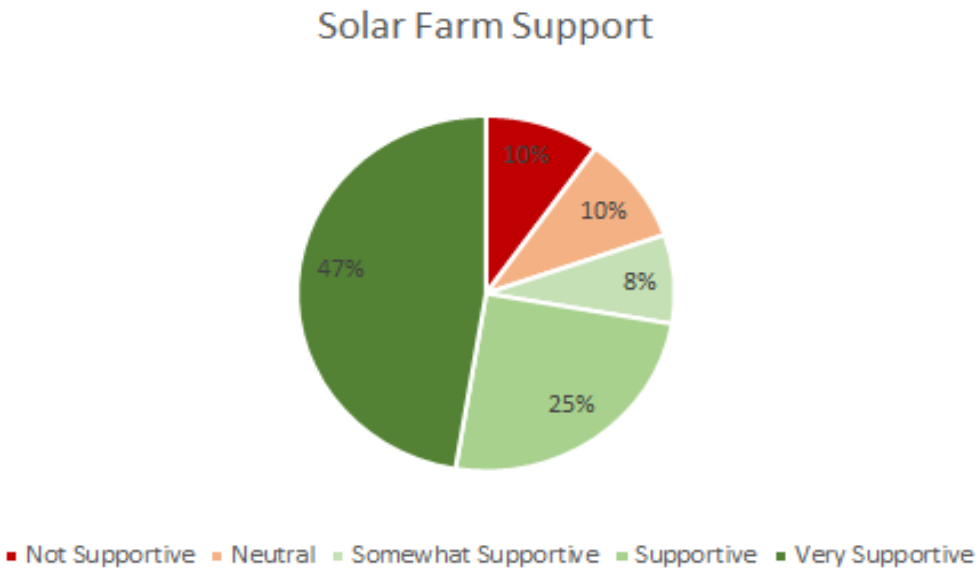


Figure 30. 72% of homeowners are supportive or very supportive of a solar farm in New London.

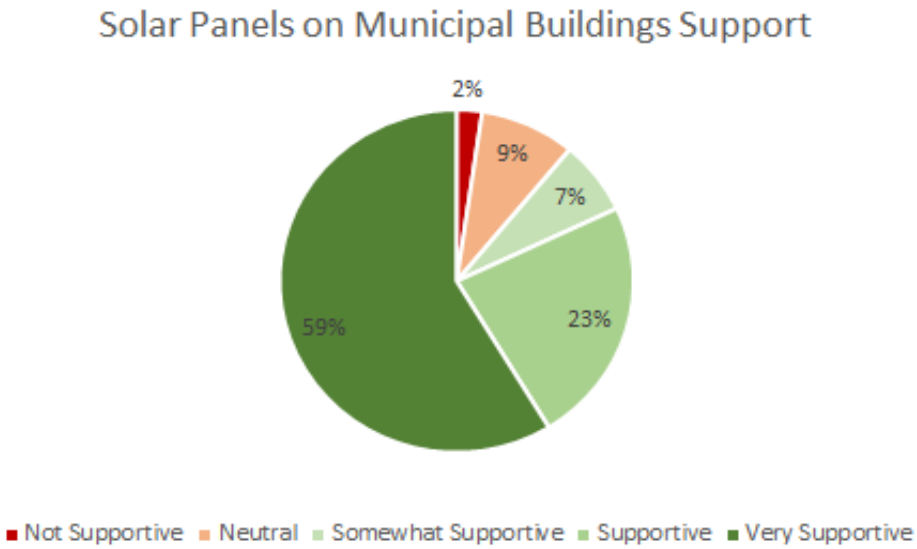


Figure 31. 82% of homeowners are supportive or very supportive of solar panels on municipal buildings.

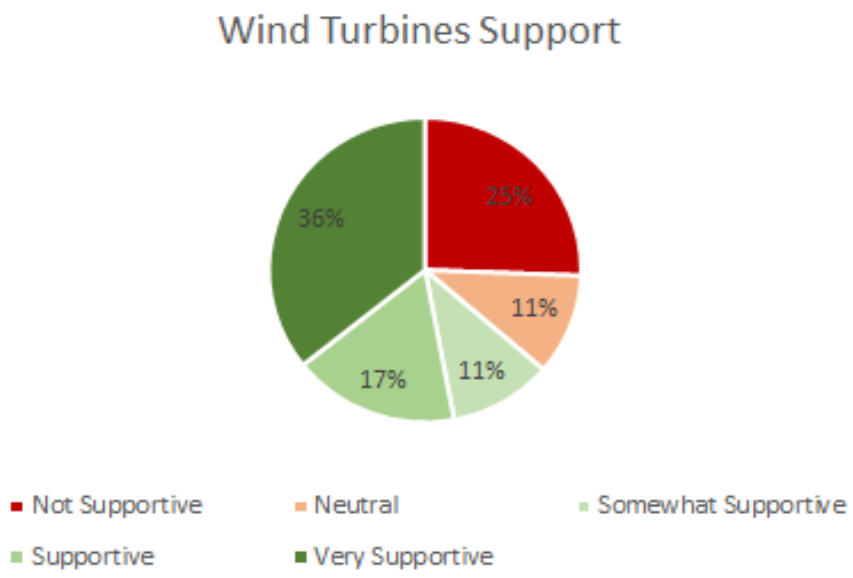


Figure 32. 53% of homeowners are supportive or very supportive of wind turbines in New London.

A successful energy descent action plan will be dependent on contributions from the town of New London, the New London Hospital, and Colby-Sawyer College. These stakeholders are large energy consumers in the town and can make a significant difference in emissions reduction if they work together to decrease energy demand and reliance on fossil fuels. The yearly emissions from these stakeholders can be seen in the proceeding Greenhouse Gas Inventory section. Furthermore, each of these stakeholders can offer a unique set of resources and knowledge. For example, the college may be able to help with the educational aspects of energy descent while the hospital works to promote personal resilience and health. This collaboration will foster communication among stakeholders to make the most of resources and knowledge available. In our communication with stakeholders in the town, we noticed that Colby-Sawyer College was working with the New London Hospital to develop a bike share program while the New London Energy Committee was working on a similar initiative. Early communication between these two entities could have allowed for knowledge and resources to be shared. With goals and steps towards energy independence outlined in an EDAP, stakeholders could work together on initiatives or designate tasks to avoid duplicate efforts.

Climate change and peak oil are two indicators of the same underlying issue and it is only logical that we tackle them simultaneously (Hopkins, 2008). By creating an energy descent action plan, New London will be taking a necessary step on the path to resilience by mitigating their contribution to climate change and responding more effectively to external shocks by meeting basic needs locally. Furthermore, a successful energy descent action plan will help New

London to comply with the New Hampshire Climate Action Plan's goal of reducing the state's greenhouse gas emissions by 80% below the 1990 levels by 2050 (New Hampshire Climate Change Policy Task Force, 2009). In creating a community that is less dependent on outside resources, New London will be less susceptible to economic recessions, the collapse of industrial agriculture, peak oil, and other potential shocks (Hopkins, 2008). As the town of New London looks to become more resilient and sustainable, creating an energy descent action plan is the clear next step. Steps for creating an EDAP are outlined below.

Steps for Creating an Energy Descent Action Plan

1. Consider partnering with other local towns to form a regional EDAP.
2. Form a temporary steering group to develop goals and foster community excitement.
3. Organize focus groups around food, energy, housing, transportation, wellness, education, and economics.
4. Hold events to engage community members in the process.
5. Establish a baseline to measure resource needs and current usage.
6. Develop a vision for New London's future.
7. Backcast from the vision.
8. Create a draft of the EDAP including a step-by-step calendar.
9. Share the document with the community and welcome feedback.
10. Involve the community in the implimentation process.

The Transition Handbook by Rob Hopkins provides a useful outline for beginning an energy descent action plan. In order to optimize the effectiveness of an EDAP in a small town like New London, the town should consider partnering with surrounding communities to create a regional EDAP. This would maximize potential resources and knowledge from all communities involved. Vital Communities may be able to help coordinate a regional effort. An endeavor that would be a challenge for a single, small town to undertake could become much more practical with the additional help.

The first step is to form a temporary steering group to develop clear goals for the energy descent, guide the general course of action, and foster community excitement around these goals (The 12 Ingredients of the Transition Model, 2013). The launch of this project should be publicized through newspaper articles, community discussions, and film screenings (Hopkins, 2008). This initial step will likely involve the New London Energy Committee, but as the project evolves, leadership roles will be handed off to volunteers who have become interested in the project. An essential part of this process involves tapping into the collective knowledge in the community. Smaller working groups will form during this phase to guide specific pieces of the project (Hopkins, 2008). These focus groups may include food, energy, housing, transportation, wellness, education, and economics. Organizations, businesses, and clubs in town may take on important leadership roles or offer knowledge and resources (Hopkins, 2008). Groups will grow as events are held and more community members become interested. Beginning in this stage, communication with the town government and connections between the four levels of community (as pictured in figure 33) must be established (Buckley, 2013).

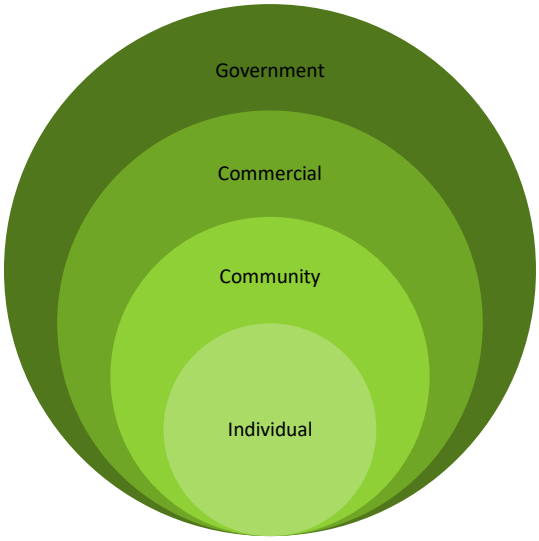


Figure 33. The four levels of community.

The next steps move into the creation of the energy descent action plan itself. The first step is to establish a baseline of the successes and failures of the current system (Hopkins, 2008). This basic information may include caloric needs, energy use, transportation, water usage, and water need. The Greenhouse Gas Inventory section of this report provides emissions statistics for New London's municipal buildings, the New London Hospital, and Colby-Sawyer College. A beginning baseline of the town's energy, food, and water usage and needs can be found in Appendix A. Results from the community survey (Appendix F) may also provide useful baseline information about the town's energy, food, and water use as well as levels of support for sustainability initiatives. The baseline will also include the many initiatives that are already taking place and will help jumpstart the project.

After a review of New London's baseline information, working groups should imagine the community 15-20 years in the future in a world where greenhouse gas emissions and fossil fuel reliance are diminished. The groups should work together to form a vision of the ideal community to work towards. Community members should be actively involved in this visioning process (Hopkins, 2008). New London's Master Plan already mentions some aspects of a vision including a more walkable community, more local farms, further support for home weatherization and green homes, more localized shopping, and the continued coordination with surrounding communities (New London Planning Board, 2011). Our vision for the town involves resilient food, water, and energy systems for New London's municipalities, the New London Hospital, and Colby-Sawyer College. The town may want to build from the vison section of this report and the current Master Plan to create an updated vision for the community.

This vision will act as the end goal from which our stakeholders can backcast. Working backwards from the vision will help to determine what tasks need to be completed to reach the vision most efficiently. Some tasks will take precedent over others and some tasks will be dependent on others. Those working on the project should collaborate to estimate how long each task will take and when the entire plan will come to fruition. The order in which these tasks and many others need to be completed must be determined to stay organized and on track (Hopkins, 2008). For instance, if a community is planning to host an informative workshop, some initial tasks would be determining community interest, the optimal day and time, an appropriate venue, gathering the required resources, and creating an invitation or other means of advertisement. Gantt charts provide an easy to read visual of the project by organizing tasks and setting timelines. Microsoft Excel has a Gantt Chart capability, which can be very useful. Committees, individuals, or organizations should be assigned to lead each task.

One of the first tasks identified in the backcasting process will likely be the writing and publishing of the energy descent action plan. There may be multiple drafts of the plan, each

requiring amendment (Hopkins, 2008). These should be shared with the community through public brainstorming sessions and be formed in part by community input. A necessary element of the plan will be a year-by-year calendar that will lead the project to its goal based on the backcasting completed in the previous step (Hopkins, 2008). For each of these steps, resilience indicators should be set to measure progress (Buckley, 2013). For example, a resilient food system may be indicated through number of acres in agricultural production. Tips for writing a successful EDAP are outlined below and adapted from the Third Year Community-Based Research Project Class in 2014:

1. Consider citizens, their needs, and their preferences.
2. Have clearly defined sections in the report such as Purpose, Vision, Background/History, Process, Renewable Energy, Personal Responsibility, Cost-Benefit Analysis, References/Resources, etc. Anywhere a separate section or subsection can be used, it should be.
3. The more organization, the better.
4. Include concrete ways for individuals to get involved in the project.
5. 50-75 pages (not including the appendix) is a good length.
6. Speak on the concept of peak oil since that is the concept that EDAP is based around.
7. Use strong graphics and visuals such as pictures of the town in the past, present, and future.
8. Use plenty of metaphors to make complex materials easier to comprehend.
9. Use simple language wherever possible.
10. Have an optimistic, upbeat tone throughout the plan.
11. Be sure to mention the personal wellness benefits of a cleaner, greener future.
12. Balance the use of qualitative and quantitative data (Community-Based Research Project Class, 2014).

An EDAP should be a working document, evolving as conditions change and new ideas emerge. As much of the community as possible should be active in the implementation process. The year-by-year steps should be used to work through the EDAP, and the resilience indicators should be used to measure progress. The progress should be publicized through a newsletter and/or website to ensure that everyone is aware of the impact they are making by contributing their time and knowledge (Hopkins, 2008). A successful energy descent action plan will foster a thriving and engaged community that will attract new residents and visitors to the area while reducing the town's greenhouse gas emissions and dependence on outside resources. Resources for further reading and benchmark energy plans are outlined in Appendix B.

Greenhouse Gas Inventory

Why Use a Greenhouse Gas Inventory?

As a municipality aiming for sustainability and resilience, quantifying the town's direct contribution to climate change is a valuable first step. This baseline can be used to guide future initiatives, such as those laid out in an energy descent action plan (EDAP). Greenhouse gas inventories provide emissions data from an institution or a municipality and can highlight the largest sources of emissions. Using information from the following greenhouse gas inventories, the town of New London, New London Hospital, and Colby-Sawyer College will be able to better pinpoint sectors to target emissions reduction initiatives.

Greenhouse gases are any compound that can absorb radiation, trap heat, and contribute to the greenhouse effect (Environmental Protection Agency, 2017). Greenhouse gas inventories measure a variety of different greenhouse gas emitters within the boundary of the inventory. According to the Environmental Protection Agency, the major greenhouse gases measured in an inventory are methane (CH_4), carbon dioxide (CO_2), nitrous oxide (N_2O), and fluorinated gases (chlorofluorocarbons (CFCs)). These greenhouse gases enter the atmosphere in a variety of different ways. Carbon dioxide is primarily emitted through the combustion of fossil fuels. Methane enters the atmosphere through the production and transportation of natural gas, oil, and coal; livestock; and the decay of organic waste in solid waste landfills. Nitrous oxide is emitted through the combustion of fossil fuels as well as through agricultural and industrial practices. These gases are measured using their global warming potential, or the amount of radiation trapped by the gas (Environmental Protection Agency, 2017). The global warming potentials of the gases measured in the inventories are included in table 4.

		GWP		GTP	
	Lifetime (yr)	Cumulative forcing over 20 years	Cumulative forcing over 100 years	Temperature change after 20 years	Temperature change after 100 years
CO_2	[b]	1	1	1	1
CH_4	12.4	84	28	67	4
N_2O	121.0	264	265	277	234
CF_4	50,000.0	4880	6630	5270	8040
HFC-152a	1.5	506	138	174	19

Table 4. The global warming potentials for greenhouse gases.

Methodology

For the following greenhouse gas inventories, we focused on collecting data for the three largest emissions sectors: heat, electricity, and transportation. The municipal buildings of New London and the New London Hospital have not conducted greenhouse gas inventories of their own. Colby-Sawyer College already conducts an annual greenhouse gas inventory through Second Nature. To conduct the greenhouse gas inventories for both the town of New London and the New London Hospital, we used the free online Local Greenhouse Gas Inventory Tool from the Environmental Protection Agency (EPA). The municipal buildings that were considered in the overall heating and electricity expenditures were Whipple Hall, the Academy Building, the fire station, the Highway Department Garage, the transfer station, Elkins Post Office, and the sewer building. Emissions from both stakeholders were estimated using data from the total spent on heating, electricity, and transportation (both diesel and gasoline) during the 2017, 2018, and 2019 fiscal years. The total spent by the stakeholders was divided by the average cost per gallon or kilowatt hour for each of the three years. These numbers are estimated but do show the trends for the greenhouse gas emissions over the past three years.

Results

New London Municipal Buildings

Electricity accounts for the most significant emissions from the municipal buildings in New London. Emissions from electricity are shown in the green section of figure 34. The town has recently installed 400 solar panels on the Highway Department Garage. This increase in renewable electricity generation will help lower the overall greenhouse gas emissions for the town. The town uses heating oil to heat all the municipal buildings.

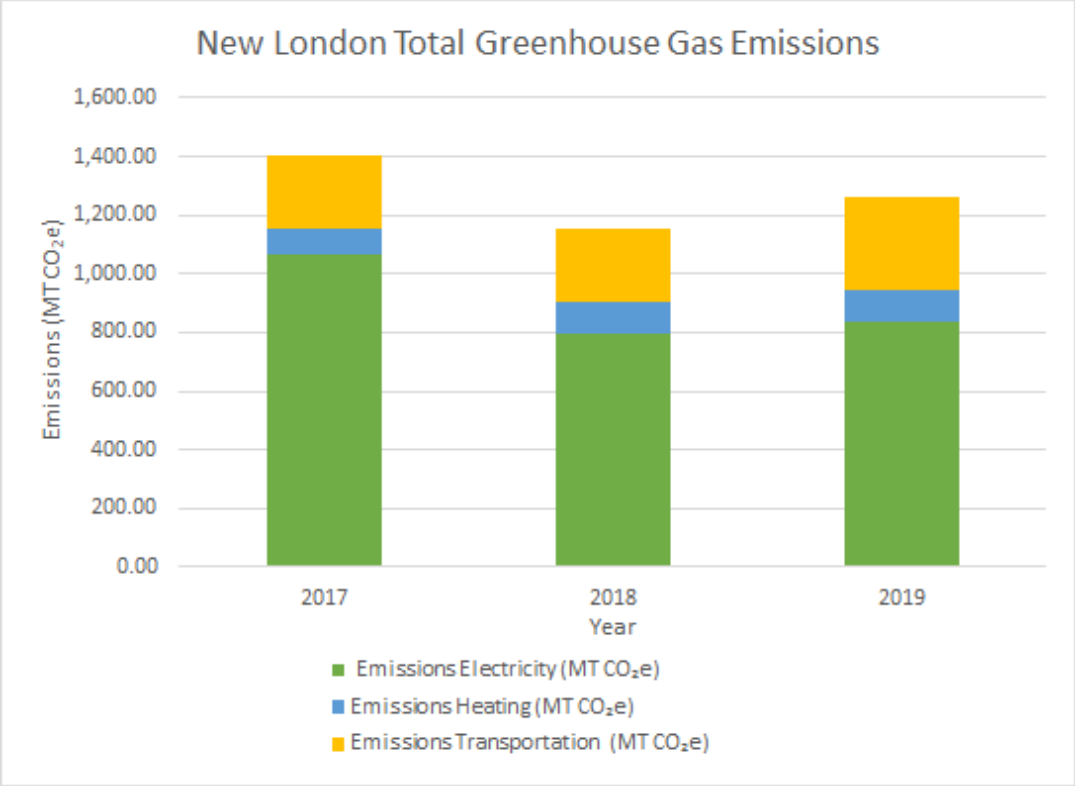


Figure 34. Total emissions from the municipalities in New London in 2017, 2018 and 2019.

New London Hospital

The most substantial emissions from the New London Hospital come from electricity use. The hospital uses both heating oil and propane to heat the facility. Transportation was only calculated for the emergency response vehicles that New London Hospital dispatches resulting in the relatively small portion of the total emissions from the hospital.

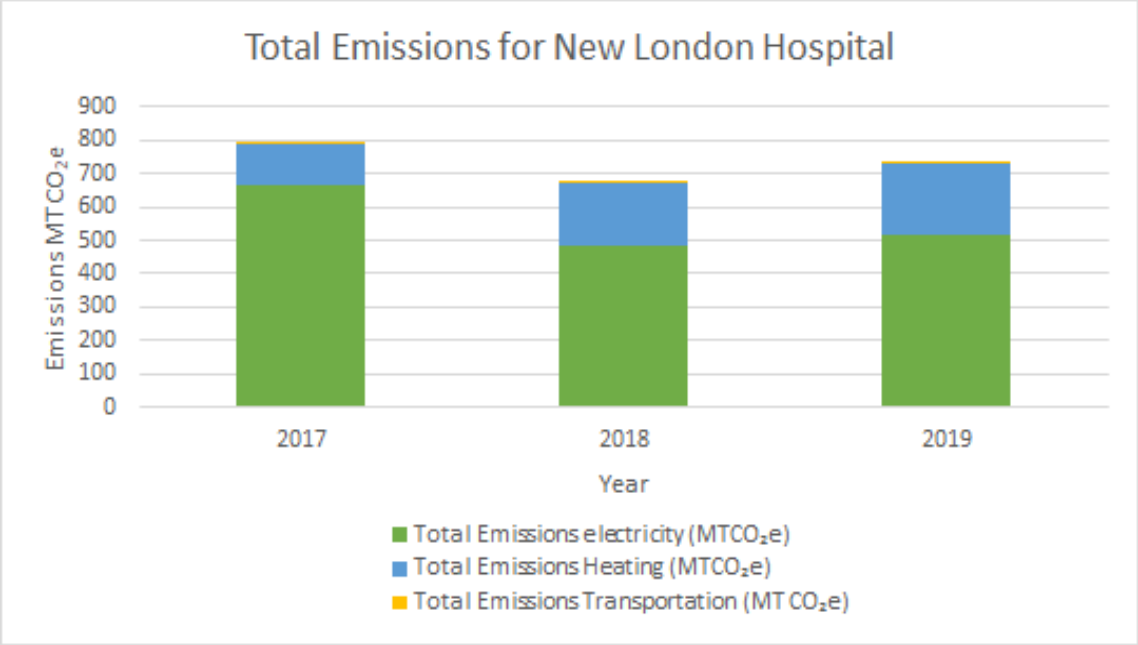


Figure 35. Greenhouse gas emission from electricity, heating and transportation at the New London Hospital.

Colby-Sawyer College

The largest emissions for Colby-Sawyer College come from heating the buildings on campus with propane. Colby-Sawyer College has no emissions from the electricity sector because the institution has been purchasing Renewable Energy Certificates since 2010 which have offset the greenhouse gas emissions from electricity use. Transportation emissions were only measured from college-owned vehicles but would be much higher if emissions from the cars of students, faculty, and staff were considered.

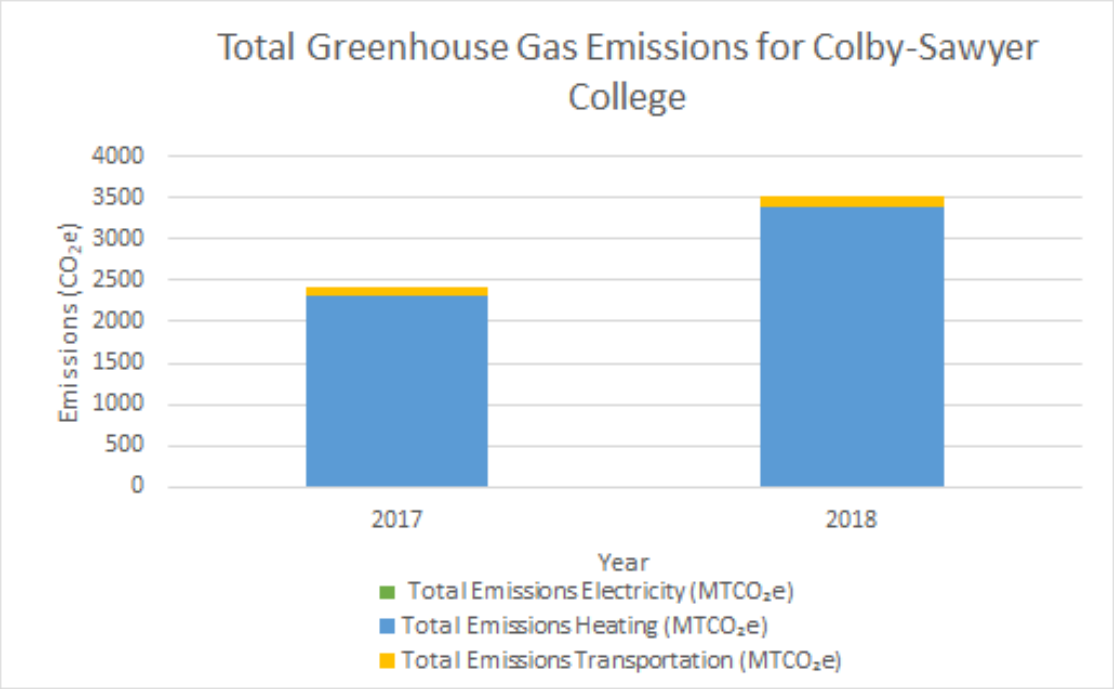


Figure 36. Greenhouse gas emissions from electricity, heating and transportation at Colby-Sawyer College.

Recommendations

New London Municipal Buildings

The baseline data for New London should be expanded from a simple greenhouse gas inventory to a comprehensive greenhouse gas inventory that would extend beyond the municipal buildings and include both businesses and residential homes. A more comprehensive inventory could include solid waste, industrial processes and product use, land use, and any emissions from outside of the boundary that are a result of activities in the town (Fong, 2014). This would provide a more accurate measure of the greenhouse gas emissions from the town of New London. The town of New London could continue using the free Environmental Protection Agency Local Greenhouse Gas Inventory Tool to expand the inventory. The town could also explore the option to subscribe to a program such as the University of New Hampshire's Sustainability Indicator Management & Analysis Platform (SIMAP) which would monitor and collect the greenhouse gas data and calculate the emissions for the town (J. Andrews, Personal Communication, February 7, 2020).

The data from the greenhouse gas inventory should be used as a baseline to guide an energy descent action plan (EDAP) discussed in the preceding section. Integrating an EDAP into the town's energy framework will be beneficial in achieving the town's goal of being carbon neutral by 2050. The overall reduction of energy demand will ultimately reduce greenhouse gas emissions in New London. New London should also consider offsetting its electricity greenhouse gas emissions through the purchase of Renewable Energy Certificates. Renewable Energy Certifications account for one megawatt hour of renewable energy that is produced and are used to offset greenhouse gas emissions (EPA, 2013). The town should also consider offsetting its transportation and heating emissions through carbon offsets. Carbon offsets are used to protect land that has high levels of carbon sequestration. Carbon offsets are purchased and used to offset all emissions including transportation and heating (EPA & Green Power Partnership, 2018).

New London Hospital

The New London Hospital should also consider performing a comprehensive greenhouse gas inventory to expand on the parameters measured to include additional sectors. To continue conducting yearly inventories, the hospital should subscribe to New Hampshire's Sustainability Indicator Management & Analysis Platform (SIMAP) or continue using the Environmental Protection Agency Local Greenhouse Gas Inventory Tool. Given that the largest source of emissions for the hospital was electricity, the hospital should focus on reductions of this sector first. St. Mary's Hospital in British Columbia was the first carbon neutral hospital in North

America and can serve as a sustainable benchmark for New London Hospital. St. Mary's Hospital achieved the goal of becoming carbon neutral by meeting the Leadership in Energy and Environmental Design (LEED Gold) standards and certifications (Green Care Community). Any new buildings that are built for New London Hospital should comply to the LEED Gold Standards. If complying to LEED Gold Standards is too expensive of an option for the New London Hospital, an alternative recommendation is that the hospital could purchase Renewable Energy Certificates (RECs). Purchasing the Renewable Energy Certificates would offset emissions from the electricity sector of the hospital. Purchasing RECs and complying with LEED Gold standards for any new construction will allow the hospital to operate more sustainably.

Colby-Sawyer College

Colby-Sawyer College should work to quantify the transportation section to include all transportation required in getting students, faculty, and staff to and from campus. This would provide a more accurate measure of the overall emissions from the transportation sector. Colby-Sawyer College should also collaborate with the town on an EDAP to reduce the institution's reliance on fossil fuels. Through the reduction of fossil fuel dependence, the institution will lower the greenhouse gas emissions and will help the town to reach the goal of becoming carbon neutral by 2050.

Energy Emergency Management

The Threat of Power Outages in New London

The most frequent threat to New London's energy system is power outages due to inclement weather. As discussed in the Ice Storm section of the introduction, residents have often been left without power for days or weeks due to severe storms. The frequency and intensity of these storms is projected to increase with climate change (New Hampshire Climate Change Policy Task Force, 2009). During these weather events, some of the homes that lose power may also be left without a source of running water as they rely on electricity to power their well pumps. According to the results from our community survey, 28% of households that are not connected to the town water supply do not have access to running water during a power outage as seen in figure 37. Power outages also pose a problem for food retailers that require refrigeration to keep food fresh. During a power outage, Spring Ledge Farm has a backup generator capable of powering the entire facility to continue with business-as-usual (Perry Landry, Personal Communication, October 10, 2019). The Concord Food Co-op of New London and Hannaford both do not have adequate back-up energy to keep food fresh (Shane Smith, Personal Communication, October 20, 2019; Peter Monigle, Personal Communication, October 6, 2019). Of New London residents who shop for food in New London, the average resident relies on Hannaford for 87% of their groceries. If an emergency event due to inclement weather were to last for an extended period, residents may not be able to meet their basic needs such as access to fresh food.

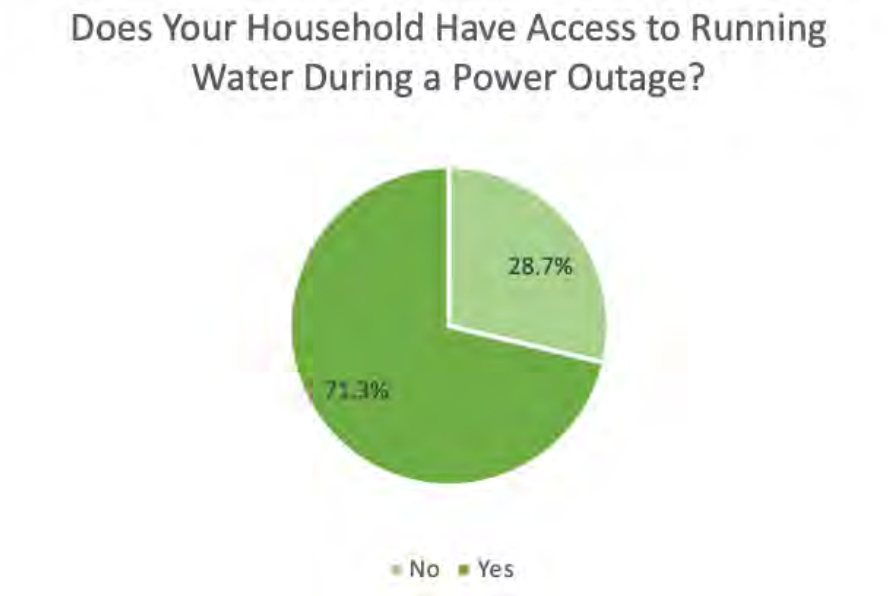


Figure 37. Household access to running water during a power outage.

The results of the community resilience survey show that approximately 60% of New London households have access to a generator that they can rely on during emergency situations such as those mentioned above. Residents without generators may no longer be able to meet basic needs such as running water, heat, and food storage during a power outage. The responses from the write-in section of the survey indicate that residents of New London, particularly those living in the more rural sections of town, were concerned about the response time of town energy providers after a power outage.

Recommendations

Recently, New Hampshire' Senate Bill 286 (SB-286) enabled communities to adopt a Community Power Program in order to provide economic, social, and environmental benefits to community members which are not obtained for them by profit-driven utilities. We recommend that the town utilizes this bill to help improve response time during power outages and provide homeowners with the resources needed to be prepared for an energy disturbance. To address these concerns discussed above, the town should work to initiate a Community Power Program or join forces with other local municipalities to implement the program. Forming or joining a regional program may be the best option for New London as it will allow for collaboration and the sharing of resources. Utilization of this bill would allow the town to negotiate a third-party energy contract on behalf of residents. A third-party contract with a localized energy provider would facilitate better communication between the town and the provider during an emergency event and likely decrease the length of time residents are left without power during an outage. Residents would be automatically enrolled in the new contract but be able to opt out and reconnect to the larger electrical grid (H. Smith, personal communication, March 12, 2020).

A Community Power Program could also be utilized to provide residents with the option to obtain backup energy sources. The town of Lebanon, NH took advantage of this recent legislation to contract a more localized energy supply that reflects their specific needs. Lebanon is working with Liberty Utilities, a utility that serves 51 communities throughout New Hampshire, on a home-battery pilot project to provide residents with a backup source of power during outages (Golding, 2019). If New London introduced a similar home-battery program this would be especially useful for rural residents, as it would provide them with a source of power as they wait to be reconnected to the grid, further improving community resilience in town during a disturbance.

We also recommend that the town prioritize open communication between the municipality and community members. After the ice storms of 1998 and 2008, residents and

businesses felt that, although the facilities succeeded in getting the town operational again, there could have been more communication during the emergency (Patnaude, 2009). The town is making great strides in developing a communication center used strictly for emergency management use, but many community members are unaware of these steps that the Emergency Management Committee has taken to ensure the safety and well-being of the town. In response to this, we recommend that the town hold an educational forum where community members could address the Emergency Management Committee to ask questions about the plan in place. This would also allow the opportunity for the Committee to share their goals for successful emergency planning and give community members a better idea of what they may need to have in their home or business to be prepared.

Another recommendation for the town of New London is to set up a program that checks in on elderly residents of the town during emergency events and power outages. Having residents of the town tasked with checking in on this vulnerable population will help to ensure the safety of all during an emergency event. The assigned party should be serious about the responsibility, physically able to assist if needed, and live close to the person they are checking in on. The Emergency Management Committee should be in contact with these organized volunteers to ensure the safety of all parties involved. The benchmark town of Princeton, New Jersey has taken steps to initiate a similar program and have included it in their Climate Action Plan in the hopes of “improving resilience in the face of extreme climate events.” They even offer an optional Community Emergency Response Training (CERT) in conjunction with the Neighborhood Buddy Initiative for those who would like to participate in the program but feel as though they should first acquire a greater skill set (Municipality of Princeton, NJ). This initiative could also foster a connection between the younger members of the community and town of New London’s older population. New London should implement a program similar to the Neighborhood Buddy Initiative to keep at-risk community members safe and provide greater knowledge about emergency management to all community members.

Sustainable Investment

Why Should Colby-Sawyer College Consider Sustainability and Resilience in its Investment Decisions?

When building resilience, it is necessary to consider the key responsibilities of the system under review. For Colby-Sawyer College, the primary goal is to foster an environment that supports students' academic, intellectual, and personal growth (Strategic Plan, 2018). A positive return on investment from the college's endowment helps to make this possible. Additional objectives of the college include being a leader in sustainability and a steward of the safety, security, and fiscal health of the community (Strategic Plan, 2018). The college's investments should align with these values. Given that the endowment is an essential component of the college's finances, we must consider it in our resilience and sustainability initiatives. The college's Blueprint for Resilience and Innovation outlines the goal of having 100% of the endowment focused on Socially Responsible Investments by 2050 (White, 2019). The purpose of this proposal is to lay the groundwork to help the college achieve a sustainable and resilient endowment.

Fossil fuel divestment is a necessary step in securing the wellbeing of future generations. The extraction of fossil fuels is responsible for wide-spread environmental damage such as land degradation, water pollution, ocean acidification, and greenhouse gas emissions (Natural Resource Defense Council, 2020). Through divesting, Colby-Sawyer College will join many other institutions in making financial changes to reduce these environmental damages. Divestment is a sustainable practice because it encourages the fossil fuel companies to evaluate their practices and move toward investing in renewable energy resources. The aim of divestment is not to bankrupt the fossil fuel industry altogether, but rather to revoke the industry's social license to operate irresponsibly and to pressure the fossil fuel industry into acting more sustainably (Edgecliffe-Johnson & Nauman, 2019).

Shifting investments towards more socially and environmentally responsible companies is an equally important step towards sustainability and resilience. The Blueprint for Resilience and Innovation indicates this end goal as Socially Responsible Investment (SRI) choices (White, 2019). To fully achieve our resilience and financial objectives, we narrowed this goal to Environmental, Social, and Governance (ESG) investments. ESG is a burgeoning category of investing that uses positive screening to guide investment decisions towards the most ethical companies while maintaining financial performance as the primary objective. SRI investment strategies can be incorporated into an ESG policy by negatively screening for undesirable

aspects of a company. These can include screens for fossil fuel companies as well as others such as tobacco companies. In either strategy, new investments will take the ethics of a company into consideration by looking at environmental, social, and governance factors. The environmental parameters measure the company's efforts to reduce emissions, protect biodiversity, conserve water, etc. Social factors consider the company's relationship with the employees and customers it works with. The governmental parameters evaluate the company's standards such as board composition and lobbying (CFA Institute, 2020). Many institutions are using ESG investment policies to help align their financial choices with their values (Manganaro, 2018).

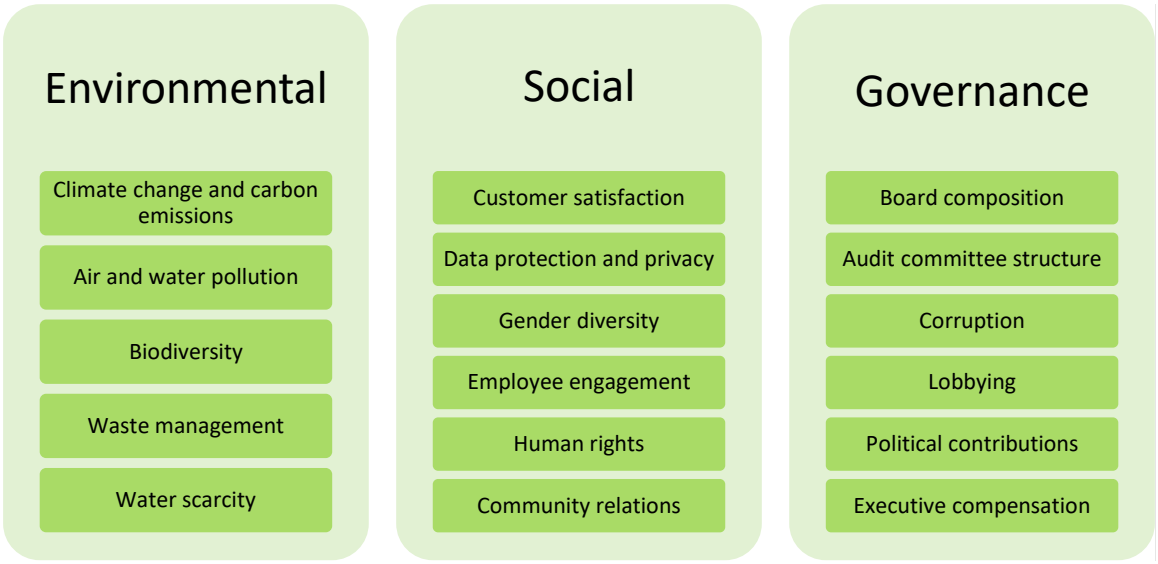


Figure 38. Factors considered in ESG investing (CFA Institute, 2020).

Widespread Change can Start on College Campuses

Climate change is not the first social issue to incite a widespread divestment movement. In the 1960's, anti-apartheid protests on college campuses in the United States sparked a worldwide divestment movement after traditional forms of protest proved ineffective. Students organized to demand that their colleges and universities divest from companies that traded with or had operations in South Africa (Gethard, 2019). In 1994, South Africans elected a democratic, non-racist government with Nelson Mandela as President. College divestment campaigns can highlight global issues and concerns and bring about meaningful change. Colby-Sawyer has a responsibility to its students to enact change that will positively impact the future.

Many colleges and other institutions are acting on their values by divesting from fossil fuels and making more sustainable and resilient investment choices. At this point in time, there

are approximately 1,100 institutions, including educational establishments, that have divested from fossil fuels (Tyler-Davies, 2019). A list of colleges that have divested, including an indication of those ranked among the most sustainable colleges, is included in Appendix E. Middlebury College announced their commitment to divest from fossil fuels in January 2019. This student-led initiative was driven by the principle that "it is illogical to pay for students' education by investing in corporations whose business models guarantee those very students will not have a livable planet to enact this education upon" (Desmond & Fleischer, 2019). Divestment campaigns generate meaningful conversations and can be a campus-wide learning opportunity. By divesting from fossil fuels, Middlebury College's actions and commitment to students and the environment are clear and Colby-Sawyer College should aspire to do the same.

Financial Resilience Colby-Sawyer College

While divesting from fossil fuels and choosing more socially responsible investment options is important for the future of the environment, the initiative would also be a positive step toward financial resilience at Colby-Sawyer College. Becoming a part of this emerging movement would likely increase the number of incoming students (Ballew, et al., 2019). As the climate crisis continues to be a concern for the future of our generation, incoming students will be looking for institutions which have their best interest in mind (NPR, 2015). Divesting from fossil fuels would prove that Colby-Sawyer College is concerned with the effect their choices will have on their students' futures.

Divesting from the fossil fuel industry will make the college less vulnerable to the foreseeable changes in this industry (Tyler-Davies, 2019). In 2018, the energy sector performed poorly, placing dead last in the S&P 500. This was due to a false assumption that the oil and gas industry would make a comeback after both the sectors had a poor investment performance during downturn in the market (Tyler-Davies, 2019). The uncertainty of this industry makes investing in fossil fuels risky in the long-term. Governments are increasingly realizing that as climate change worsens, it is only logical to constrain companies' greenhouse gas emissions. Investments amounting to trillions of dollars in the fossil fuel industry will lose their value as the world moves toward a low-carbon economy. Investors who are heavily invested in the fossil fuel industry will suffer financially as investments in fossil fuel companies become less profitable (Harvey, 2018). Furthermore, oil extraction has surpassed its peak and the amount of money and energy used to extract these depleting resources is not financially sustainable (Investment Europe, 2013).

Investing in more ESG compliant companies would also build a more resilient investment portfolio with better operational performance and reduced risk (University of New Hampshire Foundation, 2019). According to Jon Hale, Morningstar's Head of Sustainability Research, academic literature and observation have shown that sustainable investment involves no performance penalty, and a year after investing, these portfolios showed a positive skew. Of the 20 equity indexes in Morningstar's Global Sustainability Index family, 16 have beaten their non-ESG equivalent over their lifespan (Hale, 2016). The outperformance of ESG stocks is illustrated in figure 39. Arabesque, a global asset management firm, found that S&P 500 companies ranked in the top quintile for ESG outperformed those in the bottom quintile by more than 25 percentage points between the years of 2014 and 2018 (Kell, 2020). The University of New Hampshire Foundation has recognized the positive correlations between sustainability and stock price performance and has fully integrated ESG considerations into their financial analysis. As of May 2019, the university has transitioned $37 million (16%) of its $225 million in endowment funds to ESG-qualified investments and vows to continue transitioning more of its funds to ESG stocks over time (University of New Hampshire Foundation, 2019). Unlike fossil fuel extraction, most of the cost associated with renewable sources is in the initial infrastructure; after that, the energy arrives for free. While once considered a reliable investment, the fossil fuel industry is no longer at its peak and investments should be moved to emerging sources of renewable energy for a better return on investment (Lewis, 2019).

Figure 39. High Sustainability vs Low Sustainability Investment Performance (Kell, 2020).

Goals and Recommendations

We have outlined the steps that we believe will best help the college to align its investments with the values discussed above. From the outset, a Committee on Investor Responsibility should be formed to improve communication between students and the Board of Trustees and to ensure that the endowment is invested in a way that is consistent with the college's values. Following Wesleyan College's example, the committee should be comprised of two faculty members, two staff members, two alumni, five students, and one member of the Board of Trustees (Karp, Orlowski, & Silverstein). The students involved should come from a diverse array of majors and include one Business Major and one Environmental Studies or Science Major.

Colby-Sawyer College's student-managed investment fund is an innovative and real-world example of student involvement on the college campus. This Investment Management class is making strides in sustainable investment. Beginning this year, they created an ESG

sector in which a portion of their funds will be invested. This sector can be compared to the other sectors they are invested in, such as energy and real estate. Future Investment Management classes should continue to experiment with investing in ESGs, report their findings to the Trustees, and collaborate with the Environmental Studies and Science majors. As part of a learning environment, this class should continue to recognize that carefully considered experimentation with their investment funds is a more valuable learning experience than continuing with business-as-usual investing.

The progression towards 100% socially responsible investing will likely be comprised of two phases that may overlap in implementation. The first phase will involve negative screening of fossil fuel companies. The timeline developed to help Colby-Sawyer College reach this goal is adapted from successful fossil fuel divestment initiatives at other colleges outlined in Appendix D. Following the commitment to fossil fuel divestment, the college should halt any new investments in companies that deal primarily in the extraction and exploration of fossil fuels. By 2025, we propose that the college reduces the value of its fossil fuel investments by 25%. By 2028, this percentage should be increased to 50%. Fossil fuel investments should be eliminated entirely by 2035. Similar timelines have been successful in guiding other colleges towards divestment.

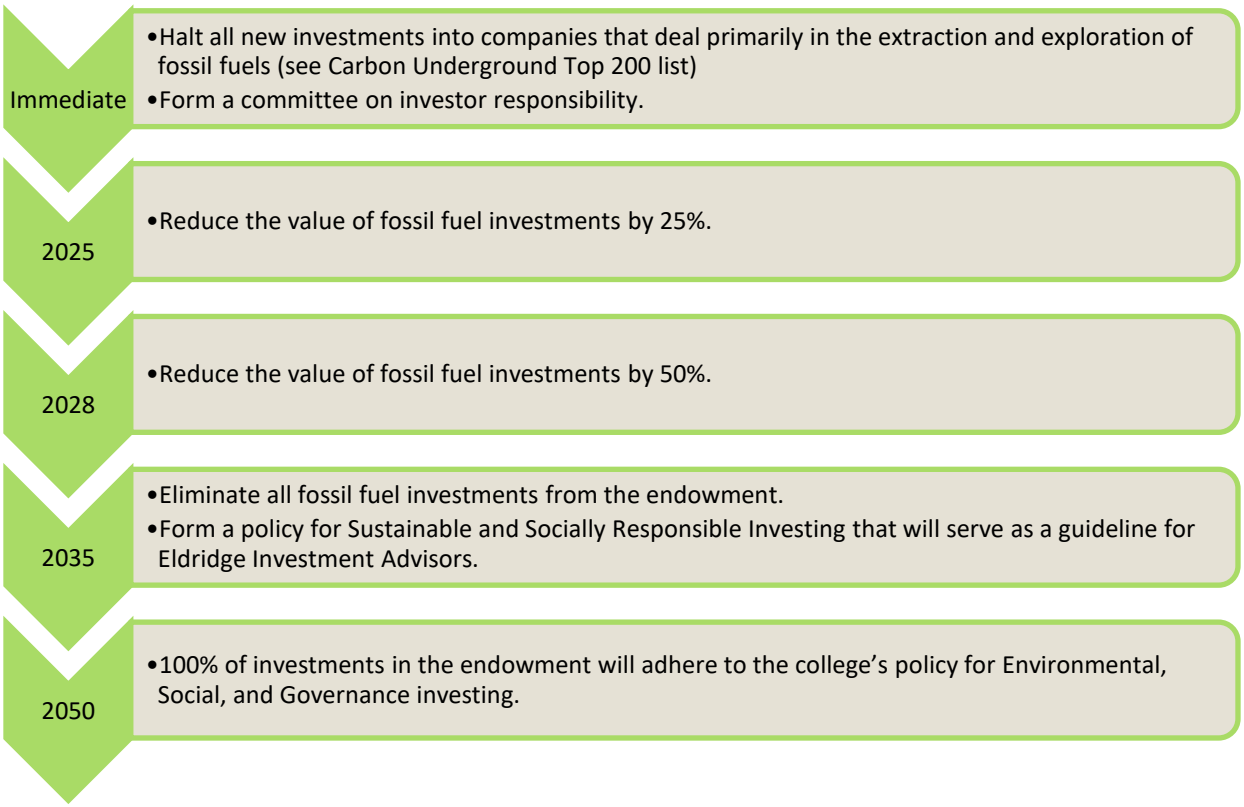


Figure 40. Suggested timeline for fossil fuel divestment and ESG investing.

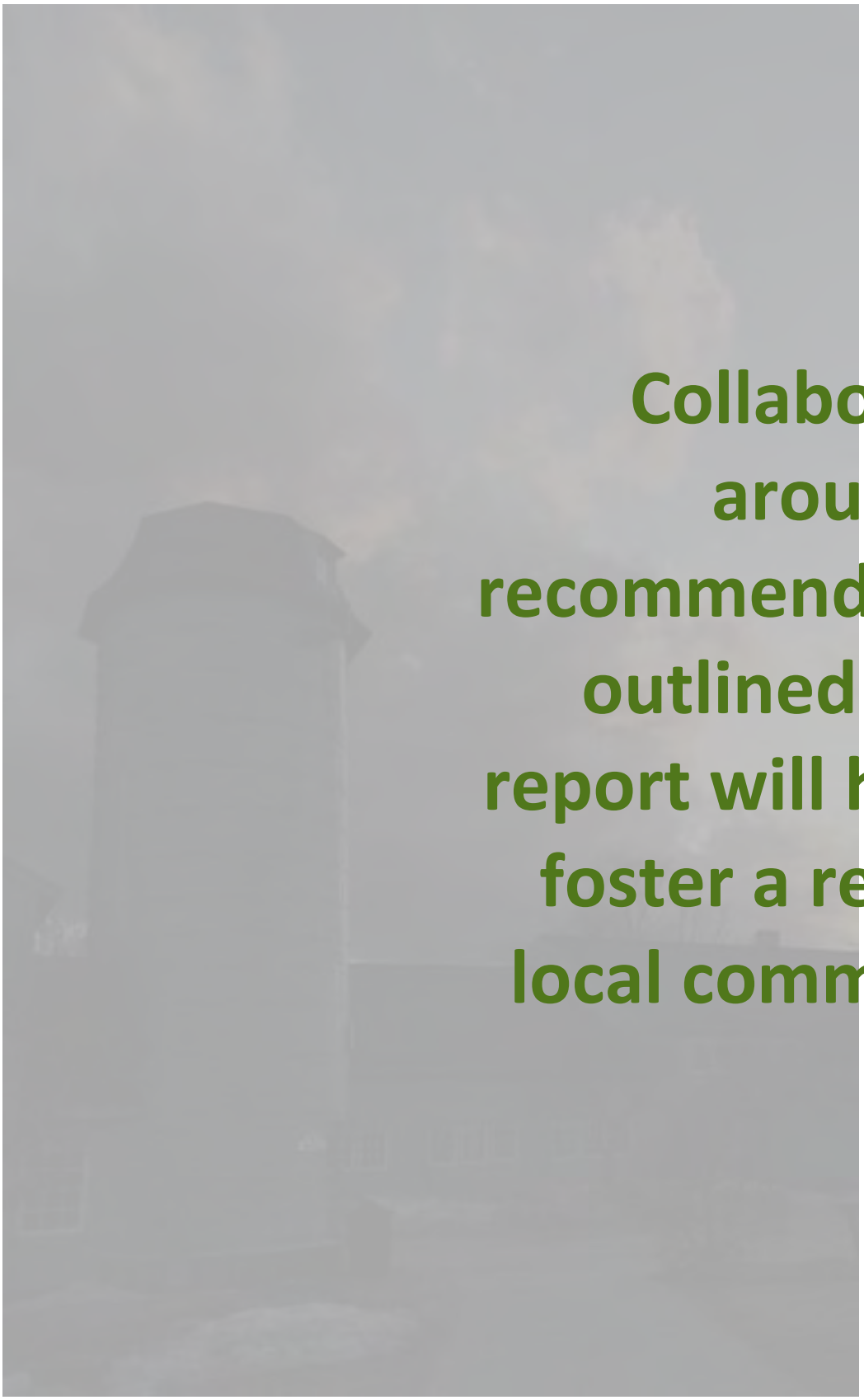
Moving forward with the phase, it is necessary to make clear the types of funds that should be divested from. Middlebury College, who has put forth great efforts to divest from fossil fuels, defines fossil fuel heavy companies as "those whose core business is oil and gas exploration and/or production, coal mining, and those whose primary business is oil and gas equipment, services, and/or pipelines" (Ray, 2019). Carbon Underground creates a list, updated annually, of the top 200 fossil fuel companies around the world. Many colleges are referring to divestment from these 200 companies when they divest from fossil fuels. Half of these companies are public coal companies and the other half are public oil and gas companies (The Carbon Underground 200, 2018). The top 10 companies for oil and for gas can be seen in Appendix C. The complete list could not be published in this document but can be received following the directions in Appendix C.

The second half of this initiative should be focused on reinvesting in Environmental, Social, and Governance (ESG) funds. The Board of Trustees, with the help of the Committee on Investor Responsibility, should develop an ESG policy for ethical investing. Colby-Sawyer's policy will outline investments that the college will favor along with investments that the college will avoid and will serve as the guidelines for Eldridge Investment Advisors, the college's new investment advisor.

Throughout this process, the Trustees should assess the performance of the portfolio to ensure that the new methods of investing continue to result in a positive return on investment. After five years, if the results are unfavorable, the college will have the option to return to previous investing strategies until the situation can be reassessed and a more favorable route towards ESG investing can be created. Once approved, the college should publicize the plan to ensure that current and prospective students are aware of this positive step forward. The college should consider participating in the Sustainability Tracking, Assessment and Rating System (STARS) to guide further refinements to the plan and provide feedback. The rating system would award the college points based on sustainability initiatives, financial and otherwise. The recommendations outlined in this report alone would earn the college eight STARS points (Association for the Advancement of Sustainability, 2019). Opting into this program will allow the college to participate in the sharing of knowledge among sustainably minded institutions.

Transitioning the endowment toward ESG investments is a worthwhile initiative that will help to ensure the long-term financial stability of this institution. The steps outlined above will guide the college toward compliance with the current sustainability initiatives and goals stated in the Strategic Plan and the Blueprint for Resilience and Innovation. Most importantly, by

divesting from fossil fuels and investing in ethical corporations, the college will be doing its part to ensure a just society and livable environment for its students.



Collaboration around the recommendations outlined in this report will help to foster a resilient local community.

Conclusion

The recommendations in this report will help to foster a vibrant and healthy community that is resilient to future disturbances such as extreme precipitation, ice storms, energy disturbances, food shortages, and pandemics. Each aspect outlined above will help to strengthen the web of community resilience in New London. For example, the greenhouse gas inventories will serve as a measure for the energy descent action plan progress and food-based education will be a necessary component in ensuring the productive use of agricultural land. We have compiled all recommendations from this report into the table below. Sorted by topic, each recommendation indicates the stakeholder involved in allowing that goal to come to fruition. Resilience indicators provide a unit to measure the progress of each recommendation.

Overall, we recommend strong communication between our three main stakeholders; the town of New London, the New London Hospital, and Colby-Sawyer College; to make collaboration on initiatives possible. Each entity is specialized for a specific function in the town but when this knowledge and diversity of resources can be shared, the system will operate more effectively. Throughout the year, we regularly attended town committee meetings and learned more than we thought possible about town function and the role of community engagement. This newfound knowledge will allow us to be more involved citizens in our future places of residence and we believe that every Colby-Sawyer student should have this opportunity to learn about community responsibility.

Table of Recommendations

	Recommendations	Stakeholder(s) Involved	Resilience Indicators
Main Street Garden	Continue writing and applying for grants to fund the project.	Colby-Sawyer College	Amount of funding received
	Continue communication with community partners, including the New London Hospital, Kearsarge Lake Sunapee Food Pantry, Kearsarge Food Hub, Warner Public Market, and Willing Hands.	Colby-Sawyer College	Percent of local food insecure households
	Solidify distribution methods as the garden's crop yield increases.	Colby-Sawyer College	Number of people the Main Street Garden produce reaches
	Solidify a storage method and location.	Colby-Sawyer College	Pounds of produce stored on the Colby-Sawyer campus
	Prioritize the connection between community members and the Main Street Garden.	Colby-Sawyer College	Number of classes and majors across campus involved Number of internship and volunteer opportunities filled by students and community
	Willing Hands extends distribution and pick-up to include the Kearsarge-Lake Sunapee Region.	Willing Hands	Number of distribution and pick up points in the Kearsarge-Lake Sunapee Region
	Reach out to local businesses to "adopt" a plot of the Main Street Garden.	Colby-Sawyer College	Number of local businesses "adopting" a piece of the Main Street Garden
	Provide Wellness Points to employees who volunteer at the Main Street Garden	New London Hospital	Number of New London Hospital employees that volunteer at the Main Street Garden
Food Education	Host hands on workshop events through the UNH Extension Office and independently, keeping in mind students, community members, and those facing food insecurity.	Colby-Sawyer College	Workshops offered on campus
	Continue to prioritize educating patients about the power of healthy food as preventative care and as medicine.	New London Hospital	Number of educational workshops, educational events, as well as written and virtual materials offered to patients
	Increase accessibility to food-based educational materials through New London's website.	Town of New London	Food-based educational materials added to town website

	Create a weekly meal plan highlighting crops from each season.	Colby-Sawyer College	The creation of weekly meal plans and their distribution to participants in the local food security programs
Agricultural Land Protection	Form an Agricultural Commission to guide town planning towards benefiting farms.	Town of New London	Existence of an Agricultural Commission in New London
	Educate homeowners on the benefits of conservation easements.	Town of New London, ASPLT	Percent of conserved open space land in New London
	Plant edible public spaces around municipal buildings, the hospital, and Main Street.	Town of New London, New London Hospital	Square meters dedicated to edible public spaces in New London
	Educate homeowners on the benefits of home "Victory Gardens." Provide educational materials to help homeowners begin a garden.	Town of New London Colby-Sawyer College	Percentage of residents with home gardens Average number of days of food supply per household
Stormwater Management	The introduction of Low Impact Development Sites into the current infrastructure to help promote stormwater management	Town of New London Colby-Sawyer College New London Hospital	Frequency of damage to infrastructure and flooding
Energy Descent Action Plan	Hold informative and interactive events to engage community members.	Town of New London	Number of community members attending events
	Create an EDAP with clear steps and a vision for the future.	Town of New London	The existence of a strong EDAP that involves the community
	Reduce the greenhouse gas emissions in the town by transitioning to renewable and decreasing energy demand.	Town of New London, Colby-Sawyer College, New London Hospital	$MTCO_2e$ emitted per year as measured by greenhouse gas inventories
Greenhouse Gas Inventory	Continue to monitor greenhouse gas emissions.	Town of New London New London Hospital	Yearly monitoring of greenhouse gas emissions
Energy Emergency Management	Utilize a Community Power Program to contract with a local third-party energy provider to improve communication with service providers during an emergency.	Town of New London	Recovery time after a power outage
	Join a regional committee focused on community power to implement a home battery program.	Town of New London	Reduced dependency on the grid Recovery time after a power outage
	Improve communication between the municipality and residents regarding emergency planning.	Town of New London	Number of residents contacted regarding emergency planning

	Initiate a neighborhood check-in program during emergency events.	Town of New London	Number of older residents partnered with a younger community member to check in during an emergency event
Sustainable Investment	Form a Committee on Investor Responsibility.	Colby-Sawyer College	The existence of a Committee on Investor Responsibility Diversity of members of the committee
	Divest from top 200 fossil fuel companies by 2035.	Colby-Sawyer College	% of holdings invested in fossil fuel companies
	Develop a policy for ESG investing.	Colby-Sawyer College	Existence of policy to guide ESG investing
	Adhere to the policy for ESG investing by 2050.	Colby-Sawyer College	% of holdings adhering to the ESG policy
	Sign up for the Sustainability Tracking, Assessment & Rating System (STARS) to guide further refinements to the plan, provide feedback, and publicize initiatives.	Colby-Sawyer College	Number of STARS points earned

Acknowledgements

We would like to acknowledge the following people, organizations, and committees for their contribution to this project:

- Adam Ricker- Contracted Planner out of NH Regional Planning Commission for New London
- Catherine Bardier – Director of Wellness and Population Health at New London Hospital
- Catherine Hogan – Grant Writer for Colby-Sawyer College
- Colby-Sawyer Investment Management Class
- Geoff Lizotte – Lead Scientist/GIS Specialist for LSPA
- Hannah Smith - American Standard Power
- Harvey Pine – Community-Based Research Project Professor
- Jamie Hess - New London Energy Committee Chair
- Jen White- Sustainability Director at Colby-Sawyer College
- Jody Murphy – Investment Management Class Professor
- June Fichter - LSPA director
- Karen Bonewald – Colby-Sawyer College Vice President Finance
- Kearsarge Food Hub
- Kearsarge Lake Sunapee Food Pantry
- Keith Chrisman – Sunapee Energy Committee Chair
- Kirsten Vigneault – Public Health Director for Greater Sullivan County
- Kurt Croft – Director of Facilities at NL Hospital
- Larry Chase- Andover Energy Committee
- Leon Malan – Community-Based Research Project professor
- Lou Botta- Emergence Management Committee
- New London Energy Committee
- New London Master Plan Committee
- Nicole Gage – New London Zoning Administrator
- Pamela Drewniak – EMS and Emergency Preparedness Coordinator at NL Hospital
- Perry Landy – Spring Ledge Farm
- Peter Monigle – New London Hannaford
- Robert Harrington- Director of New London Public Works
- Shane Smith – Concord Food Co-op of New London
- Shawn Riley- Director of Emergency Vehicles at New London Hospital
- Sue Andrews - Operations Manager ASPLT
- Sunapee Energy Committee
- Taylor Devaney – Teaching Assistant for Community-Based Research Project
- Warner Public Market
- Willing Hands

Appendices

Appendix A. New London Baseline

This data was compiled based on our first semester analysis of the town's resilience.

Energy	Residential Heating	43% of occupied homes are heated with heating oil or kerosene 21% use natural gas 17% use propane The remainder of residences use mostly biomass or electricity (Brooks).
	Municipal Heating	Approximate number of gallons of heating oil used in 2019: 21,584 gallons. Adapted from the New London Town Budget (Fiscal Year 2021 Budget & Meeting Schedule, 2019).
	Colby-Sawyer College	The college used 537,000 gallons of propane in 2019 (Second Nature, 2018).
	Municipal Electricity	An average New Hampshire household uses 615 kWh of electricity per month or 7,380 kWh annually (U.S. Energy Information Administration, 2019).
	Colby-Sawyer College	In 2018, Colby-Sawyer College purchased approximately 3,772,000 kWh of electricity. Solar panels generate 232,000 kWh annually (J. White, personal communication, November 2019).
Water	The New London-Springfield Water System Precinct	The precinct serves 64% of the population (Town of New London Planning Board, 2011). The precinct uses an average of 250,000 GPD in the winter and 330,000 GPD in the summer (Precinct Facts). Usage increases by 93 GPD for every added residential unit.
	Hospital	Average water usage per staffed bed in U.S. hospitals is 540 GPD (Silvis, 2013).

	Colby-Sawyer College	Colby-Sawyer College uses an average of 26,717 GPD and usage per student averages 60 GPD (Town of New London Planning Board, 2011).
	Stormwater	Approximately 3.4% of New London's total land area is made up of impervious surfaces.
Food	Caloric needs	Daily: 9.25 million calories Annually: 3.36 billion calories
	Farmland needs	Omnivore diet: 9,638 acres Vegetarian diet: 1,979 acres
	Current Farmland	60 acres of working farmland

Appendix B. Reference Materials for Creating an Energy Descent Action Plan

The Transition Handbook: From Oil Dependence to Local Resilience

By Rob Hopkins

The Transition Handbook is a useful resource to start with before beginning an EDAP. It begins with illustrating the need for energy descent in our society and ends with providing concrete steps for creating a local plan. Inspiring examples from successful EDAPs are incorporated throughout the book and include:

- Re-skilling workshops to teach and learn skills necessary in a localized economy
- Rural car sharing programs along with more localized jobs and entertainment options to reduce miles driven by people living in rural areas
- Elimination of plastic shopping bags
- Public spaces designed for fewer cars with more room for walking, bicycling, community markets, and edible public spaces instead of roads and parking lots
- Mini-grids powered by most appropriate local renewable energy sources (Hopkins, 2008).

Montpelier Regional EDAP

https://issuu.com/jimbuckley/docs/edap_25_page_version_with_graphic_i

The Montpelier EDAP is an applicable example of a local plan that is designed for regional use. Sections include the food system, the energy system, transportation, heating, shelter, and lifestyle. Each section analyses the current situation and lays out quantitative and qualitative goals. This plan provides multiple scenarios for reaching each goal which allows different homeowners and towns to choose different options depending on their needs and preferences (Buckley, 2013).

City of Lebanon, New Hampshire Energy Plan

https://www.uvlsrpc.org/files/5213/3916/4311/Lebanon_Energy_Plan_March_2012.pdf

Lebanon, New Hampshire is working to reduce its fossil fuel emissions and may be a useful resource or partner for the town of New London. The plan is not an EDAP and focuses more heavily on switching to renewable energy use than decreasing energy demand. This plan provides resources for funding options. Outcomes that the city is working to achieve through this plan include property tax exemption for renewable projects, developing sustainable grounds care, and installing electric vehicle charging stations throughout the community (Vital Communities, 2012).

Keene, New Hampshire Climate Adaptation Action Plan Summary Report
https://www.cakex.org/sites/default/files/documents/Keene%20Summary%20Report_ICLEI_FINAL.pdf

The Keene Climate Adaptation Action Plan embodies many of the resilient and sustainable principles in an EDAP. This summary report is divided into three sectors: the built environment, the natural environment, and the social environment. Energy descent goals include the development of a city-wide, sustainable building code, providing more public transportation options, and increasing local food production by 20% (City of Keene, 2007).

Transition in Action: Totnes And District 2030: An Energy Descent Action Plan
https://www.transitiontowntotnes.org/groups/building-and-housing/energy-descent-action-plan/

The Totnes transition plan was one of the first EDAPs to be designed for and by a local community. Published in 2010, this plan lays out a comprehensive strategy and vision for reduced energy dependence by 2030. A vision for each year between 2009 and 2030 is described in detail to measure against the progress made at that point in time. Indicators of a resilient community are also included. The rest of the plan goes into detail about working with nature, creative energy systems, localizing resources, nurturing transition, and empowering people (Hodgson & Hopkins, 2010).

Appendix C. Carbon Underground Top Ten Coal and Oil/Gas Companies

The Carbon Underground list of top 10 coal companies and top 10 oil and gas companies is based on calculated carbon emissions data using reserves reported as of December 31, 2018 and updated for company mergers and acquisitions as of April 20, 2019. The full Top 200 list could not be published in this document but can be purchased for the use of asset managers by contacting info@fossilfreeindexes.com (The Carbon Underground 200, 2018). Many colleges use this list of top 200 oil and gas companies in their divestment initiatives.

The Carbon Underground 200™ 2018							
Rank	**Coal Companies**	**Coal Gt CO_2**	**Rank**	**Oil and Gas Companies**	**Gas Gt CO_2**	**Oil Gt CO_2**	**Total O&G Gt CO_2**
1	Coal India Ltd	31.895	**1**	Gazprom PJSC	35.116	4.345	39.462
2	Shaanxi Coal Industry Co Ltd	28.972	**2**	Rosneft Oil Co	4.599	13.742	18.341
3	Adani Enterprises Ltd	27.321	**3**	PetroChina Co	4.211	3.335	7.545
4	China Shenhua Energy Co Ltd	20.188	**4**	ExxonMobil	3.006	4.487	7.492
5	Yanzhou Coal Mining Co Ltd	10.610	**5**	BP Plc	2.456	4.452	6.908
6	China Coal Energy Co Ltd	9.875	**6**	Lukoil PJSC	1.289	5.113	6.402
7	Exxaro Resources Ltd	9.684	**7**	Novatek PAO	4.190	0.657	4.847
8	DaTong Coal Industry Co Ltd	9.453	**8**	Royal Dutch Shell	2.204	2.055	4.258
9	Public Power Corp SA	9.339	**9**	Chevron Corp	1.675	2.583	4.258
10	Glencore PLC	8.560	**10**	Petroleo Brasileiro Petrobras SA	0.431	3.571	4.002

Appendix D. Sustainable Investment Timeline Examples

Sustainable investment timelines for three colleges that are working to divest from fossil fuels.

	Immediate	Short-term	Mid-term	Long-term
Middlebury (Ray, 2019)	Will not invest any new dollars in specialized private investment funds that focus on oil and natural gas.	Reduce the value of direct fossil fuel investments by 25% in five years.	Reduce the value of direct fossil fuel investments by 50% in eight years.	Eliminate direct fossil fuel investments entirely in 15 years.
Smith College (Voghel, 2019)		Reduce the value of fossil fuel investments by 50% in five years.	Reduce the value of fossil fuel investments by 75% in eight years.	Eliminate fossil fuel investments entirely in 15 years.
Georgetown (Fossil Fuels Divestment Continues Georgetown's Commitment to Sustainability, 2020)	Halting new investments in companies or funds whose primary business is in the exploration or extraction of fossil fuels.	Divestment from public securities of fossil fuel companies within five years.	Divestment from private investments of fossil fuel companies in 10 years.	Evaluate co-mingled investment funds on a case-by-case basis.

Appendix E. Educational Institutions that have Divested from Fossil Fuels

Below is a list of Educational Institutions that have divested from fossil fuels (gofossilfree). Institutions marked with an (*) represent schools which also appear on the Sierra Club Top 20 list of green schools (Sierra Club, 2019)

Fossil Free: An institution or corporation that does not have any investments (direct ownership, shares, commingled mutual funds containing shares, corporate bonds) in fossil fuel companies (coal, oil, natural gas).

Goddard College, Salem State University

Full: An institution or corporation that made a binding commitment to divest (direct ownership, shares, commingled mutual funds containing shares, corporate bonds or any assets classes) from any fossil fuel company (coal, oil, natural gas).

Antioch University, Brevard College, Brown University, California Institute of the Arts, Chico State University, College of the Atlantic*, ESF College Foundation, Inc., Foothill-De Anza, Community College Foundation, Georgetown University, Hampshire College, Lewis & Clark College*, Middlebury College*, Naropa University, Northland College, Oregon State University, Peralta Community College District, Pitzer College, Rhode Island School of Design, SUNY New Paltz Foundation, Seattle University*, State College, PA, Sterling College*, Syracuse University, The New School, Unity College, University of Oregon Foundation, University of California*, University of Dayton*, University of Hawaii, University of Maryland, University of Massachusetts Foundation, Warren Wilson College

Partial: An institution or corporation that made a binding commitment to divest across asset classes from some fossil fuel companies (coal, oil, natural gas).

Humboldt State University, Prescott College, University of Puget Sound, Western Oregon University, Yale University

Coal and Tar Sands: An institution or corporation that made a binding commitment to divest (direct ownership, shares, commingled mutual funds containing shares, corporate bonds or any assets classes) from any coal and tar sands companies.

Boston University, Georgetown University, San Francisco State University Foundation

Coal Only: An institution or corporation that made a binding commitment to divest (direct ownership, shares, commingled mutual funds containing shares, corporate bonds or any assets classes) from any coal companies.

Brandeis University, Columbia University in the City of New York, George School, Johns Hopkins University, Stanford University*, University of Maine System, University of Washington

Appendix F. Town of New London Resiliency Survey 2020 Responses

Of 232 total responses

These survey questions were distributed to homeowners, renters, and business owners in the town by mail and email.

Are you a homeowner, business of a renter of a property?		
	Frequency	Percent
Homeowner	197	84.9
Business	28	12.1
Renter of a Property	7	3.0
Total	232	100.0

Business Responses:

Does your business own a generator?		
	Frequency	Percent
No	20	74.1
Yes	7	25.9
Total	27	100.0

What type of generator does your business own?		
	Frequency	Percent
Portable	2	50.0
Permanent standby/ stationary	2	50.0
Total	4	100.0

What is your business's generator size in Watts?		
	Frequency	Percent
5000	1	25.0
7000	1	25.0
8000	1	25.0
12000	1	25.0
Total	4	100.0

How many vehicles does your business own?		
	Frequency	Percent
0	11	57.9
1	2	10.5
2	2	10.5
3	1	5.3
4	1	5.3
5	1	5.3
6	1	5.3
Total	19	100.0

What is your business's average mileage per week?		
	Frequency	Percent
0	6	37.5
10	1	6.3
25	1	6.3
50	1	6.3
65	1	6.3
100	1	6.3
200	2	12.5
400	1	6.3
500	1	6.3
1500	1	6.3
Total	16	100.0

How is your business heated?		
	Frequency	Percent
Oil	6	28.57
Propane	6	28.57
Biomass	4	20
Other (Reference table below)	5	23.81
Total	21	100.0

How is your business heated? (other)		
	Frequency	Percent
Oil and Propane	1	33.0
Oil and Wood	1	33.0
Used Oil Furnace	1	33.0
Total	3	100.0

Do you currently have a renewable energy system for your business?		
	Frequency	Percent
No	18	90.0
Yes	2	10.0
Total	20	100.0

Do you have solar panels on your business building(s)/property?		
	Frequency	Percent
No	2	40.0
Yes	3	60.0
Total	5	100.0

Is your business's solar array grid-tied or battery-tied?		
	Frequency	Percent
Battery-tied	0	0.0
Grid-tied	2	100.0
Total	2	100.0

What is the size of your solar array in Watts?		
	Frequency	Percent
17000	1	50.0
53000	1	50.0
Total	2	100.0

Are you supportive of the town implementing renewable energy systems within New London? – Solar farm		
	Frequency	Percent
Not Supportive	2	11.1
Neutral	2	11.1
Somewhat Supportive	2	11.1
Supportive	4	22.2
Very Supportive	8	44.4
Total	18	100.0

Are you supportive of the town implementing renewable energy systems within New London? – Wind turbines		
	Frequency	Percent
Not Supportive	3	16.7
Neutral	5	27.8
Somewhat Supportive	3	16.7
Supportive	5	27.8
Very Supportive	2	11.1
Total	18	100.0

Are you supportive of the town implementing renewable energy systems within New London? – Solar panels on municipal buildings		
	Frequency	Percent
Not Supportive	1	5.6
Neutral	1	5.6
Somewhat Supportive	2	11.1
Supportive	4	22.2
Very Supportive	10	55.6
Total	18	100.0

Are you supportive of the town implementing renewable energy systems within New London? – Biomass		
	Frequency	Percent
Not Supportive	0	0
Neutral	6	35.3
Somewhat Supportive	4	23.5
Supportive	5	29.4
Very Supportive	2	11.8
Total	17	100.0

Are you supportive of the town implementing renewable energy systems within New London? - Geothermal		
	Frequency	Percent
Not Supportive	0	0.0
Neutral	3	17.6
Somewhat Supportive	6	35.3
Supportive	5	29.4
Very Supportive	3	17.6
Total	17	100.0

Are you supportive of the town implementing renewable energy systems within New London? – Methane capture		
	Frequency	Percent
Not Supportive	3	18.8
Neutral	6	37.5
Somewhat Supportive	3	18.8
Supportive	2	12.5
Very Supportive	2	12.5
Total	16	100.0

What is your business's water source?		
	Frequency	Percent
Town	17	85.0
Artesian Well	2	10.0
Town and Dug Well	1	5.0
Total	20	100.0

Has your business ever had its water tested?		
	Frequency	Percent
No	1	33.3
Yes	2	66.7
Total	3	100.0

Has your business ever had issues with water quality?		
	Frequency	Percent
No	2	100.0
Yes	0	0.0
Total	2	100.0

Does your business have access to water in the event of a power outage?		
	Frequency	Percent
No	1	33.3
Yes	2	66.7
Total	3	100.0

How many times a year does your business experience flooding?		
	Frequency	Percent
0 times a year	11	57.9
1 time a year	2	10.5
2 times a year	3	15.8
3 times a year	2	10.5
4 times a year	1	5.3
Total	19	100.0

Have you implemented techniques to manage stormwater at your business?		
	Frequency	Percent
None	10	52.6
Gravel Wetland	2	10.5
Other	4	21.1
Gravel Wetland & Porous Pavement	2	10.5
Gravel Wetland & Other	1	5.3
Total	19	100.0

How long did it take your business to return to normal function after an emergency event that lasted 72 hours or longer?		
Number of hours	Frequency	Percent
0	3	25.0
2	2	16.7
3	2	16.7
6	1	8.3
12	1	8.3
24	3	25.0
Total	12	100.0

Household Responses:

Does your household own a generator?		
	Frequency	Percent
No	78	39.2
Yes	121	60.8
Total	199	100.0

What is your household generator type?		
	Frequency	Percent
Portable	37	35.2
Permanent standby/ Stationary	68	64.8
Total	105	100.0

What is your household generator size in Watts?		
	Frequency	Valid Percent
100	1	1.4
500	1	1.4
1000	1	1.4
1500	3	4.1
3000	3	4.1
3500	2	2.7
4000	2	2.7
4500	1	1.4
5000	5	6.8
5500	4	5.5
6000	1	1.4
6500	3	4.1
7000	3	4.1
7500	4	5.5
8000	1	1.4
8500	1	1.4
9000	2	2.7
10000	6	8.2
11000	4	5.5
12000	3	4.1
13000	1	1.4
13600	1	1.4
14000	4	5.5
15000	1	1.4
16000	3	4.1
17000	2	2.7
20000	5	6.8
22000	3	4.1

41000	1	1.4
60000	1	1.4
Total	73	100.0

What is your household generator size in Watts?	
Mean	10670
Median	9000
Minimum	1000
Maximum	60000

How many vehicles does your household have?		
Number of vehicles	**Frequency**	**Percent**
0	2	1.1
1	44	24.9
2	96	54.2
3	26	14.7
4	4	2.3
5	4	2.3
15	1	.6
Total	177	100.0

How many vehicles does your household have?	
Mean	2.06
Median	2.00
Minimum	0
Maximum	15

What is your household's average miles per week?	
Mean	212.04
Median	150.00
Minimum	0
Maximum	1200

How is your home heated?		
	Frequency	**Percent**
Oil	77	41.4
Propane	77	41.4
Biomass	13	7.0
Other (Reference table below)	19	10.2
Total	186	100.0

How is your home heated? (Other)		
	Frequency	**Percent**
Biomass & Electricity	1	5.6
Electricity	7	38.9
Geothermal	4	22.2
Oil & Propane	1	5.6
Oil & Biomass	2	11.1
Propane & Biomass	2	11.1
Geothermal & Solar	1	5.6
Total	18	100.0

Do you currently have a renewable energy system in use for your household?		
	Frequency	Percent
No	158	88.3
Yes	21	11.7
Total	179	100.0

Do you currently have a renewable energy system in use for your household? (If you selected "yes", please list the system)		
	Frequency	Percent
Solar	10	55.6
Geothermal	3	16.7
Biomass	3	16.7
Solar & Geothermal	1	5.6
Solar Thermal for DHW & Solar	1	5.6
Total	18	100.0

Do you have solar panels on your house/property?		
	Frequency	Percent
No	17	53.1
Yes	15	46.9
Total	32	100.0

Are your solar panels grid-tied or battery-tied?		
	Frequency	Percent
Battery-tied	1	9.1
Grid-tied	10	90.9
Total	11	100.0

What is the size of your solar array in Watts?		
	Frequency	Valid Percent
123	1	10.0
1000	1	10.0
2300	1	10.0
4800	1	10.0
5000	1	10.0
6700	1	10.0
6900	1	10.0
7000	1	10.0
9000	1	10.0
9700	1	10.0
Total	10	100.0

What is the size of your solar array in Watts?	
Number of responses	10
Minimum	123
Maximum	9700
Mean	5252.30
Median	5850.00

Are you supportive of the town implementing renewable energy systems within New London? - Solar farm		
	Frequency	Percent
Not Supportive	17	9.8
Neutral	17	9.8
Somewhat Supportive	14	8.1
Supportive	43	24.9
Very Supportive	82	47.4
Total	173	100.0

Are you supportive of the town implementing renewable energy systems within New London? - Wind turbines		
	Frequency	Percent
Not Supportive	43	25.6
Neutral	18	10.7
Somewhat Supportive	18	10.7
Supportive	29	17.3
Very Supportive	60	35.7
Total	168	100.0

Are you supportive of the town implementing renewable energy systems within New London? - Solar panels on municipal buildings		
	Frequency	Percent
Not Supportive	4	2.3
Neutral	15	8.7
Somewhat Supportive	12	7.0
Supportive	40	23.3
Very Supportive	101	58.7
Total	172	100.0

Are you supportive of the town implementing renewable energy systems within New London? - Biomass		
	Frequency	Percent
Not Supportive	28	17.7
Neutral	47	29.7
Somewhat Supportive	11	7.0
Supportive	34	21.5
Very Supportive	38	24.1
Total	158	100.0

Are you supportive of the town implementing renewable energy systems within New London? - Geothermal		
	Frequency	Percent
Not Supportive	17	10.4
Neutral	33	20.1
Somewhat Supportive	11	6.7
Supportive	45	27.4
Very Supportive	58	35.4
Total	164	100.0

Are you supportive of the town implementing renewable energy systems within New London? - Methane Capture		
	Frequency	Percent
Not Supportive	22	14.2
Neutral	60	38.7
Somewhat Supportive	10	6.5
Supportive	26	16.8
Very Supportive	37	23.9
Total	155	100.0

How many days' worth of food do you estimate your household to have?		
	Frequency	Valid Percent
0	1	.6
1	1	.6
2	6	3.8
3	13	8.2
4	10	6.3
5	27	17.1
6	2	1.3
7	35	22.2
8	3	1.9
10	20	12.7
12	2	1.3
14	11	7.0
15	3	1.9
20	4	2.5
21	3	1.9
25	1	.6
30	9	5.7
42	1	.6
60	2	1.3
90	1	.6
100	1	.6
141	1	.6
180	1	.6
Total	158	100.0

How many days' worth of food do you estimate your household to have?	
Number of responses	158
Minimum	0
Maximum	180
Mean	12.92
Median	7

What percent of food does your household buy in New London?		
	Frequency	Valid Percent
0	6	3.6
1	19	11.4
2	18	10.8
3	19	11.4
4	6	3.6
5	8	4.8
6	1	.6
7	3	1.8
10	7	4.2

15	2	1.2
20	1	.6
25	1	.6
30	3	1.8
50	10	6.0
60	2	1.2
65	1	.6
70	2	1.2
75	8	4.8
80	7	4.2
85	1	.6
90	6	3.6
95	3	1.8
98	4	2.4
99	2	1.2
100	27	16.2
Total	167	100.0

How often do you purchase groceries from within the town of New London? Please indicate the percentage of groceries that you purchase from within the town during an average week.	
Number of responses	167
Minimum	0
Maximum	100
Mean	39.66
Median	10.00

If you buy groceries from within the town of New London, where are you most likely to purchase them? Please indicate the percentage of groceries that you purchase from each provider during an average week.					
	Number of Responses	**Minimum**	**Maximum**	**Mean**	**Median**
Hannaford	167	10	100	85.71	95.00
Concord Food Co-op	167	0	35	2.64	.00
Spring Ledge Farm	167	0	30	5.01	1.00
Other Locations	168	0	90	6.60	.00

Have you ever utilized food assistance programs? (i.e. food pantry, SNAP, WIC, EBT, FVRx, etc.)		
	Frequency	**Percent**
No	158	95.8
Yes	7	4.2
Total	165	100.0

How many times have you utilized the Food Pantry in the past month?		
	Frequency	**Percent**
0 Times	4	57.1
1 Time	2	28.6
3 Times	1	14.3
Total Responses	7	100.0

How many times have you utilized SNAP in the past month?		
	Frequency	Percent
0 Times	5	71.4
1 Time	2	28.6
Total Responses	7	100.0

How many times have you utilized WIC in the past month?		
	Frequency	Percent
0 Times	5	83.3
1 Time	1	16.6
Total Responses	6	100.0

How many times have you utilized EBT in the past month?		
	Frequency	Percent
0 Times	5	83.3
1 Time	1	16.6
Total Responses	6	100.0

How many times have you utilized FVRx in the past month?		
	Frequency	Percent
0 Times	5	83.3
1 Time	1	16.6
Total Responses	6	100.0

Do you have a garden at home?		
	Frequency	Percent
No	59	35.1
Yes	109	64.9
Total responses	168	100.0

How much space in your garden is dedicated to growing produce? (Square Feet)		
	Frequency	Valid Percent
0	4	7.1
5	1	1.8
8	1	1.8
10	3	5.4
15	1	1.8
20	3	5.4
25	1	1.8
30	3	5.4
32	1	1.8
44	1	1.8
50	5	8.9
60	1	1.8
64	1	1.8
80	1	1.8
95	1	1.8
100	7	12.5
150	1	1.8
180	2	3.6
200	2	3.6

240	1	1.8
250	1	1.8
300	1	1.8
400	7	12.5
525	1	1.8
750	1	1.8
1000	1	1.8
1200	1	1.8
1600	1	1.8
2400	1	1.8
Total	56	100.0

How much space in your garden is dedicated to growing produce? (Square Feet)	
Number of Responses	56
Mean	241.65
Median	97.50

How much of your diet is made up of food from your home garden? (Percentage)		
	Frequency	**Valid Percent**
0	3	5.4
1	1	1.8
1	7	12.5
2	5	8.9
3	2	3.6
5	12	21.4
10	8	14.3
15	6	10.7
20	3	5.4
25	1	1.8
30	6	10.7
40	1	1.8
50	1	1.8
Total	56	100.0

How much of your diet is made up of food from your home garden? (Percentage)	
Number of Responses	56
Mean	10.87
Median	5.00

Do you preserve food from your home garden?		
	Frequency	**Percent**
No	25	39.7
Yes	38	60.3
Total Responses	63	100.0

What is the source of your water supply?		
	Frequency	Percent
Town Water Supply	85	50.6
Artesian Well	51	30.4
Dug Well	22	13.1
Other (see table below)	10	6.0
Total	168	100.0

Other Water Sources		
	Frequency	Percent
Community Well	4	66.7
Drilled Well	2	33.3
Total	6	100.0

Have you ever had your water tested?		
	Frequency	Percent
No	15	17.0
Yes	73	83.0
Total	88	100.0

Have you ever had problems with your water quality?		
	Frequency	Percent
No	60	78.9
Yes	16	21.1
Total	76	100.0

What problems have you had with your water quality?		
	Frequency	Percent
Arsenic	2	15.4
Radon	3	23.1
Uranium	1	7.7
Iron	3	23.1
Arsenic, Lead and Radon	2	15.4
Sulfur	1	7.7
Iron and Calcium	1	7.7
Total	13	100.0

Do you have access to running water in the case of a power outage?		
	Frequency	Percent
No	25	28.7
Yes	62	71.3
Total	87	100.0

How often does your house experience flooding or poor drainage in an average year?		
	Frequency	Percent
0 times a year	134	82.2
1 time in a year	9	5.5
2 times in a year	8	4.9
3 times in a year	2	1.2
4 or more times in a year	10	6.1
Total	163	100.0

Have you implemented techniques to manage stormwater at your household? Which Ones?		
	Frequency	Percent
None	104	65.4
Other (Reference table below)	26	16.4
Porous Pavement	9	5.7
Rain Garden	3	1.9
Gravel Wetland	11	6.9
Rain Garden and Gravel Wetland	2	1.3
Porous Pavement and Gravel Wetland	2	1.3
Porous Pavement and Water Diversion Tank	1	.6
Porous Pavement and Rain Garden	1	.6
Total	159	100.0

Stormwater Management Techniques (other)		
	Frequency	Percent
Drains	11	52.4
Water Diversion	4	19.0
Sump Pumps	3	14.3
Rain Gutters/Barrel	3	14.3
Total	21	100.0

Would you be willing to implement techniques at your household to reduce the effects of stormwater?		
	Frequency	Percent
No	42	27.5
Yes	111	72.5
Total	153	100.0

In the case of an emergency event that lasts longer than 72 hours, what is your plan for shelter?		
	Frequency	Percent
Other	14	9.0
Remain at Current Location	91	58.7
Stay at Hotel	10	6.5
Town Approved Shelter	4	2.6
Stay w/ Family/Relatives	26	16.8
Remain at Current Location and Stay w/ Family/Relatives	4	2.6
Town Approved Shelter and Stay w/ Family/Relatives	1	.6
Remain at Current Location, Stay at Hotel, Stay w/ Family/Relatives	2	1.3
Remain at Current Location and Town Approved Shelter	2	1.3
Remain at Current Location and Stay at Hotel	1	.6
Total	155	100.0

In the case of an emergency event that lasts longer than 72 hours would you leave town or stay put?		
	Frequency	Percent
Leave Town	12	92.3
Stay Put	1	7.7
Total Responses	13	100.0

Crosstabulations:

		What is your business's water source?			Total
		Town	Artisian	Town and Dug Well	
Does your business own a generator?	No	13	2	0	15
	Yes	4	0	1	5
Total		17	2	1	20

		What is your home's water source?				Total
		Town Water Supply	Artesian Well	Dug Well	Other	
Does your household own a generator?	No	49	10	4	3	66
	Yes	36	40	18	7	101
Total		85	50	22	10	167

		How long did it take your business to return to normal function after an emergency event that lasted 72 hours or longer (hrs)?						Total
		0	2	3	6	12	24	
Does your business own a generator?	No	2	1	2	0	0	3	8
	Yes	1	1	0	1	1	0	4
Total		3	2	2	1	1	3	12

		How many times a year does your business experience flooding?					Total
		0	1	2	3	4	
Have you implemented techniques to manage stormwater at your business?	None	5	1	2	1	1	10
	Gravel Wetland	1	1	0	0	0	2
	Other	3	0	1	0	0	4
	Gravel Wetland & Porous Pavement	1	0	0	1	0	2
	Gravel Wetland & Other	1	0	0	0	0	1
Total		11	2	3	2	1	19

		How many times a year does your household experience flooding or poor drainage?					Total
		0	1	2	3	4	
Have you implemented techniques to manage stormwater at your household?	None	87	8	3	0	5	103
	Other	18	1	3	1	3	26
	Porous Pavement	8	0	0	1	0	9
	Rain garden	3	0	0	0	0	3
	Gravel Wetland	8	0	2	0	1	11
	Rain Garden and Gravel Wetland	2	0	0	0	0	2
	Porous Pavement and Gravel Wetland	1	0	0	0	1	2
	Porous Pavement and Water Diversion Tank	1	0	0	0	0	1
	Porous Pavement and Rain Garden	1	0	0	0	0	1
Total		129	9	8	2	10	158

		Have you ever utilized food assistance programs?		Total
		No	Yes	
How often do you purchase groceries from within the town of New London? (By percentage)	0	4	0	4
	1	18	1	19
	2	18	0	18
	3	19	0	19
	4	5	1	6
	5	8	0	8
	6	1	0	1
	7	3	0	3
	10	7	0	7
	15	2	0	2
	20	1	0	1
	25	1	0	1
	30	2	1	3
	50	10	0	10
	60	2	0	2
	65	1	0	1
	70	2	0	2
	75	8	0	8
	80	5	2	7
	85	1	0	1
	90	6	0	6
	95	3	0	3
	98	4	0	4
	99	2	0	2
	100	24	2	26
Total		157	7	164

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