



NATURE-BASED CLIMATE SOLUTIONS

An Addendum to the Burlington Open Space Protection Plan

February 2022





“The trees act not as individuals, but somehow as a collective. Exactly how they do this, we don’t yet know. But what we see is the power of unity. What happens to one happens to us all.

- Robin Wall Kimmerer - Author of *Braiding Sweetgrass*

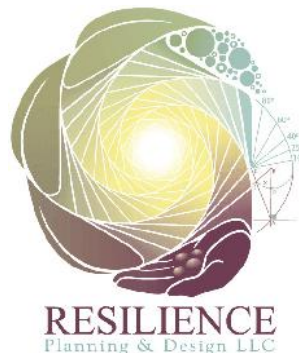


Acknowledgments

"Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has."

-Margaret Mead

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Contents

WHY NATURE-BASED CLIMATE SOLUTIONS?	6
OVERVIEW	8
Burlington's Landscape and People	12
EXISTING CONDITIONS ANALYSIS AND RESEARCH	13
OUTREACH SUMMARY	15
NBCS FRAMEWORK	17
Equity, Inclusion, and Relationships	19
Forests and Tree Canopy	25
Agriculture and Community Gardening	29
Water and Wetlands	33
Lawns, Fields, and Small Open Spaces	37
Green Infrastructure	40
IMPLEMENTATION	43
APPENDIX: EXISTING CONDITIONS ANALYSIS AND RESEARCH	55
Research and Case Studies	56
Protected Lands	59
Tree Canopy	60
Water Resources	61
Impervious Surface Cover	62
Connectivity	63
Biodiversity	64
Our Changing Demographics	65





WHY NATURE-BASED CLIMATE SOLUTIONS?

In 2020, the Burlington Conservation Board made an appeal to the City Council to write an addendum to the Open Space Protection Plan focused on climate change solutions. With the full support of the Council, the Planning Commission, and the Parks Commission, this work began in early 2021. The initiative was based on the following observations that have guided and informed the creation of this Plan:

- Climate change is the **defining challenge** of our time — and a cultural and ecological emergency that needs urgent attention.
- The City's Open Space Protection Plan was written in 2000, and updated in 2014, but did **not** specifically address climate change.
- The City's Climate Action Plan, which was updated in 2008, suggests a role for urban trees but does not fully contemplate **the role that other ecosystems play in climate mitigation**.
- Burlington has made **nationally recognized commitments** to addressing climate change in other ways—including the ambitious net zero electricity production goal, the achievement of 100% renewable power and other built environment and infrastructure-oriented investments.
- Burlington has also made **notable investments in conservation** through its Conservation Legacy Fund, conservation program in the Parks Department, and other land-protection efforts—but these investments have not been viewed or highlighted as climate change related efforts.
- A growing body of scientific evidence makes it clear that nature protection is not just good for stabilizing the climate, but is the most cost-effective, important, and inescapable requirement for successfully **slowing the heating of our city and our planet**.
- Healthy, functional ecosystems provide clean water, flood mitigation, wildlife habitat, and biodiversity protection—all of which are essential to **carbon sequestration**.
- The term **"nature-based climate solutions"** is being used by **major organizations**—like the United Nations, The Nature Conservancy, American Forests, World Wildlife Fund, and the Trust for Public Land—to describe the essential contribution open spaces and natural systems have in addressing the climate emergency.
- The United Nations estimates that **33% of climate action** will need to come from nature-based solutions—if humanity is to successfully and cost-effectively mitigate the risks and damage from the rising temperatures of the planet. However, the United Nations data also shows that globally **these nature-based efforts are only receiving 3% of the climate-action funding**.
- For the purposes of this project, nature-based climate solutions is defined on the following page.

NATURE-BASED CLIMATE SOLUTIONS *work with our soils, plants, trees, and water alongside community partnership, education, and participation to strengthen our people and our natural areas to combat climate change.*

More specifically, nature-based climate solutions:

- Significantly reduce greenhouse gas emissions.
- Reverse or mitigate the root of the problem instead of treating the symptoms.
- Provide many additional co-benefits for the ecology and community.
- Advance protection, restoration, and stewardship opportunities for natural resources.
- Reduce the threat from natural hazards while also making communities more resilient to the adverse impacts of climate change.
- Create opportunities for land stewardship education and partnerships.



OVERVIEW

This addendum to Burlington's Open Space Protection Plan (OSPP) was written to further the goals identified in earlier plans, including the OSPP and PlanBTV: Burlington's Comprehensive Plan, while specifically **identifying nature-based solutions that will combat climate change.**

Nature-based climate solutions (NBCS) are inherently multi-functional, providing a range of benefits related to climate resilience, ecological health, and community well-being. NBCS include strategies that **protect** existing natural areas, **restore** ecosystems, and **steward** the City's natural resources as a way to combat climate change. The purpose of this initiative is to catalyze and document a shift in the mindset of the City of Burlington and its residents. That is, a shift toward recognizing the inherent value that nature, including trees, plants, and soils, in Burlington's open spaces have in mitigating climate change. This is a critical evolution in thinking that compliments the City's many other sustainability and resiliency-related initiatives.

THE LINK TO CLIMATE CHANGE

The State of Vermont has indicated that climate change has serious impacts on Vermont's communities, economy, and ecosystems.¹ As temperatures rise, warmer air is affecting ocean currents, wind currents, air streams, storm systems, and many other drivers of the climate Vermonters experience currently. More intense precipitation and

¹ State of Vermont. "What Changes are Occurring? Climate Change in Vermont". <https://climatechange.vermont.gov/content/what-changes-are-occurring>



Nature-Based Climate Solutions

storms, less snow cover, rising average temperatures, and shorter winters are other associated impacts of climate change.

According to the Vermont Department of Health, spring arrives two weeks earlier than in 1960 on average, and the average air temperatures have increased by 2 degrees in the summer and 4 degrees in the winter. State data suggests that, while Vermont is currently experiencing around six days per year with temperatures above 87 degrees, that's expected to increase to more than 20 days per year.²

According to a study published by Climate Central in July, 2021, Burlington ranks 13th out of 159 cities nationwide for risk factors that contribute to "urban heat islands", which are created when there are higher temperatures and the presence of unvegetated, impermeable surfaces in cities.³

² Vermont Department of Health. State Climate Office projections. 2014. <https://www.healthvermont.gov/health-environment/climate-health/climate-change>

³ Climate Central. "Hot Zones: Urban Heat Island Effects". July, 2021.

This study also revealed that Burlington is, on average, 7 degrees warmer, due to its land use pattern and location, than other areas of Vermont, which increases the demand for cooling energy and has public health and environmental consequences.

NATURAL ECOSYSTEMS AS A CLIMATE CHANGE SOLUTION

Nature helps combat climate change by removing greenhouse gases from the atmosphere and storing carbon in the vegetation and soil. This reduces the amount of greenhouse gas emissions in the atmosphere, which is a leading contribution to climate change and its impacts. Scientific studies have also shown that trees and other vegetation can lower air temperature in city neighborhoods by up to 10 degrees.⁴

These natural process have the potential to reverse or mitigate the underlying root of the climate change issue and its associated impacts in Burlington. Nature-based climate solutions also have the potential to increase habitat, filter stormwater, protect water resources, increase the City's local food supply, reduce the impact of natural hazards, benefit human well-being, and increase Burlington's resilience. To harness nature's innate abilities to fight climate change, Burlington must invest in natural resource protection, ecological restoration, and new land stewardship opportunities.

Burlington is part of the Urban Drawdown Initiative (UDI), a network that brings together city managers, urban planners, resource specialists, community-based organizations, scientists, innovators, land managers, and others to accelerate

implementation of carbon removal strategies that simultaneously improve the social, economic, and environmental resilience of local communities. Traditionally, cities develop greenhouse gas inventories by accounting for emissions generated by the burning of fossil fuels and develop solutions to reduce those emissions. A nature-based climate solutions framework also accounts for carbon sequestration and emissions in natural ecosystems.

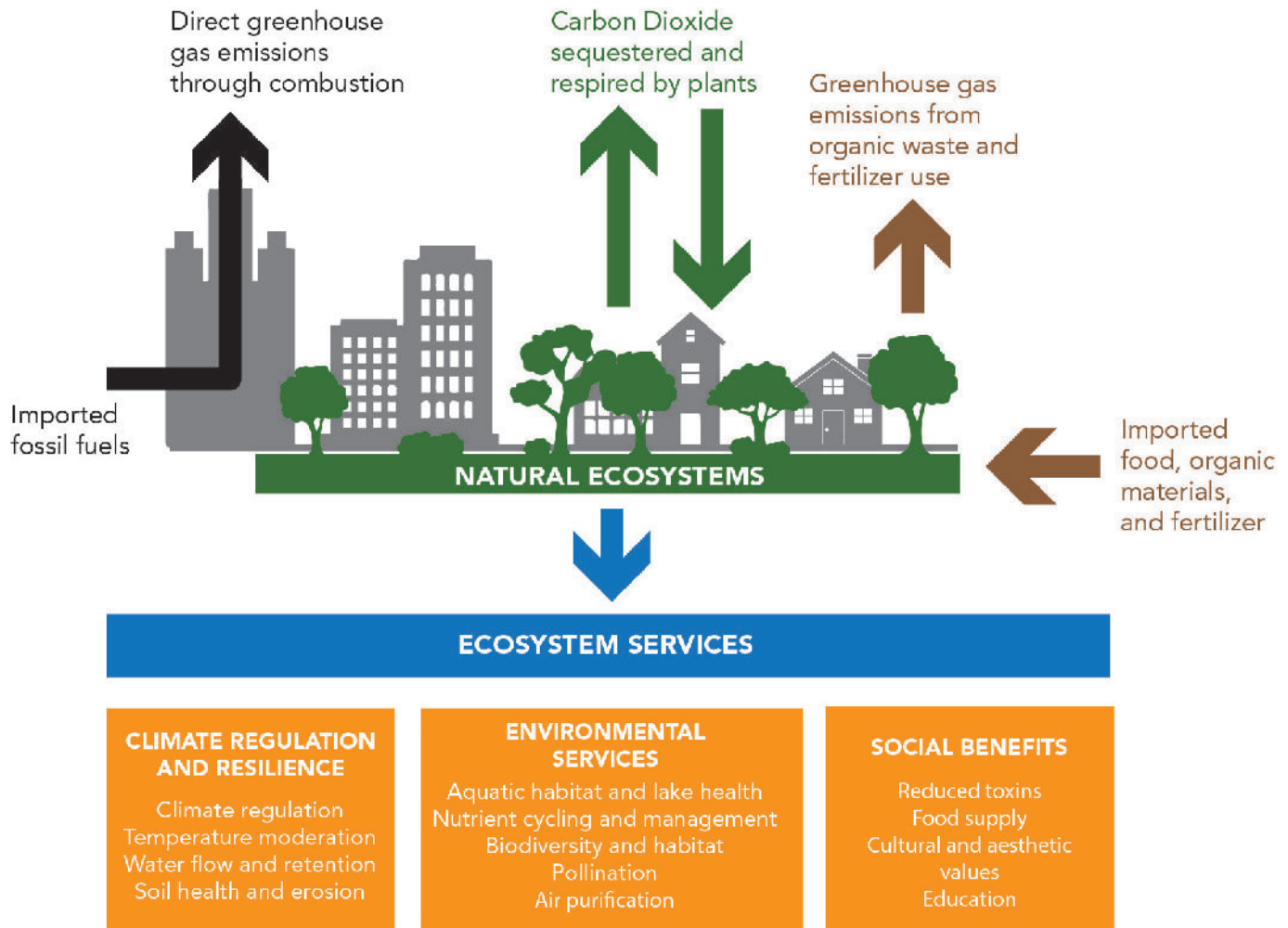
When natural ecosystems are lost, due to development, tree mortality, etc., greenhouse gas emissions increase, carbon sequestration from natural systems decrease, and the ecosystem services that open spaces provide are diminished. When natural ecosystems, which can be thought of as "carbon stocks", are increased by strategic management of open space, greenhouse gas emissions decrease, carbon sequestration increases, and ecosystem services are protected or enhanced.

PLANNING FOR NBCS

The image on the following page is adapted from the Urban Drawdown Initiative and illustrates the relationship between natural ecosystems, greenhouse gas emissions, and carbon storage. All scales of implementation are needed to harness the capability of nature-based climate solutions; from the smallest planting or pocket park, to changes in land management in parks and open spaces, and stewardship of the City's largest conservation lands.

As indicated in the image above, organic waste and fertilizer use are other prevalent

⁴ Proceedings of the National Academy of Sciences of the U.S. "Scale-dependent interactions between tree canopy cover and impervious surfaces reduce daytime urban heat during summer". Carly D. Ziter, Eric J. Pedersen, Christopher J. Kucharik, and Monica G. Turner. April, 2019.



sources of greenhouse gas emissions. Before Vermont passed a mandatory composting law, the state would send approximately 80,000 tons of organic waste per year to landfills. According to the Environmental Protection Agency, the statewide switch to composting cuts greenhouse gas emissions significantly, equating to about 9,000 cars being removed from the road.

To protect and increase natural ecosystems within Burlington, natural resource and development/housing needs must be balanced to best address issues of climate change, affordable housing, and others. There is an opportunity to balance development with natural resource protection, and even promote the integration of nature-based climate solutions in the City's new development in a thoughtful way.

MOVING TOWARDS ACTION

To propel investment and action, local officials must embrace a commitment to the following NBCS Goals for Burlington:

- Guide City staff and leaders, local organizations, and community members in collaborative efforts to implement NBCS.
- Mobilize community members to lead and participate in NBCS through education, volunteerism, and community input.
- Ensure this NBCS framework guides the next Open Space Protection Plan update by 2025.

To bring these concepts into practice, this Plan identifies innovative and aggressive

strategies for the City to initiate that capture carbon with trees, plants, and soils in Burlington's forests, fields, gardens, wetland ecosystems, and through green infrastructure solutions.

This city-wide initiative also frames the importance of land conservation and the restoration of natural systems as important climate action strategies, and recognizes the economic and social values of these resources. These efforts will leverage the carbon-capturing potential of the diverse vegetation and soil layers in these spaces while also generating additional ecosystem services that benefit Burlington and the surrounding region. Moving forward, nature-based climate solutions should be designed with consideration of their long-term "carbon-sink" potential, as well as their impacts on biodiversity, equity, and sustainable development goals.

To ensure long-term resilience, projects involving nature-based solutions should adhere to four high-level principles, defined by Oxford's Nature-Based Solutions Initiative.⁵ These include:

- NBCS are best utilized ***in conjunction with efforts to decarbonize our economy*** and phase out fossil fuel use (see Burlington's Net Zero Energy Roadmap).
- NBCS projects need to ***involve a wide range of ecosystems***. All ecosystem types hold opportunities for NBCS to enhance the provision of ecosystem services to people while supporting multiple societal challenges.
- NBCS should be designed, implemented, managed, and monitored ***in partnership with local and indigenous communities*** while generating local benefits, including

supporting livelihoods and reducing vulnerability to climate change.

- NBCS must ***support or enhance biodiversity***, from the level of the gene to the ecosystem. Biodiversity underpins the societal benefits derived from NBCS by supporting the delivery of many ecosystem services in the short term, reducing trade-offs among services (e.g. between carbon storage and water supply), and supporting the health and resilience of ecosystems in the face of environmental change. To sustain ecosystem health, other aspects must also be considered, such as ecosystem connectivity.
- ***Metrics for measuring the success of NBCS*** should include those for carbon dynamics, as well as for biodiversity across multiple trophic levels.



⁵ Nature-Based Solutions Initiative. Oxford University. <https://www.naturebasedsolutionsinitiative.org/>.



THE ABENAKI
NATION
THE FIRST OF VERMONT

BURLINGTON'S LANDSCAPE AND PEOPLE

This land we now call Vermont has changed **dramatically** over the past 10,000+ years since the Abenaki people and others began to know this place as their home.

Take a moment to picture your favorite natural area in Burlington. Listen to the bird songs and the buzzing of insects while you walk through changes in vegetation and see other people enjoying this place as well. It is important that we acknowledge the long history of this land we call Vermont, and the deep connection that people have had with its landscape throughout history. The Abenaki people of Vermont, including members from the Missisquoi Tribe, the Nuhlegan Band of the Coosuck, Koasek Abenaki Nation, the Elnu Abenaki Tribe, and others are still here living and working beside us, and new

people are arriving with their own history and stories every day.

This should serve as a reminder to acknowledge the past, present, and future of our place as humans and as part of the natural environment in Vermont. It is our responsibility to give back to this land that sustains us.

It is also important to clarify that this open space planning process in Burlington was led by mostly white residents and consulting staff. Efforts were made to reach out and engage with many voices and perspectives in meaningful ways during this process, and everyone involved is committed to continuing these efforts during implementation. We hope this NBCS initiative can grow from this starting point and be further informed by an even greater diversity of participants over time.

EXISTING CONDITIONS ANALYSIS AND RESEARCH

This project began with a city-wide inventory and analysis of existing conditions in Burlington. As part of this analysis, digital map data was reviewed, as well as other studies and planning documents. The resulting information provided a deeper understanding of Burlington's existing open space and natural resource networks. The analysis also provided a foundation for the creation of the City's own NBCS framework and implementation blueprint which are presented in this Plan.

A comprehensive review of the the following topics can be found in the Appendix.

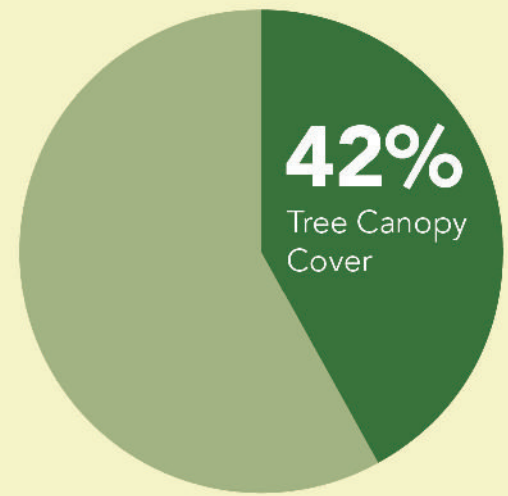
- Protected Lands
- Tree Canopy
- Water Resources
- Impervious Surface Cover
- Connectivity
- Biodiversity
- Demographics

Extensive research was also conducted to learn how urban communities are implementing NBCS and how leading agencies (such as the United Nations and the Nature Conservancy) are framing NBCS as a climate change solution. This research provided direction and inspiration for the creation of Burlington's framework. A summary of the research conducted can be found in the Appendix.

There are many departments, organizations, and individuals that have already started implementing projects that are considered NBCS throughout the City, creating fertile ground for future collaboration. This provides an opportunity for the City to elevate NBCS as a robust strategy to combat climate change, building on existing momentum to garner additional support for this vision. As the infographics on the next page indicate, there is an extensive open space network already in place.



Today,
Burlington's open
spaces include:



55 miles

of trails, paths, and
greenways



50+

parks and
urban wild
areas in the
city



50 miles of total
shoreline



OUTREACH SUMMARY

This summary highlights the **outreach and engagement methods** used, key themes identified, and findings collected during the public outreach phase of the 2021 Burlington open space protection planning process.

The purpose of this Open Space Protection Plan Addendum is to promote, embrace, and strengthen NBCS within the city to combat climate change. Implementation of this plan will require involvement from community members, city staff, elected officials, and many partner organizations. To accomplish this and ensure that the final planning document reflects the goals and priorities of the community, City staff, NCBS sub-committee, and the consulting team developed a diverse community engagement plan utilizing diverse approaches to outreach.

These included:

- Project Website
- Online Project Feedback Form

- Artwork explaining NBCS by Christine Hill of Tender Warrior
- Project flyers and signs
- Direct communications to boards, committees, and organizations
- Social media communications
- A public access video using NBCS artwork and a voiceover
- A virtual community summit
- A public access video featuring the virtual community summit
- Meetings with the following Departments, Boards, Committees, and Organizations:
 - Parks, Recreation, and Waterfront Staff
 - Parks Commission
 - Winooski Valley Park District
 - Planning Commission
 - Ward 5 Neighborhood Planning Assembly
 - Burlington Wildways
 - Stormwater Staff
 - University of Vermont Classes
- An online survey

The results from these engagement activities have been used to inform the Open Space Plan Protection Addendum.



WHAT WE HEARD

Across all of the engagement activities the participants understood the pressing need for investing in NBCS, and they all indicated an interest in helping implement these efforts in Burlington. The following themes emerged during this process:

- **There is support in the City investing in and expanding nature-based climate solutions (NBCS), as well as supporting existing NBCS initiatives.**

City staff and partner organizations are ready to do more and have lots of ideas that align well with NBCS. There is interest in continuing to use municipal properties and infrastructure for NBCS to provide examples that residents, property owners, and the development community can learn from.

- **NBCS should engage residents and property owners in Burlington.**

Residents and property owners need to be engaged in NBCS efforts because publicly owned lands will not provide enough opportunity for real impact. The good news is that the residents we engaged with are excited about the possibilities but favored different strategies. To address this, future efforts should include incentives, resources, and education on successful strategies and new practices for those interested.

- **Regulatory standards and incentives should be developed to increase NBCS in Burlington.**

Regulatory standards are still needed to protect the city's open spaces and the natural resources they contain while also expanding tree canopy and ensuring long-term maintenance. While homeowners were less excited about regulations that could impact residential properties there was a general understanding that this is an important tool for balancing the impact of development as the city continues to grow.

- **Increasing equity and accessibility of NBCS should be a priority in project planning and implementation.**

Equity and accessibility was discussed frequently throughout this process, and yet it proved challenging to engage many of the voices often missing from these types of municipal planning efforts. Some efforts that were utilized were language translation of the project webpage and direct communication with underrepresented populations in the City. Looking forward, there was agreement that more needs to be done to engage a wider variety of residents, and to ensure that their voices and wishes are reflected as improvements are made in every neighborhood.

- **Ongoing education and outreach will be needed to ensure that the topic of NBCS is accessible and understood.**

This concept and the many implementation strategies identified are new to many people, and efforts need to be made to provide hands on education and access to resources and plant materials. To do this effectively, the city must also commit to measuring, monitoring, and reporting out on the ability of the open spaces and the species within to combat climate change.

- **Connecting open spaces and regeneration of natural systems were identified as priorities for NBCS projects.**

This includes finding ways to maintain physical connections between vegetated areas while ensuring impervious surfaces are disrupted. Within these areas there is interest in prioritizing the establishment of edible species and native species that also benefit wildlife. Participants also expressed support for regenerating lost wetland areas and buffers along shorelines as examples of the ways the city can work to restore the health of the natural

NBCS FRAMEWORK

The framework that has emerged for identifying and implementing NBCS in Burlington was shaped by a review of literature on the subject, investigating similar initiatives in other municipalities, analyzing materials provided by natural resource organizations, and gaining a deeper understanding of Burlington's existing open space network and development patterns.

Five of the themes relate to distinct land cover types found in the city:

- Forests and Tree Canopy
- Agriculture and Community Gardens
- Water and Wetlands
- Lawns, Fields, and Small Open Spaces
- Green Infrastructure

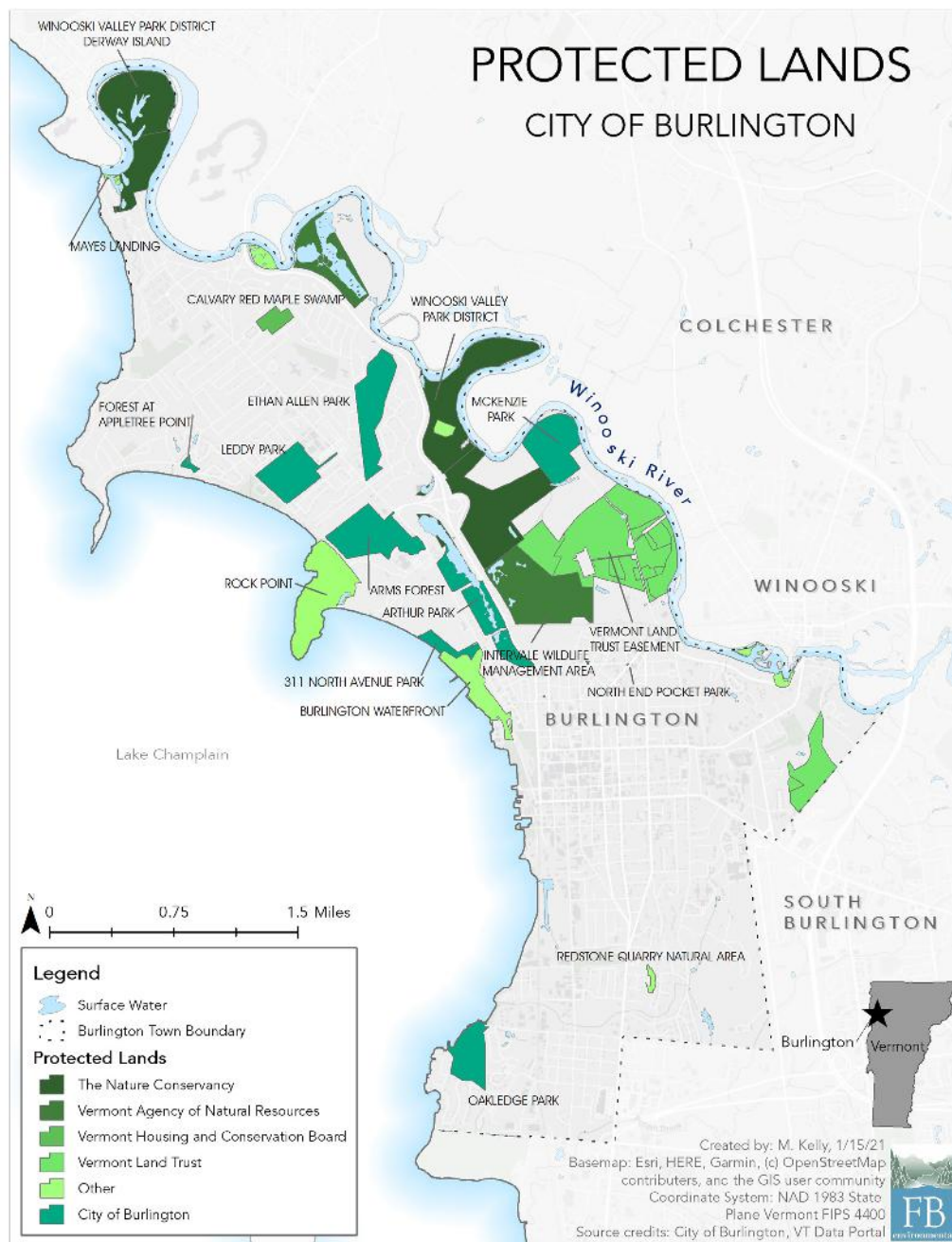
A sixth overarching theme was identified by participants as Equity and Inclusion. This was in recognition of Burlington's diverse and changing population, and efforts underway to ensure that all residents have access to natural areas and the many benefits they provide. ***It is important to recognize that a thriving human community is necessary if we want to ensure thriving ecosystems.***

While all existing NBCS-related projects within Burlington

(projects that sequester carbon, reduce emissions and create resilience) need to be recognized and supported, this planning initiative set out to identify a framework and clear actions for equitable implementation of NBCS in Burlington.


This framework, however, will only be successfully implemented through collaboration with the many individuals, organizations, and initiatives already in place and doing this critical work. It is the intent of the City that this Plan will be adopted as an aspect of the City's Comprehensive Plan and will then inform the next open space protection plan update and climate action planning efforts.





Supporting, creating, and investing in NBCS in Burlington will expand the rich open space resources the City offers its residents and visitors. Currently, protected lands within the city are primarily located in the vicinity of the Intervale. This includes the largest protected land parcel, the Ethan Allen Homestead, which is owned by the Winooski Valley Park District. Burlington also has more than 50 parks and urban wild areas throughout the city, with many located within the central portion of the city, along the Lake Champlain

waterfront, and along the Winooski River. In addition to these protected lands, there are 14 community gardens throughout the city and approximately 55 miles of trails, paths, and greenways that connect these parcels. The Burlington Greenway alone stretches continuously from the southern end of the city, along the downtown waterfront, to the north tip of the city adjacent to Derway Island. NBCS have the potential to elevate the natural areas in Burlington as a critical solutions to the climate crisis.



EQUITY, INCLUSION, AND RELATIONSHIPS

"A truly sustainable community is one in which all members **achieve, participate, and thrive.**"

- City of Burlington's Diversity and Equity Strategic Plan

This theme emerged from the many discussions in Burlington related to what NBCS look like and who they benefit. Historically, equity and inclusion have often been afterthoughts when it comes to natural resource and conservation planning projects. As Burlington builds resources and initiatives to address climate adaptation, first and foremost, there must be a commitment to strategies that prioritize equity through **targeted universalism**.

Within a targeted universalism framework, universal goals are established for all community members. However, the strategies developed to achieve those goals are based on how different groups are situated within structures, culture, and across geographies to ensure that they can successfully achieve the universal goal.

Targeted universalism is closely related to equity. It meets folks where they are, responding to different baselines which have resulted from historical and institutional systems of oppression.

EQUITY AND INCLUSION AT THE CITY-LEVEL

On a very similar timeline to this Addendum, the City of Burlington is releasing a Racial Equity Strategic Roadmap. The Racial Equity Strategic Roadmap seeks to harness Burlington's record of strong public sector leadership and progressive urban policies to catalyze a much needed shift from color-blindness to anti-racism. This process entails listening to and learning from Burlington's BIPOC (Black, Indigenous, and People of Color) communities and organizers on how **white supremacy culture and systemic racism** operates across different sectors, institutions, spaces, and internal practices. This Roadmap outlines necessary cultural, institutional, and systemic shifts for the City of Burlington.

Meaningful community engagement encompasses residents from historically marginalized communities who see themselves - and are seen as - full partners in the decision-making, program-planning, and policy-making processes that impact their lives in significant and sustained ways. Nature-based climate solutions should embrace these values and practices moving forward.

Targeted universalism is goal oriented, and intended to bring everyone to the same baseline, where universal goals and processes truly work for all.

For the purposes of this Plan, **frontline communities** include those who are most vulnerable to the impacts of climate change, those who have limited access to open space and its benefits, and/or those who, historically, do not have a voice in the local planning decision-making process. This includes low-income populations, people of color, immigrant and migrant people, the elderly, disabled people, and others. Strategies that promote equity and targeted universalism prioritize outreach, engagement, and partnership with frontline community members in an authentic, culturally-appropriate way that honors and acknowledges their unique experiences, systemic inequalities, history, perspectives, and worldviews. This centers underrepresented populations and voices in Burlington's NBCS efforts going forward.

The City of Burlington has been developing the Racial Equity Strategic Roadmap and the Racial Equity Toolkit to be used as tools to support and guide city strategies to include racial justice and targeted universalism. Such a commitment to centering and utilizing these tools will require ongoing, deep organizational work on the part of the City and its partners. This work should include addressing institutional racism. This will enable Burlington community members that have been historically marginalized to guide this nature-based climate action so that it does not lead to displacement or other unintended impacts.

Across Burlington, nature is unevenly distributed and there are clear differences

INCLUSION AND BELONGING means to have a seat at the table. Belonging is having your voice elevated at that table you were once denied. Belonging also means feeling comfortable in your own skin and being able to bring your full self into the discussion (City of Burlington).

EQUITY refers to the balance of resources distributed to individuals or groups based on what individuals or groups historically and/or currently have or need. Resources may be economic, political, social, or otherwise. What is equitable may not necessarily be equal. Equity stands apart from equality, which requires even distribution of resources to all (City of Burlington).

RACE is a social construct used to divide society by a hierarchy determined by the color of your skin. For many people, it comes as a surprise that racial categorization schemes were invented by scientists to support worldviews that viewed some groups of people as superior and some as inferior (Kivel, 2002).

RACIAL JUSTICE refers to the systematic fair treatment of people of all races, resulting in equitable opportunities and outcomes for all. Racial justice—or racial equity—goes beyond “anti-racism.” It is not just the absence of discrimination and inequities, but also the presence of deliberate systems and supports to achieve and sustain racial equity through proactive and preventative measures. Racial Justice is defined as the proactive reinforcement of policies, practices, attitudes and actions that produce equitable power, access, opportunities, treatment, impacts and outcomes for all (Race Forward, 2015).

INSTITUTIONAL RACISM refers specifically to the ways in which institutional policies and practices create different outcomes for different racial groups. The institutional policies may never mention any racial group, but their effect is to create advantages for whites and oppression and disadvantage for people from groups classified as people of color (Potapchuk, Leiderman, Bivens & Major, 2005).



Please note that the trails category in the map above also includes bike lanes.

in residents' ability to gain access to open space (see on the map above). There is increasing understanding of the many benefits from regular connection to nature. A formative step for Burlington would be to analyze and acknowledge where access to nature and open space is lacking, and to develop strategies that address infrastructure, programming, and land acquisition to address these gaps. More equitable access to open space city-wide will not only help reach the City's goal for combating climate change, but will also ensure that all residents have equal

access to the trees, open spaces, and gardens needed to reduce carbon in the atmosphere. Without a strong commitment to maintaining and expanding natural areas and vegetative cover in the city, more tree canopy cover and open spaces will be lost over time. This will not only increase emissions city-wide it will lead to greater impact from urban heat island effect, and less space for gathering, recreating, and growing food. These impacts typically affect frontline communities at higher proportions.

STRATEGIES FOR EQUITY AND INCLUSION

The following strategies have been identified as ways to act on this theme of the NBCS Framework. The specific actions identified for each are included in the implementation table.

INCREASE ACCESS TO GREEN SPACE AND ITS BENEFITS FOR FRONTLINE COMMUNITIES

A recent study by the Conservation Science Partners (CSP), Hispanic Access Foundation (HAF), and the Center for American Progress, found that communities of color and low-income communities have too few safe, close-to-home parks, natural areas, and open spaces where they are able to go outside (largely due to the impacts of systemic racism and discrimination on human settlement patterns and land protection decisions). The report also identified that communities of color are three times more likely than white communities to live in nature-deprived places. Seventy percent of low-income communities across the country live in nature-deprived areas.

The City should focus on prioritizing NBCS investments in underserved areas of Burlington, and where communities are disproportionately suffering from climate change impacts and limited access to open space. The City should also regularly partner with existing organizations, agencies, neighborhoods, and social service providers to increase opportunities for community members to be involved in NBCS decisions.

Systemic challenges should also be addressed through NBCS projects including increasing land access opportunities, protecting open space resources in areas that need it most, addressing food security needs, and identifying authentic, culturally-appropriate, place-based ways to engage with resident populations. Additionally, the City should consider

A LOCAL LOOK

Grow Wild - Burlington Parks - Champlain Elementary School Collaboration

Grow Wild is a partnership promoting biodiversity and climate resilience in Burlington, Vermont, by increasing and connecting native plant habitat for pollinators, birds and other wildlife across public and private lands. In 2021, Grow Wild partners worked with Champlain Elementary teachers and students to plant a wildlife corridor connecting Englesby Brook to a forested outdoor classroom and to establish a native plant nursery on site. The students will gather native seeds and germinate them and will share young trees with other schools in the district. The corridor has been cared for by the Burlington Parks and Recreation Department. Partnership makes this work possible.

completing a more in-depth analysis during the full Open Space Protection Plan update on access to open space and nature in areas of the city where there are higher concentrations of communities of color.

SUPPORT GRASSROOTS EDUCATION OPPORTUNITIES TO COMMUNICATE THE VALUE OF NBCS

Education plays a significant role in communicating the ecological and social benefits that nature offers, reinforcing a strong connection to our landscape, and promoting ecological literacy of NBCS. NBCS projects should have a strong civic engagement component, actively collaborating with diverse populations across Burlington, and communicating the value of NBCS. The City should consider building off existing education programs, building relationships with organizations that work with different people in the community, and developing NBCS-specific curriculum for youth programs.

A LOCAL LOOK BURLINGTON'S CITY & LAKE SEMESTER

Burlington School District's "Burlington City & Lake Semester" (BCL) has been recognized as an Outstanding Flagship Project in Education for Sustainable Development by the GlobalRCE Centre, a program of United Nations University. BCL is a multi-credit course offered through Burlington's High School that allows juniors and seniors to use the city as their classroom and curriculum for one semester of their high school journey. Students enrolled in BCL learn a curriculum centered around the core themes of Social Justice, Sustainability, Civic Engagement, Community, and Place through a variety of real-world projects and partnering with organizations and individuals across the City.

Through this program, BCL students have already participated in nature-based climate solutions, such as planting native tree species for forest restoration and climate resilience. Engaging BCL students in future NBCS strategies provide a win-win - NBCS strategies gain capacity and BCL students gain the benefits of civic engagement, being outside, and learning about natural systems.



EMBRACE EQUITY AS A PLANNING AND IMPLEMENTATION CRITERIA FOR NBCS DURING PROJECT DEVELOPMENT

In the United States, people of color, low-income neighborhoods, and indigenous peoples have traditionally been excluded from the conservation movement and local decision making processes around open space protection and planning. For more than a century, the movement to protect parks, public lands, and other natural places in the U.S. has been dominated by white people and perspectives.

According to new research by the University of Vermont and the Gund Institute for Environment, people of color and low-income people will face the harshest effects from loss of natural land cover over the next 80 years. Researchers used existing government data and demographic projections for counties across the United States to model land use change and its impact on three environmental or health benefits: air quality, crop pollination and protection from West Nile virus, which was used as an indicator of insect-borne diseases. They modeled a handful of scenarios based on potential market trends and environmental policies, and found people of color in the United States will experience an estimated 224% decrease in air quality, a 118% decrease in crop pollination, and an 111% decrease in control of vector-borne disease.

In contrast, white Americans will generally see benefits across all three categories, and high-income communities will experience benefits in air quality and vector-borne disease control. In addition to pointing out the disparities, the modeling found “mismatches” between where environmental benefits are needed and where they’re expected to happen.

In general, exclusive public engagement

A LOCAL LOOK NEW FARMS FOR NEW AMERICANS

New Farms for New Americans manages 7.5 acres of land in the City of Burlington, some at the Ethan Allen Homestead and some at the Intervale Center. Currently, 67 families are renting plots to raise food for themselves. Out of these families, there are at least half a dozen languages spoken collectively with most individuals immigrating to Vermont from Bhutan, Burundi, Somalia, Burma, or the Democratic Republic of the Congo. This program was started by the association of Africans Living in Vermont (AALV), a Burlington nonprofit serving refugees and immigrants. According to AALV, the gardens feed 250 to 300 people.

The AALV program compliments the City’s community garden program by offering larger amounts of space for home-scale food production and subsistence farming. The AALV program’s 1/16th acre minimum is more than three times the size of the largest Burlington-area community plots. Many of the plots are tended by multiple generations of one family, and the garden can be an important way for elders to contribute. AALV offers support services such as soil preparation, a greenhouse for starting seeds in the spring, a community corn-grinding mill and advice on extending the season.

and conservation framing methods — compounded by the underrepresentation of people of color at the staff and leadership levels of conservation organizations and natural resource agencies—has perpetuated the racial divide in nature access. However, Burlington has made significant strides towards embracing equity both internally (within their organizational structure) and externally (in the community). Building off this commitment, equity must be a driving criteria in NBCS project development in order to achieve just and fair outcomes.



URBAN FORESTS AND TREE CANOPY

"If we want to use forests as a weapon in the fight against climate change, then we must allow them to **grow old**, which is exactly what large conservation groups are asking us to do."

-Peter Wholben, Author of "The Hidden Life of Trees"

Urban tree canopies provide many benefits as NBCS, including improving air quality, decreasing flooding from stormwater runoff, increasing shading for buildings to reduce energy consumption, decreasing urban heat island effects, and the absorption of carbon dioxide. Preserving existing tree canopy and planting new trees represent one of the most significant strategies the City can undertake to combat climate change and urban heat island effect.

These benefits also have economic value. According to a study from USDA Forest Service and the University of California Davis which found that for every \$1 spent in California cities on tree planting and maintenance, there were \$5.82 in benefits.

Increasing canopy cover in Burlington will require ongoing measuring and monitoring

to ensure that the goal is being met. The goal set in Burlington's Climate Action Plan is to plant 588 new trees per year, and maintain the existing urban tree canopy. Currently, Burlington's existing tree canopy covers 42% of all land within the City.

The distribution of tree coverage in the City can be found on the map on the following page. As shown on the map, Burlington's tree canopy is lowest in the densely developed downtown area of the city. Undeveloped areas of the city with low tree canopy coverage include the Intervale, which is primarily agriculture, as well as the golf course located in the south eastern corner of the city. Conserved areas and well-established low density residential areas have the densest tree canopy cover. The north end area has both of these land uses and is best served by tree canopy cover currently.



STRATEGIES FOR FORESTS AND TREE CANOPY

The following strategies have been identified as ways to act on this theme of the NBCS Framework. The specific actions identified for each are included in the implementation table.

PROTECT EXISTING TREE CANOPY

The retention of healthy trees within the city is a top priority for NBCS. This can be

achieved through conservation efforts on both public and private land. Older forests sequester more carbon than young forests and therefore represent the highest level of priority for protection, but preventing a loss of canopy cover is the target regardless of tree age. The City of Burlington updated its Tree Canopy Assessment in 2019 and learned that the canopy increased from 38% to 42% because of successful efforts like the street tree program. However, some losses were also identified and those need to be further

understood and addressed. A strategic plan for tree removal offsets, to replace trees removed in one area, by planting trees in another area will help the city increase its tree canopy at a higher rate. This allows for the amount of urban tree canopy to be maintained, even with tree removal during development, and could result in possibly expanding it.

An update of the City's tree ordinance would also leverage additional tree planting. It's important to note that much of Burlington's forested land area is owned by private land owners. The ordinance should cover both public and private forests with a component that is integrated into the zoning regulations. It should also address preventing loss of tree canopy, and, where that's not possible, mitigating the impact of tree loss with new plantings.

TREE PLANTING

Tree planting is an important supplement to the protection and restoration of existing forests and tree canopy. While new forests do not sequester carbon as efficiently as older forests, planting will allow the city to prioritize the integration of trees into the urban landscape.

Additionally, tree planting allows for the careful selection of species resilient to climate change. Priority should be given to native species, which support local insects and ecosystems and are well-adapted to the northeast climate. Increasing the number of trees will increase the amount of carbon that can be sequestered while cooling the city in summer, providing habitat, and many other benefits.

A LOCAL LOOK BURLINGTON'S NORTHBEND ORCHARD ON MANHATTAN DRIVE

The City of Burlington's Parks, Recreation, and Waterfront launched a restoration project in the spring of 2020 to repurpose an underutilized City space into a small neighborhood orchard and community food forest on Manhattan Drive. The goals of this project were to reestablish the surrounding habitat, provide a community food source, increase neighborhood native tree canopy cover, improve air quality and shade through an increase of canopy cover, and increase civic engagement which empowers community members to address climate change. Additionally, a mowed space was transformed into a no-mow zone to attract pollinators and to support plant productivity.

The orchard includes plums, peach and hazelnut trees, and aronia bushes, black currants, elderberry, and raspberries in the greenspace. The goals for 2021 are to maintain the existing orchard and engage in invasive species control of the adjacent zones by clearing the area of vegetation and introducing native trees and shrubs. To the west, neighbors will revegetate the area with native plants, establish a wind break along the northern edge, and extend the community orchard. To the east, neighbors will plant native tree species in an effort to increase canopy cover for this section of the roadway.



CASE STUDY

AMERICAN FORESTS' TREE EQUITY TOOL

In most cities, trees are sparse in socioeconomically disadvantaged neighborhoods and more prominent in wealthier, whiter neighborhoods. The inequitable distribution of urban tree canopy in cities is both a human and environmental issue. Trees contribute to fresh air and clean drinking water, cool homes, which reduces heat-related illnesses and utility costs; lower flood risk; and increase wealth by creating tree-related career opportunities.

To address the issue of inequitable distribution of tree canopy in urban areas, American Forests has created a tool called the Tree Equity Score which scores a geographic area based on the quality and quantity of their tree canopy and the associated benefits of that canopy. This tool can be used by neighborhood organizations, local officials, and everybody in between. It can also be used by a variety of sectors, such as urban forestry and public health, given the role trees play in slowing climate change and advancing social equity. Urban land-use planners and others can use the scores to decide where and how to invest in forestry and infrastructure. The scores can also be used to take a fresh look at an existing urban forestry program.

CASE STUDY

TREES, FRESH FRUIT, GREENS, AND SHADE

Speak for the Trees Boston is a new nonprofit organization dedicated to improving the size and health of the tree canopy in the greater Boston area through local community projects, focusing on areas with low canopy coverage. The implementation of the HERO Hope Garden on Geneva Avenue was initiated by Speak for the Trees and several local nonprofit groups, including Farmers Collaborative, Boston Food Forest, HERO Nurturing Center and HomeHarvest. It is supported by national partner American Forests, which is also producing an interactive online Canopy Planner Tool for the city.

Speak for the Trees, Boston is focused on maintaining and sustaining a healthy and vibrant urban forest in the greater Boston area. To accomplish this, Speak for the Trees is committed to supporting the vitality of the urban tree canopy in the greater Boston area, especially in areas with low canopy coverage. Their work focuses on community projects at the neighborhood level, engagement, educational outreach, and public advocacy. SFTT partners with community members, parallel organizations, and municipalities to build a healthier tree canopy for all.





AGRICULTURE AND COMMUNITY GARDENS

"Food is the place where you begin."

-Dr. Vandana Shiva

Farms and smaller scale community gardens play a key role in building community, fostering a connection to the land, and increasing food security. Food production also has the potential to mitigate the impacts of climate change through carbon sequestration and storage through the accumulation of biomass.

Climate change affects agriculture by causing climate unpredictability, water scarcity, and soil degradation. Farmers and backyard growers are excellent stewards of NBCS, and can use their existing knowledge in addition to new skills to protect and restore natural resources. This may include farmland protection initiatives, healthy soils practices, and other land management practices that increase carbon storage while limiting greenhouse gas emissions and improving

water quality. In the City of Burlington, large-scale agriculture is concentrated largely in the Intervale Center, while small-scale food production is interspersed throughout residential scale gardens and the City's community gardens.

STRATEGIES FOR AGRICULTURE AND COMMUNITY GARDENING

The following strategies have been identified as ways to act on this theme of the NBCS Framework. The specific actions identified for each are included in the implementation table.

EXPANDING COMMUNITY GARDENING OPPORTUNITIES

Urban gardens not only provide food and medicine for the surrounding community, but

also function as NBCS by mitigating the urban heat island effect, improving air circulation and cooling via plant shading and transpiration, providing wildlife habitat, sequestering carbon, and allowing for water regulation through soils that are not sealed under impervious surfaces.

The Burlington Area Community Gardens (BACG) program is comprised of 14 garden sites across the Burlington area, which can be seen on the map to the right. Sites range from small neighborhood plots to larger sites with multiple acres of available plots. There are opportunities to increase NBCS at these existing gardens and expand the garden network to create additional food producing landscapes.

We have also identified opportunities to decrease the amount of tilled space in the community gardens through education on NBCS and no till food production methods. Furthermore, urban gardens provide a sense of place, cultural identity, and social cohesion all important factors for a society working to adapt to a changing planet.

SUPPORT FOOD SECURITY

Food security means all people have access to affordable, safe, and nutritious food



at all times. Food security and NBCS are intrinsically linked, given that climate change and associated environmental stressors affect food supply. Access to local gardening and farming opportunities and increasing land access can provide individuals with the opportunity to grow fresh food, herbs, and plants of their choice while reducing “food

miles” and helping combat climate change. This could also include converting currently unmanaged agricultural lands or restoring developed lands to gardening spaces. Food miles refers to the distance that food is transported from the time of its making until it reaches the consumer. Food produced locally is transported less miles than food produced in other areas of the country, reducing the greenhouse gas emissions required to transport.

PROMOTING SOIL AND WATER CONSERVATION

Sustainable management of soil and water in an agricultural setting can reduce surface water runoff and erosion, improve soil quality by improving nutrient cycling, increase carbon sequestration in biomass, enhance habitat, conserve energy, improve livestock well-being, stabilize streambanks, and more.

Soil and water management in agricultural areas – small or large – can also achieve many other goals of NBCS including advancing the protection, restoration, and management opportunities of natural resources, reducing the threat of natural hazards, and making areas more resilient to the adverse impacts of climate change. This strategy aims to ensure continued protection of the vegetated buffer areas along the Winooski River and other surface waters and to promote forest farming, or multistory plantings of overstory and understory of plants, grown for a variety of products, carbon capture and other benefits.

CARBON FARMING

According to Dr. Rattan Lal of Ohio State University's Carbon Management and Sequestration Center, carbon farming is a system of increasing carbon in terrestrial ecosystems for adaptation and mitigation of climate change and to enhance ecosystem goods and services. This involves removing excess carbon dioxide from the atmosphere and storing it in soil organic matter and in the aboveground biomass of long-lived trees and plants. Eric Toensmier's "Carbon Farming Solution" points to research that reveals woody, plant based systems generally have far higher sequestration rates than improved annual cropping and grazing strategies alone. Carbon farming techniques include:

- Multi-layered agroforestry systems with perennial crops and beneficial mycorrhizae fungi
- Intercropping or alley cropping annual crops with tree and perennial crops
- Growing annuals with perennials in polyculture arrangements
- Reduced tillage of the soil
- Cover cropping for erosion control, weed suppression, and nitrogen fixation
- Mulching and leaving crop residue
- Riparian buffer strips
- Silvopasture systems that integrate livestock, pasture, and trees



A LOCAL LOOK QUEEN CITY ACRES BURLINGTON, VT

With urban farm plots across the North End neighborhoods of Burlington, Queen City Acres (QCA) is 100% community housed. They have successfully woven the farm together across multiple backyards, and seen the community coming together as well. QCA interacts with host families and customers daily, and over 8,000 pounds of produce are grown per year and made available to the community through local co-ops, groceries, food hubs, restaurants, food shelves, and a CSA. Growing food close to home is crucial to sustainable, local food economies. QCA promotes the leveraging of underutilized spaces for production, and notes that urban farming increases the productive capacity of residential communities, reduces food transportation, and creates jobs that drive the local economy..

CASE STUDY GROWING FROM THE ROOT A PHILADELPHIA URBAN AGRICULTURE PLAN

Philadelphia's Urban Agriculture Plan: Growing from the Root aims to develop a comprehensive plan that uplifts Philadelphia's rich history of urban farming and gardening, and clearly defines the resources, policies, processes, and programs necessary to sustain it for future generations.

According to the City's Urban Agriculture Director, COVID-19 further emphasized the need for an urban agriculture plan, increasing the population experiencing food insecurity, stress, and trauma. To complete the plan, Philadelphia Parks and Recreation hired Soil Generation, a Black and Brown led coalition of growers, and Interface Studio, a city planning firm, to co-develop the plan with input and inspiration from Philadelphia's urban agriculture community.

The rapidly increasing COVID-19 cases, racial injustice, and police brutality that occurred in 2020 stalled the project and caused the team to revisit their own internal group dynamics in order to show up more authentically for their community, especially people of color and other underrepresented populations. This included addressing power in decision making, white privilege, and acknowledging cultural differences in communication.

The City has recently picked the project back up and is centering community values by creating a culturally competent and equity based approach to ensure residents most impacted are engaged and represented in the planning process. The project team will carry out the process according to the values of transparency, racial and economic justice, and inclusion.

WATER AND WETLANDS

"Mni Wiconi - Water is Life."

-Lakota Language



Wetlands are especially well suited to perform many of the NBCS that mitigate the effects of climate change. Wetlands can handle large influxes of water during flooding events, support great biodiversity, filter pollutants, and have tremendous potential to sequester carbon.

It is important to take special care to protect the remaining wetlands, particularly those with thick organic layers capable of storing up to ten times as much carbon as other soils in the region. The wetlands of Burlington also have regional significance, being near the end of the Winooski River watershed where the third largest river in Vermont, the Winooski River, enters Lake Champlain. The water and wetlands of Burlington also are of significance to wildlife, for example, supporting a large colony of herons.

The City of Burlington also has shorefront and floodplain ecosystems along Lake Champlain and the Winooski River. Stormwater from the city drains either into the Winooski River or directly into Lake Champlain. Of the wetland and floodplain areas present within the city, approximately 350 acres are identified as priority wetland restoration areas. These areas have the potential to protect downstream water quality conditions and mitigate phosphorus loading to Lake Champlain, and are also critical to combating climate change because of their tremendous potential to sequester carbon.

STRATEGIES FOR WATER AND WETLANDS

The following strategies have been identified as ways to act on this theme of the NBCS

Framework. The specific actions identified for each are included in the implementation table.

PROTECT WETLANDS AND VEGETATION ALONG THE WATER'S EDGE

Freshwater inland wetlands, in part due to their substantial areal extent, hold nearly ten-fold more carbon than tidal saltwater sites—emphasizing their importance in regional carbon storage. This is a reason for prioritizing the protection of the City's remaining wetlands.

Wetland soils are anoxic (oxygen-poor), and therefore slow decomposition and lead to the accumulation of organic matter. The magnitude of storage depends upon wetland type and size, vegetation, the depth of wetland soils, groundwater and nutrient levels, pH, and other factors. Wetland soils also store carbon that washes in from upland areas, by capturing soil erosion or the movement of leaves and tree debris. Wetlands also release carbon through both natural, seasonal changes and, more drastically, when their equilibrium is affected by human interference. When disturbed, the carbon storage in wetlands is released, worsening the problem and eliminating the benefit that their retention and protection provide.

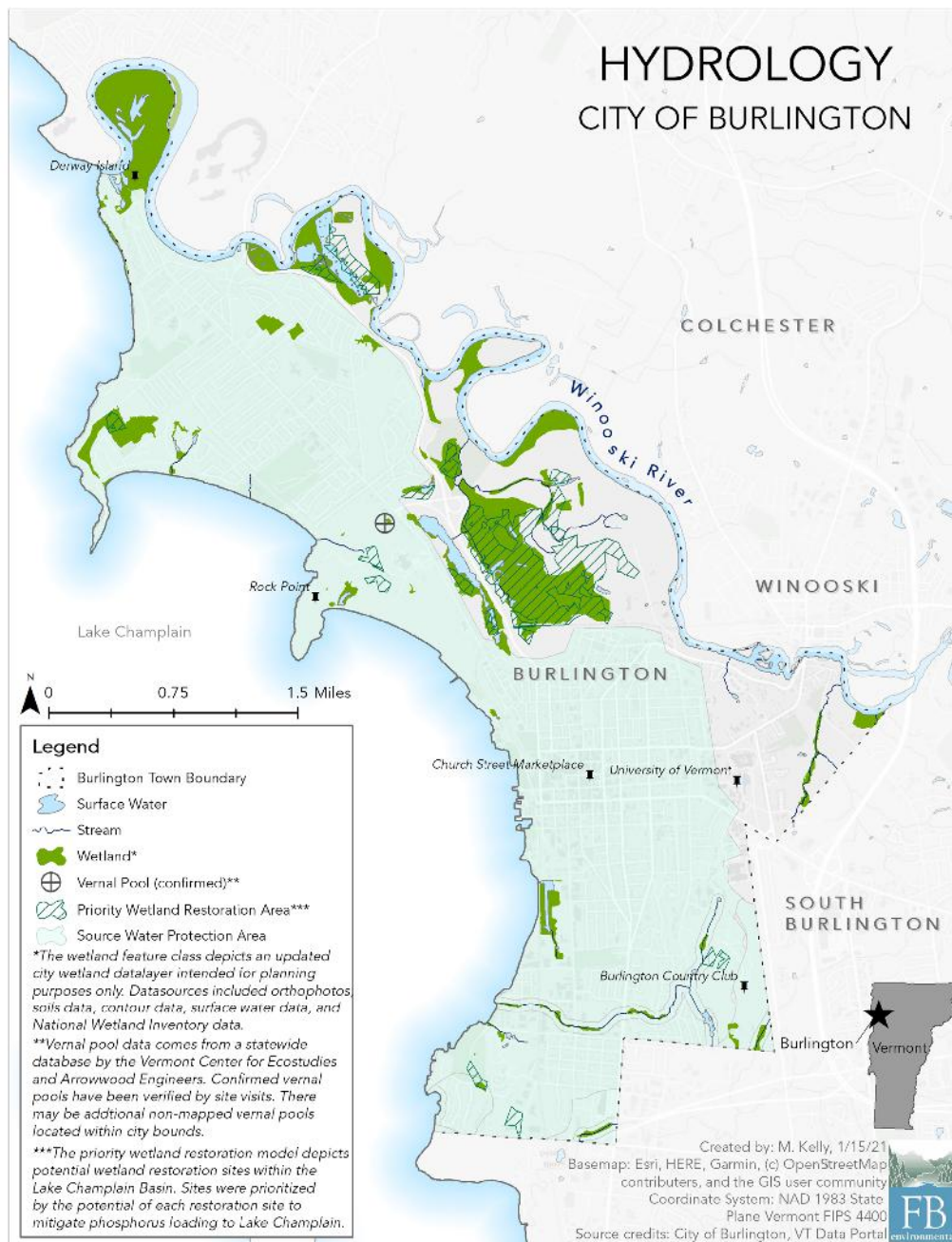
A LOCAL LOOK INTERVALE CENTER CONSERVATION NURSERY

The demand for riparian trees and shrubs in the State has grown exponentially in recent years, as conservation and restoration projects have expanded. There are many reasons for the need for native riparian trees and shrubs including:

- Phosphorus reduction in Lake Champlain
- Wildlife corridors and habitat
- Bank stabilization to mitigate storm surge
- Controlling invasive plants in riparian areas
- Increased understanding of the importance of native plants in maintaining critical biodiversity

In Burlington one of the best ways to reduce phosphorus while also increasing riparian resilience is to increase buffers along the Winooski River. Burlington's own Intervale Center Operates a Conservation Nursery which helps to meet these needs. The Nursery is dedicated to growing native, locally sourced trees and shrubs for riparian restoration projects throughout Vermont. In addition to growing trees, the Intervale Conservation Nursery also provides planting services for riparian buffer zones and storm water management projects.





RESTORATION OF WETLANDS AND VEGETATION ALONG THE WATER'S EDGE

Wetlands restoration, and the construction of new wetland areas promotes a return to high carbon sequestration levels and promotes many additional ecosystem services. Most wetland restoration efforts in the city are now decades old and display varying degrees of success. New restoration efforts should be identified where advances in wetland restoration science can be used.

Riparian buffers are the upland vegetated areas adjacent to wetlands and surface waters. They reduce nonpoint source pollution from adjacent land uses, stabilize streambanks, enhance aquatic and terrestrial habitats, provide canopy cover, and increase carbon storage in plant biomass and soils. In addition to mitigating water quality problems or bank destabilization issues these buffer areas provide vegetation that also reduces the impact of natural hazards, such as flooding, which have become worse because of climate change.

CASE STUDY

RESTORING THE PINE GROVE GOLF COURSE FOR CLIMATE RESILIENCY

As a result of climate change, the City of Northampton, Massachusetts is facing changes in the frequency and magnitude of larger storm events, as well as longer periods with drought and heat waves. The former golf course, with its forests removed, underground drainage systems, filled wetlands, channelized stream, and destruction of its floodplain exacerbated all of these negative impacts of climate change in this small watershed. The Pine Grove Golf Course restoration addresses all of these adverse impacts while also providing recreation opportunities to an urban core area that is nearby, building resilience by restoring natural hydrology and ecosystems damaged by a golf course, and providing carbon sequestration by reforesting the golf course.

Through this project, 105 acres have been restored - this includes removing catch basins, all the large concrete blocks, the irrigation pump house, and half a dozen bridges across a stream. It also included allowing approximately ten acres of the site to start growing into wetlands, beginning to address invasive species, and introducing the public to the site.





LAWNS, FIELDS, AND SMALL OPEN SPACES

"If you are concerned about the human impact on our planet's climate, reducing the amount of lawn you mow each week is one of the best things you can do to reduce your family's carbon dioxide emissions."

-Doug Tallamy, Author of "Bringing Nature Home"

While large tracts of forests and wetlands are critical for carbon storage and sequestration, it is important not to overlook the role that lawns, fields, and small open spaces play in Burlington. These areas can take many different forms, such as residential yards and school yards, small "pocket parks" and trailside plantings. They provide large areas for gathering and play, and add to the diversity of habitats within the city. Looking forward, the vision for these areas is one of "less mowing, and more growing" wherever feasible. They also can be intentionally created or protected to preserve wildlife corridors and a contiguous network of open space.

STRATEGIES FOR LAWNS, FIELDS, AND SMALL OPEN SPACES

The following strategies have been identified

as ways to act on this theme of the NBCS Framework. The specific actions identified for each are included in the implementation table.

NEW APPROACHES TO VEGETATION MANAGEMENT

Many opportunities exist across Burlington's lawns, fields, and small open spaces. These are areas of the City where the vegetation is largely dominated by Eurasian grasses, and the typical management strategy is frequent mowing. Lawns and fields can function as "carbon sinks," soaking up carbon dioxide from the atmosphere, especially when disturbance is strategic.¹ Mowing vegetation frequently releases carbon stored in the soil, thereby contributing to climate change rather than combatting it. In addition to storing

¹ Princeton University. "Lawn Maintenance and Climate Change". May 11, 2020. <https://psci.princeton.edu/tips/2020/5/11/lawn-maintenance-and-climate-change>

carbon in the soil, lawns and fields also have the potential to protect soils from erosion, and create valuable habitat for wildlife. However, these spaces are often seen as ‘prime’ sites for development of infrastructure or agriculture because of the relative ease of land conversion.

INCREASE POCKET PARKS AND CONNECTED OPEN SPACES

Within the most developed areas of Burlington there are opportunities to create and connect small open spaces and increase NBCS. These areas, especially when interconnected, transform the landscape in positive ways by interrupting the impervious surfaces and integrating nature into this human dominated landscape.

NBCS include voluntary conversion of lawns, school yards and other environments. Grow Wild is a relatively new initiative in Burlington, supported by a consortium of organizations, promoting these conversions by providing plant lists and information on techniques for growing natural habitats and wildlife corridors.

In Burlington, there are a number of contiguous habitat & wildlife corridors spanning multiple private properties. Protecting the connectivity of these open spaces in neighborhoods of private residences through education and relationship building with private property owners should be pursued.

Additionally, the City’s stormwater bioretention systems are planted with a variety of flowering plants that attract pollinators and provide habitat in the urban landscape.

A LOCAL LOOK BURLINGTON WILDWAYS

Burlington — situated on a peninsula between Lake Champlain and the delta of the Winooski, one of Vermont’s longest rivers — has an extraordinary wealth of natural lands and wild places. Many of these beautiful, ecologically diverse areas were threatened by neglect, fragmentation, invasive species, and a lack of coordinated conservation. Without collective effort, connectivity – corridors for wildlife and recreational trail opportunities for people – could have been lost forever.

In 2017, Burlington City Council, with support from the mayor and many others, unanimously passed a comprehensive resolution to protect our wild places. The Council urged four public landowners: • Burlington Department of Parks, Recreation & Waterfront • Winooski Valley Park District • Intervale Center • Episcopal Diocese of Vermont, the owner of Rock Point to work together to keep these areas connected and conserved, and to make them more accessible for both people and wildlife. In response, they established a partnership called Burlington Wildways. Before Burlington Wildways formed, many of the city’s wild green spaces were not understood as a connected, interdependent, and valuable resource. These wild spaces mitigate climate change threats as well as help the city actively sequester carbon and preserve biodiversity.

In 2019 Burlington Wildways opened the first section of the Burlington Wildway trail, a 5.5 mile long trail that winds alongside the Winooski River starting at Salmon Hole and connecting through into Ethan Allen Park in the New North End. New connected sections are planned to open in fall 2021 and fall 2022. Burlington Wildways partners are also working on collective tree planting, invasive species control, initiatives to preserve biodiversity by planting native species throughout the city and inclusive nature connection.


CASE STUDY

INCREASING URBAN POLLINATOR HABITAT PORTLAND, ME

Over the past ten years, the City of Portland has seen a movement built around creating a network of pollinator habitat and gardens throughout the city. Pollinators play a critical role in ecosystem health, enabling the reproduction and diversity of the majority of the world's plants. Without pollinator plant communities and their associated ecosystems, the services they provide would be lost. Additionally, planting pollinator gardens helps address climate change through carbon sequestration and addresses habitat fragmentation by creating diverse, interconnected natural communities. In 2014, the Portland Pollinator Partnership formed to protect and advocate for pollinator habitat and native species in the City. They steward a Portland Pollinator Habitat map where community members can add their pollinator gardens to see how they fit into the larger habitat network.

In 2015, the City of Portland and the Wild Seed Project (a Portland-based organization that collects and sells seeds of wild and uncultivated native plants and provides native plant education) commissioned an action plan to document the habitat potential of the city's parks, community gardens, libraries, highways, power line corridors, hospitals, correctional facilities, and residential neighborhoods. The report identifies key landowners along the habitat network, management recommendations, and tips for members of the public to improve habitat wherever they live.



An aerial night photograph of a city. The top half shows a dark, forested area with some city lights visible in the distance. The bottom half shows a large, modern building with a green roof and a large, illuminated, rectangular structure in the foreground, possibly a water feature or a large planter. The overall scene is illuminated by city lights, creating a contrast between the dark green of the trees and the bright lights of the urban environment.

GREEN INFRASTRUCTURE

"It is time to expand what has been a romantic attachment to the ornaments of nature into a commitment to reshape the city in harmony with the workings of nature."

-Anne Whiston Spirn, Author of "The Granite Garden"

Green infrastructure refers to a range of low impact development techniques that incorporate soils and plants to provide natural processes within developed areas. These include native landscaping, bioretention systems, rain gardens and swales, green walls and roofs, street trees, and others. Burlington's intact parks and open spaces are also critical green infrastructure and should be thought of as critical components of the city's "living" infrastructure system. This network of parcels provide many ecological, social, and economic benefits.

Although the term has been popularized to classify ecological based stormwater management solutions, many policymakers and planners across the country are now recognizing that using the term more broadly provides an opportunity to increase the number of ecosystem services provided through each intervention or addition to

the open space network. As a NBCS, green infrastructure provides an opportunity to restore natural functions in the most developed portions of the city while mitigating climate change. Fortunately, Burlington has already started to implement green infrastructure projects that will be useful to educate and inspire others.

STRATEGIES FOR GREEN INFRASTRUCTURE

The following strategies have been identified as ways to act on this theme of the NBCS Framework. The specific actions identified for each are included in the implementation table.

RETROFIT AND RESTORE EXISTING SITES

Retrofitting existing spaces with green infrastructure can be challenging but is an important element of creating the living

infrastructure that offsets the impacts of the built environment and traditional grey infrastructure. This was identified as a priority in the City's master plan which calls for the creation of a "Green Machine" that includes rain gardens, green plazas, green streets, and more. These retrofit efforts are also reflected in the great work related to City Hall park, the St. Paul Street improvements, and other recent projects like the bump outs in the vicinity of Grant Street and elsewhere in the City. While retrofits can be immediately prioritized on public lands and rights-of-ways, retrofits on existing private properties will often take more time. Making such improvements on private properties should be pursued through both incentive-based programs and through redevelopment requirements.

GREENING NEW DEVELOPMENT

The other strategy related to green infrastructure is planning for new development. This is a critical opportunity for implementing NBCS and reducing the negative impacts often associated with new development. While there are examples in Burlington where buildings have incorporated green roofs, more can be done to incentivize or require these improvements on all future development projects. In fact

A LOCAL LOOK GREEN STORMWATER INFRASTRUCTURE EFFORTS - BURLINGTON, VT

In 2018, 90% of Burlington voters approved the Clean Water Resiliency Plan, which is a coordinated effort to reinvest and upgrade the City's aging infrastructure and use best practices to combat the effects of and become more resilient to climate change. The Plan prioritizes six comprehensive projects throughout the City that will manage nearly six acres of stormwater runoff from impervious surfaces, and help mitigate the most challenging of the remaining combined sewer overflow points in Burlington. In 2021, the City of Burlington constructed 16 separate grant and City funded bioretention systems to slow storm flows and provide pollinator habitat.

this is exactly what other forward thinking cities are doing. Tree planting on private and public sites to offset tree removal from other construction projects is another tactic to employ. Fortunately, a lot of this overlaps and is compatible with the Integrated Water Quality Plan highlighting the momentum and investment the City has already built around nature-based solutions and urban ecological systems.



St. Paul Street is getting an upgrade

- New bumpouts and crosswalks
- Wider sidewalks
- More trees
- Rain gardens
- Permeable paving
- Bike racks
- Street lights
- New benches
- Granite curbs
- Burying overhead utilities

Great Streets BTV St. Paul Street from Main to Maple Fall 2018 - Summer 2019

Project Sponsors: City of Burlington, New Hampshire, Burlington Public Works, GPC
Project Partners: SRB, Belmont Engineering, GreenSource's Affiliates, BT Technical Services, Burlington Community Foundation
Services Other Design: Mott MacDonald, Debra & Greg, Engineers of the Art

Learn More: www.burlingtonvt.gov/greatstreets

CASE STUDY

CREATING THE FAIRMOUNT GREENWAY

The Fairmount Greenway Task Force (FGTF) completed a Concept Plan in 2011, and their first pilot program focused on converting 6 vacant lots (over 3 acres) into new green spaces, including gardens, urban agriculture, urban wilds, and sitting areas. The FGTF has also:

- Worked closely with the City of Boston to create a 9-mile “neighborway” along residential streets to foster safe bicycling and walking.
- Established the Oasis on Ballou Urban Agriculture site for training prison re-entry men of color in employable farming skills.
- Collaborated with the Southwest Boston CDC to train local youth in sustainable landscaping through the Hyde Park Green Team.
- Installed Living Roofs on six bus shelters along the Corridor demonstrating environmental benefits to air quality and green job opportunities.

The living roofs, which are placed on top of bus shelters, consist of two to three inches of soil and native, drought-tolerant plants in a filter mat that can hold up to 24 gallons of water during a major rainstorm. The goal was to demonstrate the environmental benefits of green roof technology while creating green jobs. In partnership with YouthBuild Boston and TNT Eco-Teens, local youth have been trained in the construction and maintenance of green roofs.



IMPLEMENTATION

Implementation of nature-based climate solutions in Burlington should be a collaborative process focused on education and building relationships.

The following pages include an implementation matrix for the City to use as a guide to expand NBCS in the City. The matrix includes:

- **Actions** nested under NBCS strategies and themes
- **Lead entity/organization** to complete the action
- **Supporting entities/organizations** who are candidates for supporting the action item
- **Priority/timeline**
- **Metrics**, for tracking progress and impacts of action items completed



IMPLEMENTATION PLAN

How does Burlington translate these Nature Based Climate Solutions into action? What new initiatives can we begin? Where and how can we expand the existing initiatives, where there is already momentum and investment? The seven themes highlighted in the plan -- forests and tree canopy; agriculture and community gardening; water and wetlands; lawns, fields, and small open spaces; green infrastructure; and equity and inclusion -- are further broken down below into strategies, actions, and opportunities. These can be thought of as both a roadmap forward, as well as an invitation to community members. This section cannot capture all of the potential steps to leverage nature based solutions to address climate change, but it is our hope that it will provide members of the community with a view into how they can participate and shape the collective response. Ultimately, we also intend for this section to be a guide for how financial resources can be directed to this work, as well as define the topical areas to begin forging the collective action necessary to address climate change through nature based solutions. Please note that the Burlington Conservation Board is managing a more detailed implementation matrix that includes additional information about each strategy and action including level of priority, anticipated timeline, and groups that could be involved.

THEME 01: FORESTS AND TREE CANOPY	
A. CONSERVATION OF EXISTING TREE CANOPY	
STRATEGY	ACTION
1A.1 Update the Urban Forestry Master Plan.	Broaden to incorporate the City's Street Tree Plan and nature-based climate solutions into a larger framework that includes intact forested areas, peripheral small open spaces, and private lands, both residential and commercial.
	Inventory specific trees by tree type and location. Include a complete analysis of overall tree canopy and strategies to protect the canopy as needed.
	Analyze Burlington's tree canopy to assess health and threats (biologic, abiotic, or anthropogenic).
	Identify strategies and metrics for monitoring the health of the tree canopy and the increase in canopy cover over time.
	Acknowledge and plan for the impact climate change will have on existing tree species.
	Include a carbon calculation of the amount of carbon being captured city-wide.
	Organize a planning retreat with existing land managers, neighborhood groups, and entities such as Branch Out Burlington and Grow Wild as a part of the Urban Forestry Master Plan Update.
	Create a fund to support the expansion of the city tree program beyond greenbelts and formal park areas to include: forest stewardship, seed collection and nursery operations and public education partnership. This fund could also help create resources for expanding the capacity of tools and knowledge for the utilization of trees harvested, including but not limited to milling trees to be used for lumber to be used in community projects.
	Inventory Non-Native Invasive Plants (NNIPs) community-wide and recommend pragmatic rehabilitation strategies to address the impacts of these species with a focus on maintaining biodiversity.
1A.2 Update the City of Burlington's Tree Ordinance.	Include a clear reference to climate change mitigation.
	Ensure it protects the existing canopy
	Require the replacement of trees that are removed, when appropriate
	Map prime reforestation zones, especially around forested blocks

1A.3 Conserve unprotected parcels with tree cover in the City's open space network.	Map forested areas that are unprotected.
	Map prime reforestation zones.
	Steadily increase tree canopy cover and accessible open space city-wide.
1A.4 Pursue Adaptive Management to Mitigate Harmful Impacts of Deer Grazing.	Educate the public on this issue and the solutions needed.
	Work with Abenaki communities to allow hunting under specific conditions and instances in the City.
1A.5 Redefine The City's Urban Wild Designation.	Broaden the definition of "Urban Wilds" from its current form to include any and all lands that meet the criteria.
B. TREE PLANTING	
STRATEGY	ACTION
1B.1 Determine and Expand the tree canopy.	Regularly (every 2-3 years) analyze tree cover by wards and/or neighborhoods to better understand the distribution of trees, how equitable the tree canopy cover is, and the benefits provided by canopy cover to residents. Use this information to further engage residents in different ways to increase tree cover over time.
	Work with the Cemetery Commission to identify areas for additional trees and associated native plants.
	Accomplish this strategy through voluntary partnerships with private property owners, and through the adoption of regulatory requirements for new development.
1B.2 Support planted trees with resources.	Continue to invest in relationship oriented tree planting partnerships that increase the urban forest canopy and meet other needs such as food production. This work should be empowered to work in both private and public lands.
	Investment is needed in staffing capacity to coordinate planting projects with community partnerships and residents.
	When planting new trees, incorporate them with other low impact development improvements (grading, soil amendments, companion planting, etc.) to ensure they are supported by other green infrastructure elements and deliver as many ecosystem services as possible.
	This work should be incorporated and acknowledged in the Urban Forestry Master Plan. This plan should develop and recommend various funding strategies for this work.
1B.3 Increase the diversity of tree species and growing methods.	Identify public locations to implement the Miyawaki method*, also called the "Potted Seedling Method", beyond the current pilot project**. *This is an afforestation technique that uses native species to create dense, multilayered forests. **This demonstration project should include observation and measurement, documentation, reporting, and education to inform future tree planting efforts in Burlington.
	Investigate the possibility of creating a "tree bank" that can be utilized by utility companies and others to replace trees if they need to remove them from the right-of-way or elsewhere in the city. The Forestry Plan for the city should identify the type of species and areas where these trees could be planted.
1B.4 Educate the city about nature-based climate solutions.	Educational signage related to NBCS should be provided around the city as appropriate to identify and explain the systems in place and their role in reducing climate change.
	Public efforts around expanding the tree canopy would also fulfill this strategy

THEME 02 COMMUNITY GARDENS AND FOOD SECURITY	
A. COMMUNITY GARDENING	
STRATEGY	ACTION
2A.1 Support and expand the community garden network, and the resources they provide.	Build new gardens in the Old North End, South End, and the City's downtown core. As this expansion takes place, special care must be taken to not expose gardens to soil contaminants.
	Provide the necessary funding and staff support to create raised beds for food production around municipal facilities, and incorporate these spaces into the community garden network. Create a program and maintenance plan to ensure these beds are utilized efficiently and serve as a successful demonstration project to Burlington community members.
	Work to decrease the amount of tilled space in the community gardens through education on NBCS, Permaculture, and no till production methods including cover cropping, sheet mulching, and incorporating perennials.
	Provide composting facilities within nearby community gardens to local residents. This will create an opportunity to practice and learn about composting, and the importance of organic material in soil building for food production and carbon capture. This will also create a more decentralized composting system. The City could engage with local compost companies to build out this decentralized composting program across the city.
	Conduct a study of micro-food deserts within the city where neighborhoods do not have access to fresh, nutritious food and prioritize these areas for new community gardening opportunities.
2A.2 Extend education opportunities around gardening and gardening as NCBS.	Provide programs and skill-sharing workshops on planting drought tolerant crops, integrating perennials, and other climate mitigation and adaptation strategies for small-scale gardeners.
	Provide resources for facilitation and organizing of the network of garden and agricultural leaders and organizations supporting gardens and agriculture to work together to consider and develop collective approaches to garden access and education.
2A.3 Regenerate the land around community gardens.	Adopt regenerative land stewardship practices across the community gardens and other agricultural operations, including: planting cover crops; diversifying crops; managing riparian buffers; increasing carbon in topsoil; removing invasive species; and ceasing tilling, pesticides, and artificial fertilizers. The Intervale Center currently practices many of these NBCS as a part of their mission to strengthen community food systems and represent a potential partner to achieve this action.
	Plant hedgerows as wildlife and pollinator habitat, water filtration, and shared public food at the boundaries of community garden sites where feasible.
	Incorporate agroforestry techniques on larger agricultural lands. Agroforestry is the "intentional mixing of trees and shrubs into crop and animal production systems to create environmental, economic, and social benefits" (Bentrup & MacFarland, 2020). Consider partnering with groups such as Keyline Vermont, the University of Vermont's Center for Sustainable Agriculture, and the Vermont Agency of Agriculture, Food, and Markets.
B. FOOD SECURITY	
2B.1 Increase access to fresh local food.	Design and implement community food forest installations at existing or new community garden sites, schoolyards, and on other public lands including greenbelts.
	Lower barriers for safe growing conditions for food production. Create a soil testing program, modeled after Dig-Safe, that residents can contact for soil sample analysis before planting food bearing crops. Provide participating residents with the soil analysis and some guidance on what they can safely grow in the area that was tested.
	Identify appropriate areas on publicly owned parcels to establish perennial food gardens, edible landscapes, and urban orchards that all residents can access.

1B.2 Increase access to community gardens.	Appoint a garden representative to each ward.
	Connect residents of the city to the Community Garden program by providing them with growing space, gardening mentors, and other necessary resources to assist them with developing a community connection and access to food.
	Reach out to prospective new community members through partnerships with New Farms for New Americans, The Intervale, The Episcopal Diocese of Vermont, and the Vermont Community Garden Network.
1B.3 Make food production part of the City's green infrastructure/ land use regulations	Identify appropriate areas on publicly owned parcels to establish perennial food gardens, edible landscapes, and urban orchards that all residents can access.
	Identify land with prime soils for agricultural activities that can support local farmers and families. For example, the University of Vermont has prime agricultural land north of the County Club. Consider partnering with the University and others to protect this land and place it into a combination of annual and perennial food production.
	Convert greenways, rights-of-way, and other similar shared areas to food producing landscapes and community garden spaces that are near where people live and work. In the case of soil contamination or other site-specific challenges, regularly test soil, utilize raised beds for food, or consider native non-edible plantings instead. Make collaborative decisions about these spaces with the neighborhood's residents from the start.
	Encourage the integration of perennial food systems in Chapter 26 as part of the green infrastructure requirements for new developments. This should be addressed in the City's land use regulations.

THEME 03: WATER, WETLANDS, AND WATERSHEDS	
A. PROTECT THE REMAINING WETLANDS WITHIN THE CITY	
STRATEGY	ACTION
3A.1 Regulate protection of riparian zones and shoreland areas associated with surface waters	The City has adopted a shoreline buffer requirement and maintenance manual that could serve as inspiration for how to regulate other shoreland areas in Burlington.
	Review the existing regulations associated with wetlands and water bodies to determine if additional regulations or enforcement opportunities exist and should be incorporated.
	Ensure continued protection of the riparian buffer along the Winooski River while not restricting the river's need to change course over time. This should include the use of NBCS when it is determined that bank stabilization or restoration is needed to slow erosion.
3A.1 Proactively manage public wetlands and waterways	Monitor wetland ecosystems to prevent adjacent landowners from encroaching, and to ensure that trash is removed.
	Identify floodplain / wetland parcels that can be managed to accommodate floodwaters, protect or restore canopy cover, reduce erosion and pollution, store carbon, and provide habitat.
	Protect and maintain the historically fertile Winooski River Valley floodplains through a combination of conservation, stewardship, and restoration activities.
	Decrease the use of salt on paved surfaces in winter to protect plants and water quality. This can be accomplished through education and possibly certification of city and private sector staff.

B. RESTORE THE WETLANDS AND OTHER VEGETATION ALONG THE WATERS' EDGE	
STRATEGY	ACTION
3B.1 Determine which areas are suitable for restoration.	Update the database of city wetlands to include information indicating where wetlands may have previously existed that could be restored, and where existing wetlands are constricted and may be expanded to previous extents.
	Survey riparian vegetation along Lake Champlain and other surface waters to identify areas to target for riparian buffer planting.
3B.2 Incentivize riparian and wetland restoration.	Expand Burlington's existing initiatives for riparian area restoration through partnerships with land owners and interested organizations. These efforts should be informed by the Derway Cove Restoration, Intervale floodplain restoration work, and initiatives in the Winooski Valley Park District and Burlington Parks Recreation and Waterfront areas.
3B.3 Require riparian and wetland restoration as development occurs.	Require greening/vegetating of any approved armoring and shoreline stabilization projects.
	Require the integration of shoreline redevelopment practices that include native plantings and serve as NBCS demonstration sites for future projects.
3B.4 Creatively design and use wetlands.	Develop stormwater parks that can be used as vegetated recreational spaces which can also flood during extreme events.
	Explore the potential to construct floating wetlands on Lake Champlain that will protect the shoreline from wave action while improving water quality and sequestering carbon.

THEME 04: LAWNS, FIELDS, AND SMALL OPEN SPACES	
A. VEGETATION MANAGEMENT	
STRATEGY	ACTION
4A.1 Update mowing practices.	Work with local land managers and City staff to map lawns, fields, and meadows in greater detail across the city. Then identify new opportunities to partner on changes to mowing frequency and to prioritize the addition of native plantings. Existing partnerships with statewide organizations such as Audubon Vermont, and the Vermont Fish and Wildlife Department could aid this initiative.
	Work with City staff to develop management plans for lawns, fields, and meadows on city-owned lands. Implement low-mow mowing practices to protect pollinators and foragers on these lands. These efforts should be informed and inspired by the conversion of the Rock Point solar field into a pollinator-friendly meadow, and low-mow practices being implemented by the City Parks, Recreation, and Waterfront Department.
	Work with private landowners to identify no-mow and low-mow zones on their property. Include outreach and education to golf course members and users to explain the benefits of naturalized grasslands and meadow spaces.
	As changes are made to the mowing frequency of public spaces it will be important to consider public concerns related to ticks, mosquitoes, and other insects. This may inform the management of these spaces and may require educational materials and communications addressing these concerns.

4A.2 Increase native plantings.	Support native bee populations by protecting and creating pollinator habitat and forage. The City obtained its Bee City status in 2019. This includes reducing the mowing frequency and timing on lands in the city, and allowing for the re-establishment of native areas important for pollinators and wildlife such as the Oakledge Park Project.
	Establish and support voluntary native planting programs for private yards by providing incentives for changing mowing frequency and planting native plants. The City has participated in pilot projects and provided education for residents, such as the "Wild for Pollinators" initiative and the "Half-yard Project", both of which encourage residents to convert portions of their yards to native plants for pollinators. The City has also been engaging local students in this work through "Everyone's Urban Wild."
4A.3 Build connectivity.	Collaborate with private land managers to create management plans that cross multiple properties and include best management practices for grass dominated lawns and fields to ensure they contribute additional NBCS. Utilize the City's management plans, once completed, as case studies.
	Identify wildlife corridors throughout the city using the data collected through the Burlington Mammal Tracking Project, and prioritize these corridors for changes in vegetation management, land protection, and efforts related to open space connectivity.
B. INCREASE POCKET PARKS AND CONNECTED OPEN SPACES	
STRATEGY	ACTION
4B.1 Increase pocket parks and connected open spaces	Use information from the 2014 Open Space Plan to identify the remaining suitable locations for pocket parks and prioritize acquisition of these spaces.
	Look to the 2021 NBCS Survey for specific ideas on where to create new pocket parks.
	Create pocket parks that connect existing open spaces and expand the open space network, especially in the southern portion of the city where there is an identified need to improve open space access and connectivity.
	Prioritize the creation of pocket parks in areas near (or including) water and wetland resources, significant natural community types, and unique wildlife and plant habitat.
C. CEMETERIES AS GREEN SPACES	
STRATEGY	ACTION
4C.1 NBCS in perpetuity.	Work with the Cemetery Commission to identify areas for additional trees and associated native plants.
	Promote green burials as a NBCS.

THEME 05: GREEN INFRASTRUCTURE

A. RETROFIT EXISTING DEVELOPMENT

STRATEGY	ACTION
5A.1 Coordinate inter- departmental cooperation.	Create a municipal project evaluation matrix (referencing the Open Space Plan, Integrated Water Quality Plan, Plan BTV, and the Climate Action Plan at a minimum) that is used by all City led projects, encourages inter-department communication, and requires the inclusion of green infrastructure.
	Coordinate infrastructure retrofit projects across City departments to ensure the integration of NBCS that yield as many ecosystem services as possible. To do so it will be necessary to identify and then coordinate how this can be institutionalized into the project planning process, and include an educational component so the public understands the benefit of the work completed.
5A.2 Upgrade public and private construction.	Support the implementation of the Integrated Water Quality Plan and Plan BTV. The Downtown & Waterfront Plan calls for the creation of a "Green Machine" that includes bioretention systems, rain gardens, green plazas, green streets, and more. The City Hall park, St. Paul Street, and other recent projects serve as important examples for education and inspiration. This will be accomplished through future infrastructure efforts, property retrofits, and regulatory changes.
	Promote the use of pervious surfaces for roadways and driveways using regulatory and non-regulatory initiatives. The City has an existing policy to encourage residential driveways to have permeable surfaces for improved stormwater management and water quality. It has also implemented permeable paver use in some areas of downtown, such as the newly redesigned St. Paul Street area.
	Work with the Stormwater Utility to promote the existing incentives for removing impervious pavement, rehabilitating the soil, and planting native plants that will contribute NBCS.
	Promote the "bioretention bump-out" application administered by Burlington Technical Services Department to residents wishing to request a bioretention system in their neighborhood.
	Encourage the installation of green roofs and walls on existing residential, commercial, institutional, and municipal infrastructure using a combination of regulatory and non-regulatory initiatives.
5A.3 Upgrades in storm water mitigation.	Continue to promote and incentivize existing rainwater catchment practices, and investigate the potential for promoting and incentivizing grey water recycling.
	Continue to expand stormwater infrastructure by supporting the construction of soil and vegetation assisted filtration areas that improve water quality, reduce stormwater volume, and capture carbon. This includes bioretention systems, rain gardens, bioswales, and other solutions.
	Support Burlington's Stormwater Program in their efforts to update the Chapter 26 Ordinance that requires the review of projects that disturb more than 400 sq. ft. to include further mitigation of stormwater from both redevelopment and new development.
	Support the Stormwater Program in their continued efforts to reduce the effect of existing combined sewer overflows (CSOs) in the city. This may include building on the "BIP Runoff Reduction Opportunities Map" created by the Stormwater Program to prioritize areas for incorporation of stormwater filtration techniques into developed areas.
	Coordinate with Stormwater staff to continue creating vegetated bioretention areas that also sequester carbon with the help of native plants. Provide consistent outreach and education related to these retrofits to explain the many functions and benefits they provide.
	As stormwater outfall areas are maintained or reconstructed seize these opportunities to integrate native plants that will sequester carbon and offer other benefits as NBCS.

5A.4 Upgrade planting.	Evaluate Leddy Park and other City properties to identify opportunities for green infrastructure improvements for additional plantings as NBCS around the parking lot.
	Adopt a municipal policy that guides the transition from using annual plants to perennial plants in locations where the City is responsible for the plantings.
	Create a NBCS demonstration planting project for the median on Main Street by UVM.
	Dedicate additional education and enforcement resources to reducing the compacting of green space. This is most often the result of parking on lawns and greenbelts, and could be counteracted with the use of an incentive or rebate to property owners that install barriers and rehabilitate the compacted soil.
	The harbor is already experiencing climate change impacts from wind and waves. Some NBCS should be identified and implemented for shoreline protection.

B. GREEN NEW DEVELOPMENT

STRATEGY	ACTION
5B.1 Incentivize NBCS in development.	Adopt incentives or requirements for green roofs, vegetated walls, and other vegetated design interventions for all new development proposals in the Downtown and along commercial corridors.
5B.2 Update land use regulations.	Ensure that the City's Site Planning Standards go beyond minimizing harm to the environment to actively contributing to Burlington's NBCS. This may include increasing tree retention requirements or mitigation, updating resources related to desirable plant species, and open space connectivity related guidance.
	Review the pervious area requirements in the land use regulations to determine if they should be increased to create more opportunities for NBCS.
	Ensure that the site scale landscape standards in the land use regulations require the preservation or restoration of canopy cover, further the City's Bee City status, and promote the inclusion of dense, multi-layered native plantings.

THEME 06: EQUITY AND INCLUSION

A. INCREASE ACCESS TO NATURE AND ITS BENEFITS FOR HISTORICALLY DISENFRANCHISED COMMUNITIES

STRATEGY	ACTION
6A.1 Target investment strategically.	Prioritize investments in nature based climate solutions in areas of the city that are underserved/have limited access to nature.
	Collaborate with groups like the City of Burlington's Racial Equity, Inclusion and Belonging (REIB) Department and the Vermont Releaf Initiative to learn more about NBCS needs and issues in the community and to identify ways to collaborate.
	Reserve community garden access for Black, Indigenous, and People of Color (BIPOC) communities, as well as New Americans and other underrepresented communities. Provide funding assistance mechanisms, perform targeted outreach, and other support as needed.
	Encourage the Community Garden Program to create and adopt an organizational equity statement and implementation plan to identify and deconstruct systemic barriers related to community garden access.
	Consider utilizing new agricultural land acquisitions to serve as land-based economic opportunities for New Americans and other underrepresented groups as a cooperative or small farm incubator.

B. CREATE EDUCATION OPPORTUNITIES TO COMMUNICATE THE VALUE OF NATURE-BASED CLIMATE SOLUTIONS.

STRATEGY	ACTION
6B.1 Support	Support the Burlington City and Lake Semester program which works to connect high school students to the community through an immersive semester program and offers a unique opportunity to incorporate NBCS into student learning through curriculum, camps, and volunteer projects.
6B.2 Expand	Ramp up NBCS related educational programs and resources for residents of all ages, and find new ways to engage the New Americans and frontline communities.
	Encourage student participation in the Burlington School Food Project to continue to strengthen the connection between farms and food.
	Invite Gund Institute and Rubenstein School faculty members, and their students, participating in NBCS research to city planning meetings for future open space planning projects.
6B.3 Create	Create more opportunities to bring school aged children and university students into the urban wilds to experience and learn about NBCS.
	Engage students in native planting projects on school properties outside of gardens for food production (e.g., forest and meadow planting). This could include working with the Winooski Valley Park District and Wildways partners to integrate NBCS into ongoing efforts to integrate place-based outdoor education into student learning.
	Explore opportunities for outdoor educational camps that build on the existing curriculum developed.

C. CREATE EDUCATION OPPORTUNITIES TO COMMUNICATE THE VALUE OF NATURE-BASED CLIMATE SOLUTIONS.

STRATEGY	ACTION
6C.1 Do the work	Measure and monitor the area of vegetative cover in each neighborhood, and work with residents to identify and implement needed NBCS projects. This will inform the management of Burlington's open space network and the implementation of future NBCS projects.
6C.2 Get help	Increase partnerships with community organizations for the completion of NBCS projects city-wide.

THEME 07: OTHER IDEAS

A. INCREASE ACCESS TO NATURE AND ITS BENEFITS FOR HISTORICALLY DISENFRANCHIZED COMMUNITIES

STRATEGY	ACTION
7A.1 Data collection	Focus Groups should be used during the creation of the full Open Space Plan to ensure a broader representation of people inform the plans development. These group discussion will allow for a deeper dive on key issues.
	Carbon measuring, budgeting, and drawdown calculations and reporting related to NBCS will inform future efforts. Baseline data is needed so the City can identify the amount of carbon currently being captured in Burlington, and then calculate the additional amount being removed by each NBCS project completed.

7A.2 Education	Expand on existing wildlife tracking through the iNaturalist program by collaborating with University of Vermont scientists to establish a formal tracking study.
	Conduct data collect on tree canopy, food deserts, the state of the waterways, and places for habitat connectivity as community science projects to get more people involved and invested in establishing NBCS throughout Burlington
	Collaborate with scientists at the Gund Institute and the Rubenstein School of Environment and Natural Resources at the University of Vermont to introduce younger local students to the George D. Aiken center green roof and other green infrastructure projects in Burlington. This could include identifying additional opportunities for collaborating with scientists and designers to bring this green roof technology to other institutional spaces in the city.
	Educational signage related to NBCS should be provided around the city as appropriate to identify and explain the systems in place and their role in reducing climate change.
	Support and enhance existing programs like the Lake Semester, and involve students in native planting projects on school properties. This could include additions to the school curriculum with participation from educators.
	Commit to providing broad public education on NBCS and the services and savings they generate. This could include an annual report card on the initiatives underway, projects completed, and carbon captured. These educational efforts should also highlight the intersectionality of vegetative cover, food production, reducing energy consumption, and increasing community relationships and how they all contribute to climate resiliency.
7A.3 Investment	Reinvestment of savings from NBCS strategies into land access frameworks for BIPOC community members.
	Create a City purchasing policy that favors NBCS.
	Promote the use of indoor plants in all City owned facilities for the many NBCS and benefits they provide.
7A.4 Silo Busting and Community Involvement	Find ways to create more intersectional collaboration between City departments on NBCS related initiatives.
	Coordinate infrastructure retrofit projects across City departments to ensure the integration of NBCS that promote soil and water conservation.
	Build city staff capacity to facilitate collaborative decision about these spaces with the neighborhood's residents from the start.
	Provide City staff and additional educational materials to support & guide individuals and community groups who want to plant wildlife corridors, trees, gardens, and edible forests, or who want to take advantage of city incentives for green building, permeable paving, or bumpouts
	Review the existing Natural Resource Overlays and District regulations in the Zoning to ensure they cover all of the intended parcels, to address any identified deficiencies, and to identify ways to make the language less subjective.

APPENDIX

EXISTING CONDITIONS ANALYSIS AND RESEARCH

This project began with a city-wide inventory and analysis of existing conditions. This review of land use and land cover data was informed by the Open Space Protection Plans, other studies and planning documents, and digital map data. This resulting information provided a deeper understanding of Burlington's existing open space and natural resource networks. The inventory and analysis also provided a foundation for the creation of the City's own NBCS framework and implementation blueprint presented in this Plan.

A summary of the findings is presented in a series of short profiles for the following topics:

- Protected Lands
- Tree Canopy
- Water Resources
- Impervious Surface Cover
- Connectivity
- Biodiversity
- Demographics

Burlington is starting this NBCS initiative in a really good place. As the infographics on the next page indicate, there is a robust and accessible open space network in place. There are also many individuals and organizations already hard at work on related efforts and well positioned for future collaboration.





SUMMARY OF RESEARCH

To establish a nature-based climate solution framework for Burlington, extensive research was conducted to learn how urban communities are implementing NBCS and how leading agencies are framing NBCS as a climate solution (such as the United Nations and the Nature Conservancy). This research and case study review (combined with the city-wide existing conditions analysis) was started early on in the planning process and provided direction and inspiration for the creation of Burlington's framework. Some key concepts found during this review are summarized below:

BIOPHILIC CITIES

The Biophilic Cities network is a growing global community of partner cities, organizations, and individuals committed to planning and designing cities that are abundantly incorporating the natural

world into the daily lives of residents. This movement is built on the idea that the presence of nature enhances cities - increasing resilience and improving the health and well-being of those who live there. Biophilic cities draw inspiration from the term 'biophilia', which refers to the innate positive psychological and physiological response that humans experience when interacting with the natural world. Nature-based approaches can be used to create biophilic spaces in cities. Long-term investment solutions will help cities secure a successful, sustainable future and address climate change.

A NETWORK OF NBCS

Biophilic cities are known to embrace a diversity of nature-based solutions, including green infrastructure, such as living walls and roofs on buildings, and blue infrastructure, such as urban wetlands. These habitats are



OUR CHANGING DEMOGRAPHICS

Nature-based climate solutions will be implemented city-wide, ranging from large parcels of publicly owned land, to interconnected backyards in a neighborhood. Engaging the **WHOLE** community in these efforts is critical to maximizing the potential benefits of NBCS. Understanding Burlington's demographics enables the City to best partner with the community to implement NBCS in the future.

Key characteristics generated by the US Census' American Community Survey include:

- The City of Burlington is a small city with a total area of **10.3** square miles that serves as a regional population center.
- The 2019 total population is **42,545**.
- Burlington is a younger community overall with a median age of **26.8** years old.
- **15%** of the population does not identify as white.

- **13.5%** speak a language other than English at home.
- **12.8%** of Burlington's population is characterized as having a disability.
- **92.2%** of the population is a high school graduate or higher.
- The poverty rate, or the percent of the population living at or below the national poverty level, is **26.4%**.

As the residential population continues to change over time, there will be new needs and opportunities that NBCS can help address. This includes food security, protection from natural hazards, and an improved quality of life for all.

especially valuable when connected with other urban green spaces, such as parks and other natural ecosystems. Woodlands, wetlands, and grasslands can also effectively absorb carbon dioxide and sequester carbon, mitigating emissions.

BUILDING CAPACITY AND SUPPORT FOR NBCS AND BIOPHILIC DESIGN

As natural capital accounting (which measures the potential value of NBCS in economic terms) becomes a mainstream part of the design and construction process, and small-scale, innovative, and affordable NBCS are invested in, there will be more opportunities for biodiverse solutions to help strengthen more cities' natural resources, livability, and resilience.

As the impacts of climate change continue to put pressure on our cities, residents, wildlife, and natural resources, modern city design should embrace **biophilia as a core idea** and **utilize NBCS to address these challenges holistically.**

While natural capital approaches can drive investment in NBCS and increase green economic growth, cities must communicate the benefits of nature-based solutions as a climate change action strategy more effectively to mobilize local officials, planners, leaders, and the general public.

URBAN DRAWDOWN INITIATIVE

In 2017, a group of cities began exploring the role municipalities play in carbon drawdown, which refers to the future point in time when levels of greenhouse gases in the atmosphere stop climbing and start to steadily decline. This led to the formation of the Urban Drawdown Initiative (UDI), a network that brings together cities, resource specialists, community-based organizations, scientists, innovators, land managers, and others to accelerate implementation of carbon removal strategies that simultaneously improve the social, economic, and environmental resilience of local communities. Conventional city-based climate action has primarily focused on efforts to reduce city-based carbon emissions. This Initiative was established to support and disseminate city-scale actions that operationalize high-leverage carbon drawdown actions.

Cities are important to include in carbon drawdown efforts because:

- Cities own a lot of land and open spaces.
- Cities can influence new markets for carbon drawdown and create a marketplace for high-value nature-based solutions.



- Cities can lead and establish unique partnerships such as with school districts, and
- Cities are at a climate nexus and carbon drawdown must now be a major focus of climate action.

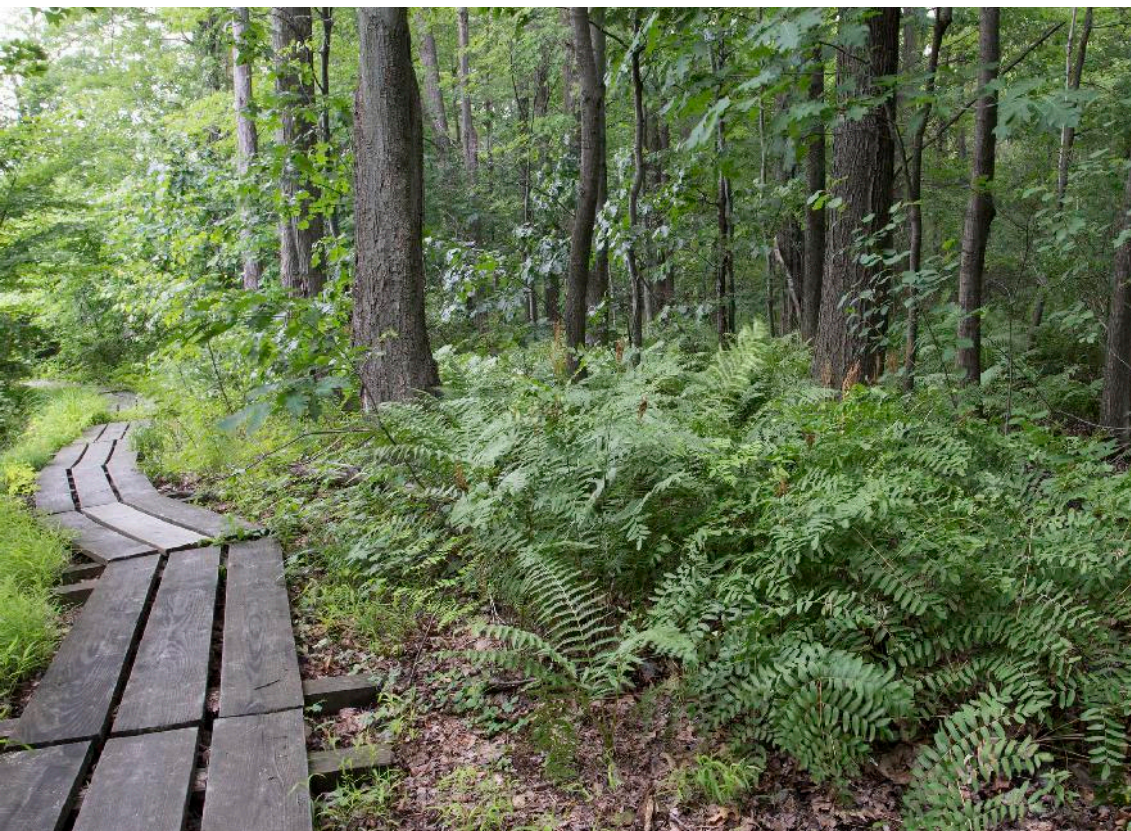
The UDI has developed a framework and series of actions that can be customized to fit the unique circumstances, capabilities, and objectives of each city. They also offers tools and resources that enable cities to integrate drawdown actions into their existing climate action plans and programs. Actions that were identified as having strong positive impacts from drawing down carbon in the atmosphere include:

- Utilizing natural biological processes, nature, and ecological systems to drawdown carbon from the atmosphere to store in living systems.
- The use of a city's organic resources in direct drawdown actions allow organic material to be captured and utilized as resources for land-based sequestration activities. Additionally, urban forests and land management activities generate significant volumes of organics, most

of which is directed into the waste stream. Processing organics into useful by-products that sequester a significant portion of its constituent carbon, such as biochar, can be utilized to stimulate additional carbon sequestration in soil and other biological systems.

- In natural ecosystem solutions, equity-based economic development opportunities exist to build a robust green economy and improve the livelihoods of all residents in a city. Community-based enterprises and engagement of social service organizations and non-profits should be a foundation to any NBCS program to implement the wide range of actions that will be needed—from organic materials collection, to composting, to soil and regenerative agriculture development, to urban forest management.
- Sustainable drawdown will require policy support at all levels of government. Implementation of drawdown actions in cities may require changes to municipal ordinances, codes or policies to support new types of technologies, practices, or land uses.

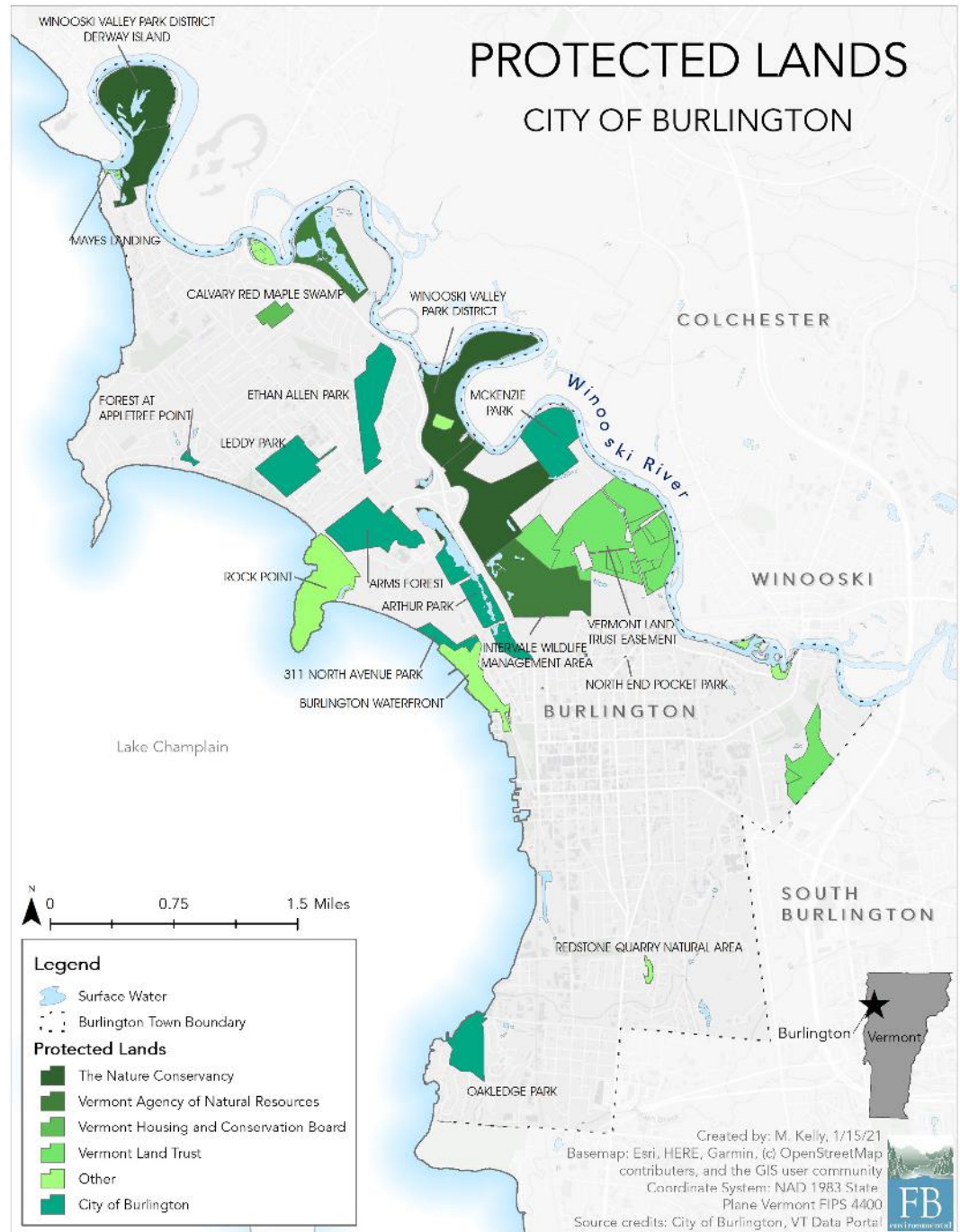
- Lack of public awareness of carbon drawdown activities limits understanding and support for the civic and political actions that must be taken to rapidly expand urban NBCS. Integrating education and community partnerships into NBCS work is crucial for building public support and capacity.



PROTECTED LANDS

Protected lands within the city are primarily located in the vicinity of the Intervale. This includes the largest protected land parcel, the Winooski Valley Park District, at approximately 250 acres. In addition, Burlington has more than 50 parks and urban wild areas throughout the city, with many located within the central portion of the city, along the Lake Champlain waterfront, and along the Winooski River.

In addition to these protected lands, there are 14 community gardens throughout the city and approximately 55 miles of trails, paths, and greenways that connect these parcels. The Burlington Greenway alone stretches continuously from the southern end of the city, along the downtown waterfront, to the north tip of the city adjacent to Derway Island.



TREE CANOPY

Burlington's existing tree canopy covers 42% of all land within the City. Conserved areas and well-established low density residential areas have the densest tree canopy cover. The north end area has both of these land uses and is best served by tree canopy cover currently.

Contrastingly, tree canopy is lowest in the densely developed downtown area of the city. Undeveloped areas of the city with low tree canopy coverage include the Intervale, which is primarily agriculture, as well as the golf course located in the south eastern corner of the city.

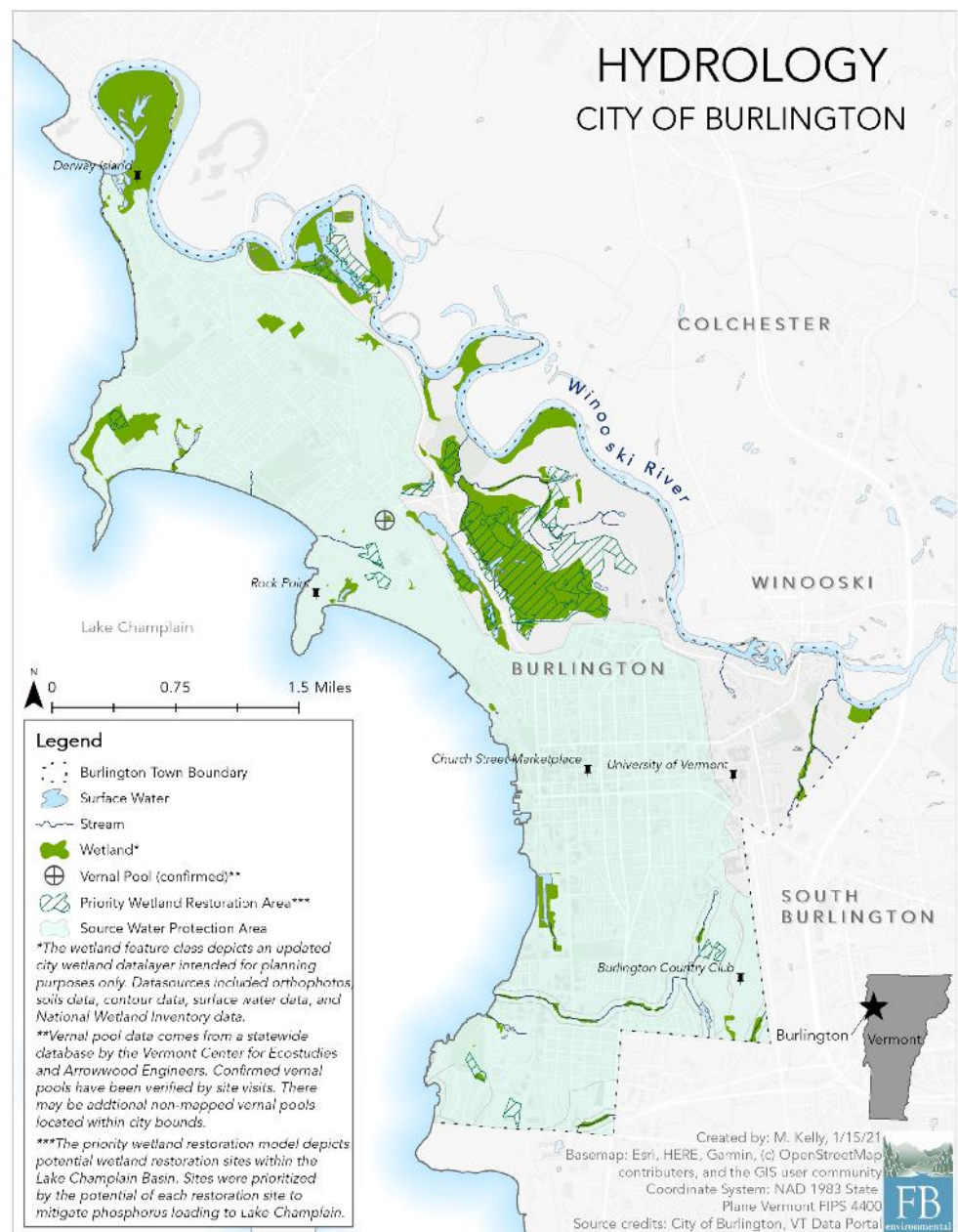


WATER RESOURCES

The City of Burlington is bound by the Winooski River to the northeast and Lake Champlain to the West. Stormwater from the city drains either into the Winooski River or into Lake Champlain. Taking a larger watershed perspective we see the Winooski River, flowing from its headwaters in the town of Cabot 90 miles to its outlet in Lake Champlain at the northern tip of the City of Burlington.

The City of Burlington is vulnerable to flooding from both the Winooski River - much of the land located along the Winooski River is located within the City's Flood Hazard Zone Overlay – as well as along Burlington's Lake Champlain waterfront. Along the river, the Flood Hazard Zone covers approximately 1,509 acres, including Derway Island, and the Intervale.

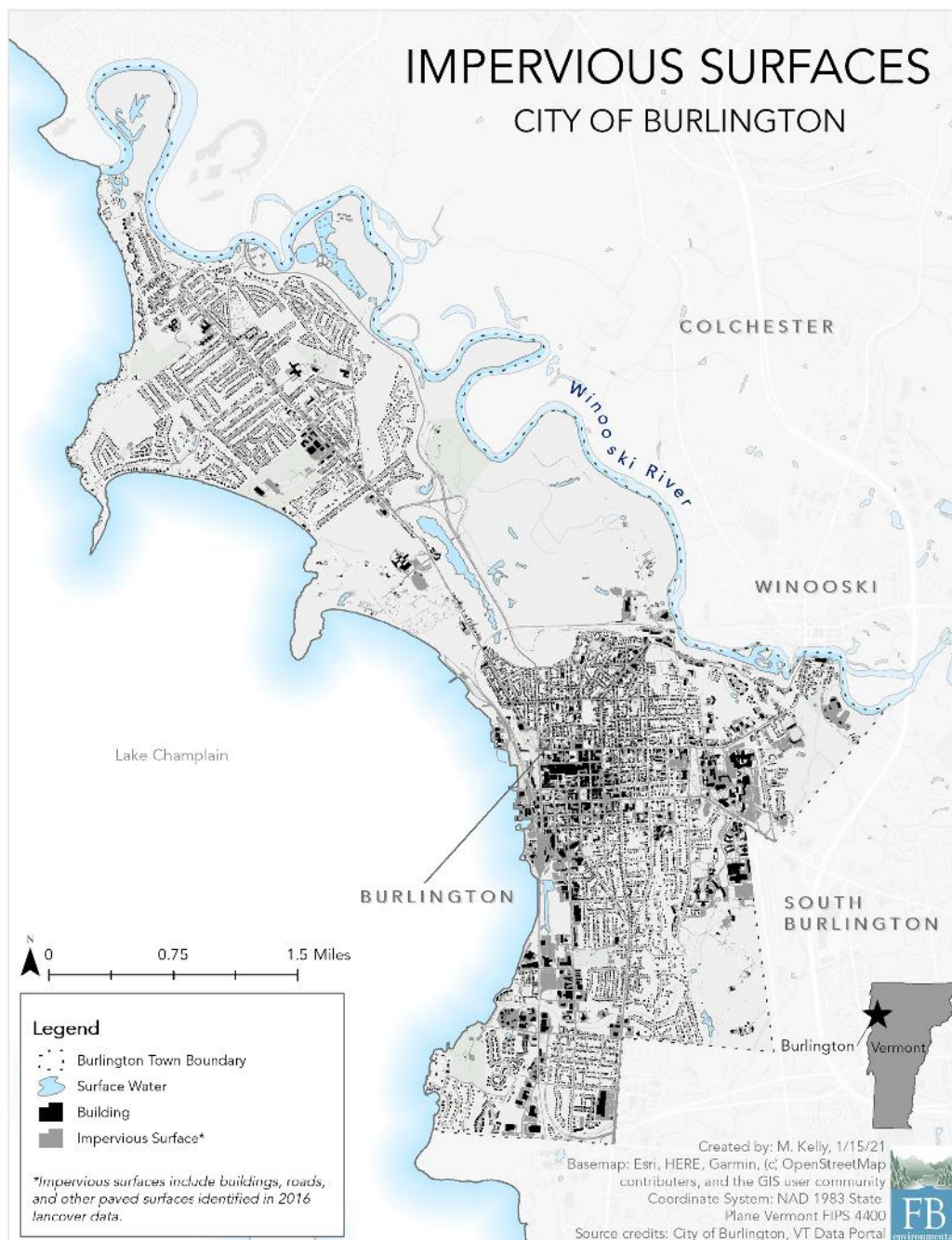
The Flood Hazard Zone also provides a buffer along Lake Champlain's shorefront. Lake Champlain reached a historic recorded crest of water level at 103.27 feet in 2011, rising above the flood hazard overlay zone which covers areas within the 102-foot water level inundation. Of the wetland and floodplain areas present within the city, approximately 350 acres are identified as priority wetland restoration areas. These areas have the potential to protect downstream water quality conditions and mitigate phosphorus loading to Lake Champlain, but are also critical to combating climate change because of their tremendous potential to sequester carbon.



IMPERVIOUS SURFACE COVER

Scientists have long recognized the adverse impacts associated with increasing development density on water resources. Studies have shown a link between the amount of impervious area in a watershed and water quality conditions.

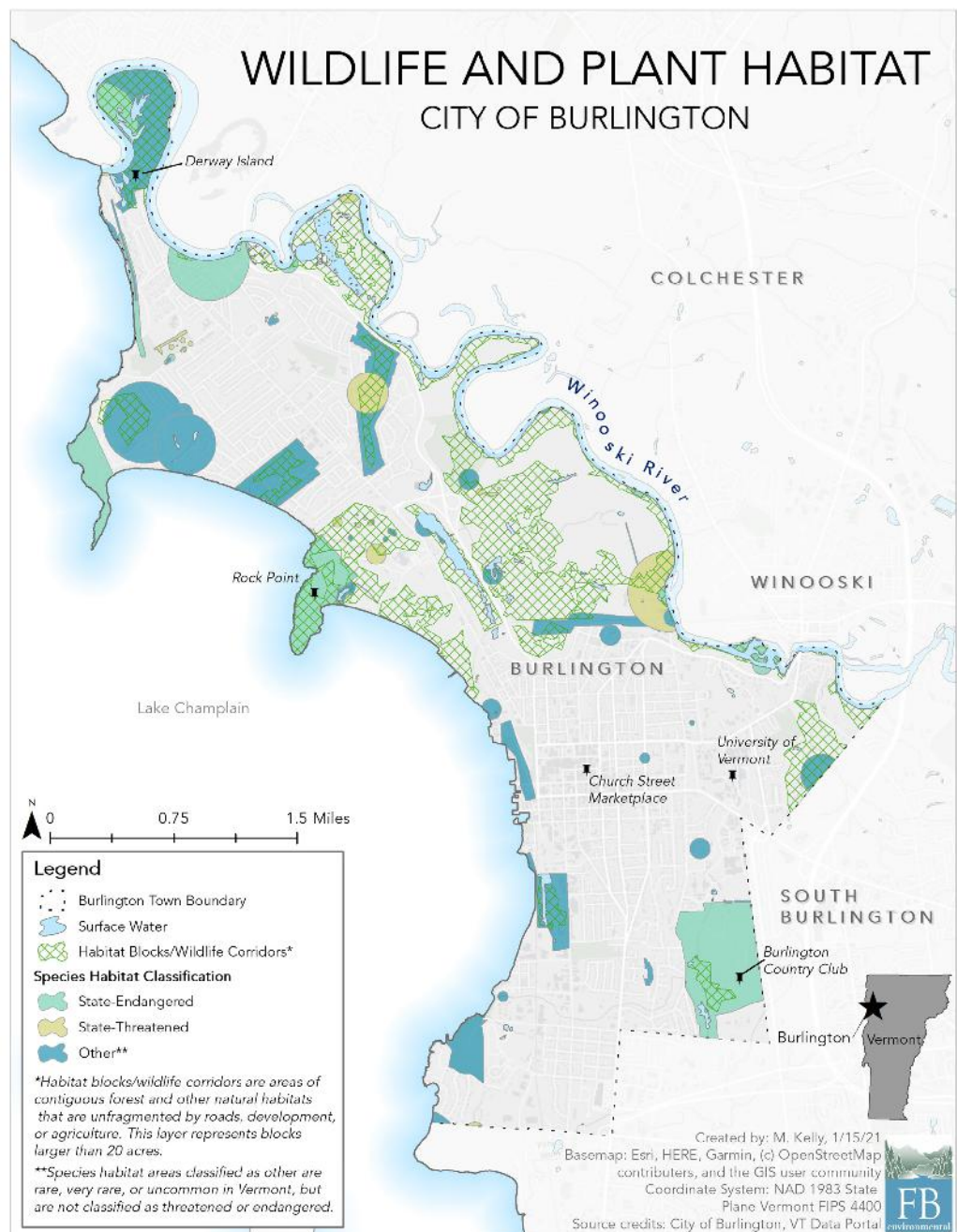
According to the Center for Watershed Protection, 10% of impervious cover is often cited as the threshold above which aquatic health and water quality are negatively impacted. As an urban area, the City of Burlington has approximately 28% of impervious surface coverage. This impervious cover is highest in ward eight (59.5%) and ward three (54.6%), both located in the downtown area, and lowest in ward seven (14.9%).



CONNECTIVITY

Habitat connectivity is imperative for both daily and seasonal wildlife movement to reach food, shelter, water, and breeding sites. Habitat blocks and wildlife corridors are areas of contiguous forest and other natural habitats that are unfragmented by roads, development, or agriculture. In Vermont, habitat blocks are primarily forests, but also include wetlands, rivers, streams, lakes, ponds, and rock outcrops. Habitat blocks and wildlife corridors mapped within city bounds are larger than 20 acres and are most prevalent in the central part of the city and along the Winooski River (see Wildlife and Plant Habitat Map). Areas of land or water where rare, threatened, and endangered species and natural plant communities are also present mostly in the central part of the city, along the waterfront, and along the Winooski River.

These areas indicate the presence of rare, un-common, and historical species and indicate practical conservation value. Both habitat blocks, wildlife connectivity, and presences of rare, threatened, or endangered species cross jurisdictional boundaries but are depicted only within city bounds on this map. Efforts to further improve habitat connectivity include disrupting impervious surface cover, road mitigation (e.g., gaps in guardrails, less salt application, lower speed limits, culvert crossings), land conservation, and land use regulations.



BIODIVERSITY

Many species have been observed within Burlington. This information is shared via iNaturalist, a community science application where observers can track a variety of species sighted. Reports include beavers, mink, red squirrels, gray squirrels, bobcats, racoons, coyote, chipmunks, eastern cottontails, fishers, gray foxes, red foxes, groundhogs, hairy-tailed moles, brown rats, deer mice, long-tailed weasels, muskrats, porcupines, river otters, short-tailed weasel, skunks, star-nosed moles, opossum, and white-tailed deer.

Fortunately, this is just a portion of the rich community of species found within Burlington's open space network. Burlington's Urban Wilds are lands designated to contain and protect natural communities, including habitat for rare and endangered plant and animal communities, wildlife habitat, and travel corridors, as well as riparian systems such as wetlands and floodplains. Together, these natural systems are and will continue to be a central component of Burlington's effort to foster biodiversity while mitigating climate change using NBCS.

