

Fostering collective action: climate mitigation initiatives and collaboration potential in Metro Vancouver



Vancouver Climate Strike at City Hall on September 27, 2019 (Kerr, 2019)

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Executive Summary

In 2019, following the *Special Report on Global Warming of 1.5°C* (IPCC, 2018) by the Intergovernmental Panel on Climate Change (IPCC), municipalities across the Metro Vancouver region declared a climate emergency. In doing so they acknowledged that we cannot continue 'business as usual' and need to take action to limit the consequences of anthropogenic climate change.



Figure 1. Road map illustrating steps to organize toward a coherent strategy for collective climate action (CALP, 2019)

In order to meaningfully address climate change in the Metro Vancouver region, the Society Promoting Environmental Conservation (SPEC), the Collaborative for Advanced Landscape Planning (CALP) and four 4th year Environmental Sciences Undergraduate students have teamed up to map local climate mitigation initiatives and promote collaboration between them. Working towards a coherent strategy for collective action, this project aims to address the second and third steps of the road map shown in Figure 1.

This project has four main objectives:

1. Collaboration

To promote collaboration between initiatives by sorting them based on the resources they need and can offer

2. Engagement

To effectively present initiatives to the public to encourage awareness and involvement in initiatives in their region

3. Trends

To identify trends in the focus areas and approaches of initiatives and identify any gaps that currently exist

4. Longevity

To determine ways to make our map self-sustaining by using citizen science techniques

Research for local climate mitigation initiatives was conducted through web searches, existing databases, and personal knowledge. Using a selection criteria to define a climate mitigation initiative, those that met the criteria were then categorized by their focus areas and approaches to engage climate action (Figure 2).



Figure 2. Selected focus areas and approaches of climate mitigation initiatives used for the scope of this project. Focus areas were chosen based on their relevance in mitigating anthropogenic emissions. Approaches were chosen based on their effectiveness in engaging climate action.

Data on 41 climate mitigation initiatives in Metro Vancouver was collected and mapped using [ESRI Story Maps](#). The most common focus area of these initiatives is renewable energy, and the most common approach of these initiatives is education. A majority of the initiatives mapped exist in the municipality of Vancouver. To determine collaboration potential amongst initiatives, data on what resources initiatives need and can offer was collected by contacting initiatives to fill out a Google Form. Due to organizations hosting more than one initiative, our Google Form was sent to 35 organizations. From the 14 responses we received, the top 3 resources needed are funding, access to a professional network, and public space tied with expertise (Figure 3), and the top 3 resources offered are partnership, social media presence and expertise (Figure 3). 5 resources (funding, volunteers, social media presence/reach, large professional network, expertise) were indicated as being both needed and offered by initiatives, highlighting potential for collaboration. This project's intention to promote collaboration can be achieved by initiatives accessing our online map and contacting initiatives that share needed and offered resources.

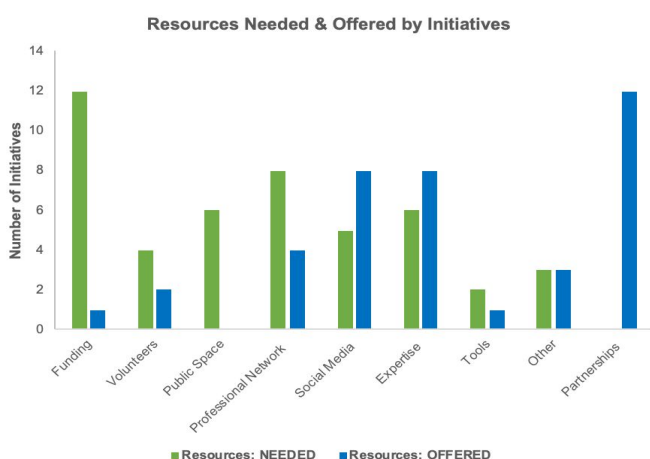


Figure 3. Summaries of the resources needed and offered from the 14 initiatives that successfully filled out the Google Form. Initiatives were able to select more than one resource that they needed or offered, owing to the sample size greater 1.

Future directions for this project should consider expanding the scope to include a broader range of initiatives and explore whether meaningful collaboration has occurred from this map. This map will be hosted on the websites of SPEC and CALP and a new Google Form was created to collect information about initiatives moving forward. For this map to become self-sustaining, future research will need to be conducted in the field of computer programming and software development.

Authors

The research team for this project consists of four 4th year Undergraduate students at UBC with unique interests and experience pathways who share a common interest in climate change and mitigation efforts.

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1.0 Introduction

1.1 *The Problem*

As the consequences of anthropogenic climate change are becoming more prominent around the world through increased temperatures, sea level rise, and increased severity of storms, it is undeniable that the Earth's changing climate is affecting humans. Through research and reports from organizations such as the Intergovernmental Panel on Climate Change (IPCC), it is becoming increasingly clear that we cannot continue 'business as usual'.

In Metro Vancouver, municipalities such as Vancouver, Burnaby, Richmond, New Westminster, Port Moody, North Vancouver and West Vancouver have acknowledged the need to take action, thereby declaring a climate emergency. To avoid the consequences outlined by the IPCC in the scenario of the earth warming to 1.5°C and beyond (IPCC, 2018), we must act now and we must act together. This proposed project aims to foster collective action, which has been defined by Wright, Taylor, and Moghaddam (1990) as a group behaviour that's motivated by a member's desire to improve the position of the group. Fostering collective action towards fighting climate change will be facilitated through mapping existing climate initiatives and identifying potential areas for collaboration among initiatives and public involvement pathways.

1.2 *Drivers of Climate Change*

There is an overwhelming consensus that global warming is mainly caused by humans, as stated by the IPCC (IPCC, 2014), and that "human influence has been the dominant cause of observed warming since the mid twentieth century" (Stocker et al., 2014; Cook et al., 2016). Anthropogenic climate change is driven by greenhouse gas (GHG) emissions, through the burning of fossil fuels (IPCC, 2014). Rising temperatures, ocean acidification, increased frequency of extreme weather events, and ecological extinction threats are some of the impacts of climate change (IPCC, 2014). Limiting climate change to 2°C to minimize impacts can only be achieved by staying within a global carbon budget of approximately 1,000 Gt CO₂ eq through the end of the century (IPCC., 2014). But current rates of emissions (50 Gt CO₂ eq/year) show that the carbon budget will be used up in 20 years (Creutzig et al. 2016). There are many important ecological climate solutions such as carbon sequestration and resilience building in ecosystems, and carbon capture technologies that mitigate the problem, but the rapid phasedown of fossil fuel emissions is by far the most important step in climate action as these emissions are the main cause of the changing climate and the root of the problem (Hansen et al., 2013; IPCC, 2014). Therefore, climate initiatives included in this project must work to mitigate climate change through action, innovation, or education in reducing GHG emissions.

1.3 *Social Movements*

Little (2014) defines social movements as "purposeful, organized groups striving to work toward a common goal" (p.1). Social movements arise when populations feel that their needs

and interests are not being satisfied so they come together to create change. Grievances become social movements when the “movement actors are able to create viable organizations, mobilize resources, and attract large-scale followings” (Little, 2014, p.13). The current climate movement is a global call for an end to the use of fossil fuels and a switch to renewable energy, as well as demands for climate justice, where the rights of the people and communities that are most vulnerable to climate impacts are prioritized (United Nations, 2019c). People in the movement are concerned about the impacts of climate change and have come together to push for action and change in the world.

As climate change is a global problem, the actions of the world locally and globally are connected and relevant to the issue. Social climate movements must act on all geographical scales in order to create change (Shaw et al., 2018). Some examples of social movement methods are symbolic protests, economic boycotts, labor strikes, political and social non-cooperation, and nonviolent intervention (Stephan & Chenoweth, 2008). Large changes such as shifting from fossil fuels to renewable energy can occur through a combination of personal and collective action (Geiger, 2019). But the evidence suggests that coordinated collective action is more effective than people acting as individual consumers (Geiger, 2019). Social communities are commonly involved in collective action. Individuals tend to seek out information, often coming from their social networks, that confirm their views of the world, such as one’s view of climate change (Palm et al., 2017). Therefore, when people in communities make changes they can influence others within their community. This is because publicly visible behaviours spread through networks more readily than private behaviors (Geiger, 2019). Thus, demonstrating the importance of showcasing the climate action people are taking, through local climate initiatives, to help encourage more involvement.

1.4 Collaboration

Research has shown that collaboration assembles multiple perspectives and expertise, and increases access to networks and resources, which can give power to organizations to function more efficiently and achieve a common goal (Bond & Carmola Hauf, 2007). Therefore, collaboration is critical among climate initiatives and organizations to collectively combat climate change. Though to be successful, collaborations must provide valuable benefits to both the member organizations (Olson, Balmer & Mejicano, 2011). This project has the potential to strengthen collective climate action by mapping areas for collaboration through the identification of the resources needed and offered by initiatives.

1.5 Research Objectives

This project aims to create a database and map of active climate mitigation initiatives in Metro Vancouver, focusing on government and nonprofit organizations. The objectives of this project are as follows:

- 1) To promote collaboration between initiatives by sorting them based on the resources they need and can offer;
- 2) To effectively present initiatives to the public to encourage awareness and

involvement in initiatives in their region;

3) To identify trends in the focus areas and approaches of initiatives and identify any gaps that currently exist;

4) To determine ways to make this map self-sustaining by using citizen science techniques.

This project is a collaboration between the Society Promoting Environmental Conservation (SPEC), and Collaborative for Advanced Landscape Planning (CALP), with contributions from Buddy Up! This work will impact climate mitigation initiatives and citizens of the Metro Vancouver region. By creating a map to expose climate initiatives of varying focus areas, size, resources, approaches, etc., we hope to open up the possibility of collaboration among initiatives, which has the potential to profoundly impact their scope and influence. This map will be a user-friendly tool for citizens who are looking for ways to get involved in climate action, are seeking information and resources, or are simply curious about what initiatives in Metro Vancouver are doing about climate change.

2.0 Methods

2.1 Database Design

In order to compile and map mitigation initiatives we utilized a mixed-model of collecting basic information on initiatives via organization websites and contacting initiatives to acquire information on their resources needed and offered as well as the regions they are most active in. We acquired basic information from the websites of the various organizations organizing them. This information included the names of initiatives, their locations, their target demographics, their dates of existence, their approach, their focus areas, and a brief description of their initiative. In order to categorize climate mitigation initiatives, we developed a selection criteria that contains focus areas and approaches.

2.11 Selection Criteria

Our selection criteria was created on the basis that greenhouse gas emissions are the leading drivers of anthropogenic climate change (Blanco et al., 2014). Using this driver, we developed a set of questions to define climate initiatives to ensure that they are engaging in climate action, which is considered to include work done to reduce greenhouse gas emissions, to improve education and raise awareness with respect to climate change mitigation, and to integrate climate change measures into policies and planning (UN, 2019a).

Selection Criteria for Mapping Climate Mitigation Initiatives

What is a *Climate Mitigation Initiative*?

To be a climate initiative, the initiative **must satisfy all** of the following requirements:

1. Be located in Metro Vancouver
2. Be active within the last year
3. Be organized by a non-profit¹ or governmental organization²
4. Work to actively reduce and increase awareness and engagement in the reduction of greenhouse gas (GHG) emissions

Additionally **at least one other** criteria below must be satisfied:

- Does the initiative affect climate policy/law in a way that prioritizes environmental protection?
- Does the initiative promote sustainable modes of transportation?
- Does the initiative increase green spaces in urban environments?
- Does the initiative promote zero waste?
- Does the initiative work to reduce carbon footprint & promote the transition to renewable energy?
- Does the initiative educate on or implement sustainable food systems?
- Does the initiative contribute to the acceleration of a just transition away from fossil fuels?
- Does the initiative help to build awareness on climate change mitigation?
- Is the initiative a resource that structures or supports climate action?
- Does the initiative facilitate action on climate change through research in a particular field?

2.12 Focus Areas

Given that the final deliverable map of this project represents climate mitigation initiatives and focuses on GHGs as a core driver of anthropogenic climate change, it is important to analyze the different techniques that can be used to mitigate climate change. One way of organizing these initiatives is to classify them according to focus areas chosen based on their relevance in mitigating anthropogenic emissions³. In literature, a few of the main techniques pertaining to

¹ In this case, non-profit refers to any initiative that is not working for profit. Initiatives do not have to be a registered non-profit to fall into this selection criteria.

² Non-profits and government organizations were chosen for the scope of this project with direction from our community partners. It should be noted that there is a tension between government initiatives that are trying to take action and grassroots initiatives that arise because governments are failing to do enough. Due to the limited scope of this project, we have not documented the details of activism and tensions in the climate movement that we have recently seen.

³ Initiatives can be categorized into multiple focus areas. For example, the City Farmer initiative was determined to be in the focus areas of green urbanization and sustainable food systems.

the scope of climate mitigation initiatives and therefore the focus areas of our project (Figure 1) are discussed as follows⁴:



Figure 1. Focus areas of climate mitigation initiatives used for the scope of this project. Focus areas were selected based on their relevance in mitigating anthropogenic emissions. Categorization of initiatives into focus areas is based on questions in the selection criteria and in instances where a focus area is not clear, a somewhat-subjective categorization.

a) Renewable Energy

With an increasing global population, it is expected that the demand for energy will grow exponentially (UN, 2019b). Carbon intensive fossil fuels currently dominate energy production, therefore a switch to renewable energy sources has great potential for mitigating climate change by directly reducing GHG emissions (IPCC, 2011). Renewable energy sources can include bioenergy, hydropower, geothermal energy, solar energy, wind energy and ocean energy (Owusu & Asumadu-Sarkodie, 2016).

b) Green Urbanization

Green urbanization incorporates the use of nature in urban environments to reduce the impacts of climate change (Demuzere et al., 2014). By adding green spaces such as green roofs and walls, and restoring current green spaces such as forests, wetlands, and grasslands (Griscom et al, 2016), these nature-based infrastructures increase the sequestration of carbon (Demuzere et al., 2014). In the case of conserving urban forests and planting trees, studies in the US and in Europe have shown that sequestration exceeds emissions and thus this technique is extremely valuable (Strohbach et al., 2012; McPherson et al., 2005).

c) Zero Waste

With effective reduction in waste generation, global GHG emissions can be reduced by up to 20% (Zero Waste Declaration, n.d.). Emissions pertaining to waste are released through the transportation of waste, waste processing, and disposal through incineration or landfill degradation (DeCremer, 2018). By adopting zero waste strategies, reduction in the amount of goods that are produced, consumed and consequently thrown away can drastically reduce anthropogenic inputs to climate change.

d) Sustainable Food Systems

⁴ While an “other” category was considered at one point, through some rescoping of the current focus areas, all initiatives were able to be categorized.

Food systems contribute up to 30% of global greenhouse-gas emissions, from production to consumption (Vermeulen et al, 2012). Food production systems directly release carbon dioxide, methane, and nitrous oxide into the atmosphere, and drive land use changes that indirectly release additional carbon dioxide when forests are cleared, wetlands are drained, and soils are tilled (Willett et al., 2019). Sustainable food production should use no additive land, safeguard existing biodiversity, reduce and manage water use, substantially reduce nitrogen and phosphorus pollution, produce zero carbon dioxide emissions, and cause no further increase in methane and nitrous oxide emissions (Willett et al., 2019).

e) Green Transportation

Transportation contributes to climate change through the burning of fossil fuels such as gasoline and diesel, releasing carbon dioxide and other GHGs (methane, nitrous oxide and hydrofluorocarbons) (EPA, 2019). By setting emissions standards for fossil fueled vehicles, expanding the use of electric vehicles, and increasing accessibility of public and active transportation in urban areas, would dramatically decrease GHG emissions from this sector.

2.13 Approach

This project focuses on three approaches used by social movements to create climate action: action, education and innovation.

a) Action

Action, in the scope of our project, refers to engagement in reducing GHG emissions and/or a call for reducing GHG emissions. This can include behaviours such as striking, as conducted by the Sustainabiliteens initiative, which can be effective in creating change as they encourage the involvement of others and call for action from policymakers to reduce emissions (Warren, 2019). Similarly, lobbying can be incorporated in this category, as lobbying too is an action of communication allowing the voices of environmental groups to be heard by governmental entities in order to encourage reducing GHG emissions (Berg, 2009). Civil disobedience as seen through the movement of the Extinction Rebellion initiative can include disobeying laws to encourage governmental actions to reduce greenhouse gas emissions (Lemons & Brown, 2011). However, action can also be considered as behaviours such as purchasing an electric vehicle or limiting the use of one's household heating and energy systems in order to directly reduce greenhouse emissions. It is clear that as an approach, "action" is multi-faceted and perhaps is too broad of a category. In the case of striking, lobbying, and civil disobedience, perhaps it can be placed in the sub-category of political action. While for behaviours taken by individuals to directly reduce emissions, it can be categorized as direct personal actions. For the scope of this project, the term action has been used to encompass initiatives that fall in this broad range.

b) Education

Education is central to changing people's behaviours to be more conscious of climate change (Siegener, 2018). Education has the power to inform, engage and motivate people

to take action (Siegener, 2018). Effective climate literacy not only empowers and teaches citizens but it helps increase pressure to change policies and develop a low-carbon economy (Ledley et al, 2017). The Planet Protector Academy is one example of a climate initiative we included in our map that uses an educational approach. The initiative creates school programs where children learn about climate-conscious behaviours. Seminars and workshops, curriculum changes, and toolkits/resources are some other examples of programming that initiatives with an educational approach may use.

c) Innovation

Environmental innovation is defined as “new or modified processes, practices, systems and products which benefit the environment” (Oltra, 2008). Research and innovation are needed in order to adapt to and mitigate climate change (Adenle et al., 2015). But technological solutions will only be effective in creating change if they are combined with behaviour changes (Siegener, 2018). These approaches are interconnected and build off of each other, therefore it is important to have initiatives taking a variety of approaches⁵. One initiative we included in our map that uses an innovation approach is Mugshare at the University of British Columbia. Mugshare aims to reduce the number of disposable cups used at the university by providing reusable mugs for people to use as an alternative. Other examples of types of approaches within innovation are research, retrofitting, and carbon footprint calculators.

2.14 Resources needed and offered

A Google Form (see Appendix A) was created to acquire information on the resources they need from and can offer to other initiatives. Categories for resources needed and offered are included in Table 1. In applying Maslow’s hierarchy of needs to the level of an organization, the pillars of organizational needs are survival, stability, community and relationships, esteem and recognition, and self-actualization (Scheurell, 2018).

Table 1. Resources needed and offered by initiatives based on Maslow’s Hierarchy of Needs applied to the level of an organization (Maslow, 1954; Scheurell, 2018).

Resources Needed & Offered	Description
Funding	Can include donations and willingness to write a grant. Is part of the survival component of organizational needs in which the focus is on developing a strong foundation.
Public Space	Can include event space or office space. Is part of the stability phase of organizational needs where the focus is to increase growth and efficiency.
Volunteers	Part of the stability phase of organizational needs where the focus

⁵ Similar to categorizing focus areas, initiatives can have more than one approach. For example, the Future Delta 2.0 Videogame initiative by CALP offers GHG mitigation through innovation and education approaches.

	is to increase growth and efficiency.
Professional Connections	Can include developing connections with vendors, experts in various fields, and with organizations that can provide funding. Is part of the community and relationships component of organizational needs where the focus is on building alliances.
Social Media Reach	Can include gaining or providing social media reach. Is part of expansion and enhanced organizational experience within organizational needs.
Computer Science Expertise	Can include web development or tech support. Is part of expansion and enhanced organizational experience within organizational needs.
Partnerships	Can include partnerships to create more initiatives, to give back to initiatives that may need financial help, and to connect with local communities, businesses and the government. Is part of the self-actualization component of organizational needs where the focus is on community giving and social responsibility.
Tools	Can include technology, information on resources and open software. Assists in the execution of organizations goals with the use of unique technologies where the focus is on the self-actualization component of organizational needs.

It is intended that collaboration between initiatives can be fostered by matching the resources needed and offered, as shown in Figure 2.

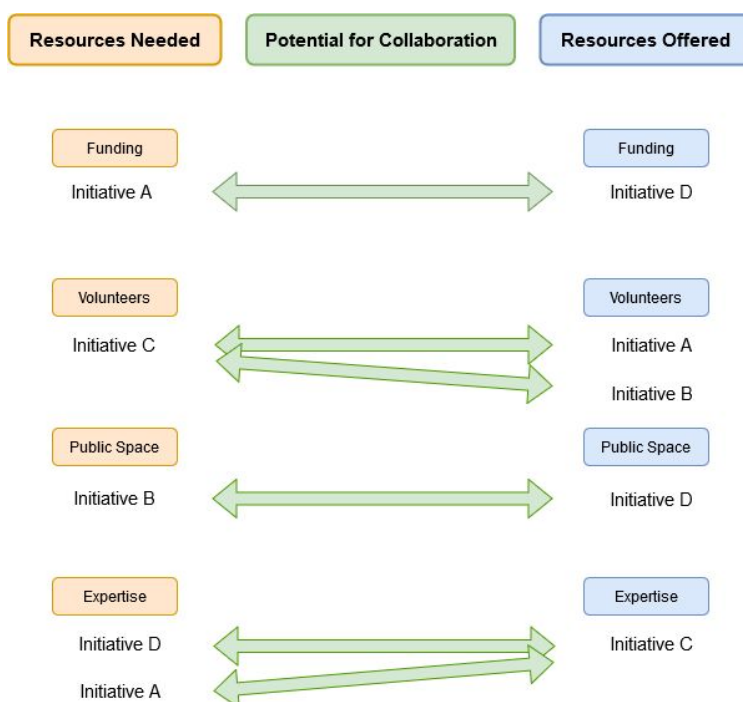


Figure 2. Model demonstrating how collaboration between initiatives can be promoted by matching initiatives based on the resources they need and can offer to other initiatives.

2.2 Data Collection

We gathered information on climate initiatives using online search engines and pre-existing online databases, such as the City of Vancouver's Greenest City Projects map, SPEC's Sustainability Sector map, and a climate initiative list created by CALP. Some of the search terms we used to find climate initiatives in Metro Vancouver include: "climate initiatives," "climate action," "climate activism," "environmental initiatives," and "sustainability engagement." Upon gathering contact information and details about these initiatives, we emailed a link to a Google Form (see Appendix A) 35 organizations out of the 41 initiatives collected, due to an overlap in the number of initiatives hosted by organizations. Using the Google Form, our goal was to gather additional information about areas the initiative is active and resources they need and can offer. The rate of response of initiatives was slow, therefore we sent a follow up email to acquire more responses.

Of the 14 responses we received, none of the initiatives we contacted replied asking for clarification on how to fill out the form. We do acknowledge that there is a potential for the responses we did not get from initiatives to be caused by confusion about the email and Google Form. A couple weeks after we sent out the initial email and form, we did send a follow up email and received more responses. This was another indicator that the response rate was potentially related to the high volume of emails the initiatives we contacted, receive regularly, which allowed our email to be easily missed, rather than confusion of its contents.

2.3 Mapping

Upon gathering our data, we used ESRI Story Maps as well as Google Maps to spatially map the climate mitigation initiatives. This was done to determine which mapping tool was best suited for presenting initiatives in this project. While using Google Maps we simply used the Google Maps website to generate a custom map where we input the names of the organizations we contacted from which the search engine would pin the geographical location with a marker. This location was either the organization's office building or in the case where they did not have an office, we placed their markers in a polygon of an area they are most active in. We also customized the markers for the initiatives based on the focus area, the lack of a distinct focus area, and the case of multiple focus areas. To include more details about the initiatives we provided the initiative and organization name, a description of the initiatives, their focus area, their approach, their resources needed and offered, and a link to their website in the descriptor box that appears when one hovers above the initiative on the map.

Using the Story Map Shortlist template on ESRI Story Maps, we created a map that allowed us to organize initiatives based on focus area into individual coloured tabs. We also included extra focus area tabs for initiatives that have multiple focus areas or initiatives that lack a focus area. Then we located all the initiatives by manually entering their addresses after which the search engine would mark them according to the colour of their focus area tab. For organizations that

lacked a physical location, we instead placed a marker in a single location they were most active in. For each organization we provided the initiative name, a description of the initiatives, their approach, their resources needed and offered, a link to their website, and an image pertaining to the initiative in the descriptor box that appears when one hovers above the initiative on the map.

Upon presenting the climate mitigation initiatives both using Google Maps and ESRI's story maps, it was clear that Story Maps were most ideal to disseminate this information. The coloured tabs, the associated coloured map points, the imagery upload feature as well as the ability to include hyperlinks makes ESRI's story maps a better choice than Google Maps. While Google Maps does allow for imagery and coloured map icons, it doesn't provide as many options in changing the design or colours. Additionally, Google Maps manually enters details of initiatives (images, address, name etc.) that aren't formatted very well. In some cases, the image associated with an initiative in Google Maps may just be the physical building where the initiative is located which isn't very visually appealing. Alongside the visual appeal, Story Maps are also quite user-friendly. The tabs feature allows users to explore the different focus areas individually to allow for easy understanding. Furthermore, the organization of the initiatives as blocks beneath the tabs provides the user with a strong overview of the range of initiatives. While Google Maps has similar features (groupings based on icons and organization based on icons along the sidebar), it is a lot more difficult to understand what a map is conveying, and one is unable to view groupings of initiatives individually.

2.4 Analysis

After the mapping process we analyzed the results to determine the main gaps present. In order to report on observable trends and gaps that are evident among climate initiatives, we visually represented the spread of our data in 5 areas (focus areas, approaches, resources offered & resources needed and initiative location) using bar graphs. This allowed us to determine the common and rare types of resources and needs, the common and rare focus area and approach categorizations of initiatives, as well as an understanding of the geospatial distribution of initiatives. Looking at these results will allow us to determine the potential for even more connections that are perhaps not focussed on resources and needs.

3.0 Results & Discussion

3.1 Collaboration

In order to effectively promote collaboration among climate mitigation initiatives, we must determine pathways for collaboration. To do this, we used responses to our Google Form to consider the resources that are needed and offered by initiatives in Metro Vancouver. We received responses from 14 initiatives (see Appendix A) of the 35 that were sent out in February, yielding a response rate of 37%. From the responses received, the top 3 resources needed are as follows: funding, access to a professional network, and public space (Figure 3a). These

initiatives also conveyed what resources they could offer, with the top 3 including: partnership, social media presence, and expertise (Figure 3b).

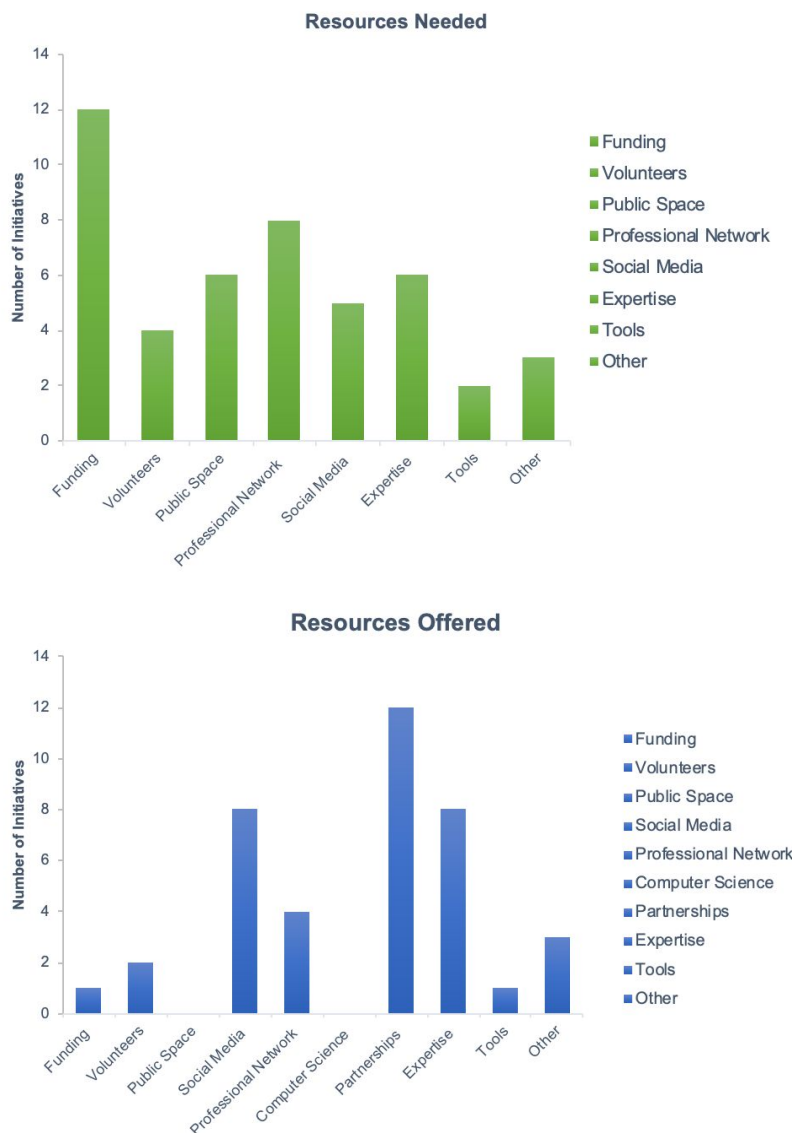


Figure 3. Summaries of the resources needed (a) and offered (b) from the 14 initiatives that successfully filled out the Google Form. Initiatives were able to select more than one resource that they needed or offered, owing to the sample size greater 1.

Of these resources, 5 (funding, volunteers, social media presence/reach, large professional network, expertise) were indicated as being both needed and offered by initiatives, at varying levels. These results highlight that there are potential pathways for collaboration within initiatives, yet not all resources are needed or being offered in the area. Although there is potential for collaboration through certain resources, partnerships were the top resources offered, which indicates that initiatives may be able to collaborate independent of the resources that can be offered or required. However, upon analyzing our data, it was realized that inconsistencies between the two questions on our Google Form asking what resources

initiatives need and can offer may impact these results. For example, partnership was indicated as one of the top resources that could be offered, however “partnership” was not a selectable option for resources needed. As a result, we are unable to conclude how many initiatives need partnerships and if this is a two-sided pathway for collaboration or just one-sided.

When asked if initiatives were comfortable with having the information, they provided in the form online, 54% (7 initiatives) responded with yes, 23% (3) with no, and 23% (3) with everything except contact information. We were surprised that only 54% of initiatives were willing to share the information they provided in the Google Form online. However, upon analyzing our data, we realized that we unintentionally provided a misleading option as an answer, which 23% of respondents selected: “Everything except contact information (excluding name of the initiative)”. This was a poor choice to include because in order to contact these initiatives we retrieved their contact information online, therefore excluding such information would not mean that other organizations could not access it online. Even with this data collection error, 23% of initiatives did not want any information from the Google Form published online, which limits the pathways for collaboration if their data cannot be utilized.

From the collaboration potential outlined above, we are able to offer a “matchmaking” process of connecting initiatives. Currently, at the capacity of our project and our online mapping software, we will not be directly contacting and connecting initiatives. Rather, this matchmaking process will involve interested initiatives accessing the online map, viewing the initiatives that have provided the resources they need and can offer, and reaching out to them via the provided contact information if their initiative needs a resource that is offered, or offers a resource that is needed.

3.2 Engagement

Our ESRI Story Map (see Appendix B) currently contains 41 initiatives. Details describing the features of the map are mentioned in Section 2.3 of the methods. This map will be hosted on the websites of CALP: <https://calp.forestry.ubc.ca> and SPEC: <https://spec.bc.ca> until this project reaches a large enough scale upon which we envision it being disseminated on its own website.

3.3 Trends in initiatives focus areas, approaches and locations

From our initial data collection of climate mitigation initiatives in the Metro Vancouver region, we were able to produce a spreadsheet of 41 initiatives (see Appendix C) that are active in the region and target mitigating greenhouse gas emissions, which are requirements outlined by our selection criteria. This list of initiatives is categorized by focus area, wherein 23 fall within renewable energy, 8 in sustainable food systems, 8 in green transportation, 7 in zero waste, and 5 in green urbanization (Figure 4). Initiatives were further categorized by approach, with 15 using education, 7 using innovation, 10 using action, and 8 using multiple approaches to mitigate GHG emissions (Figure 5).

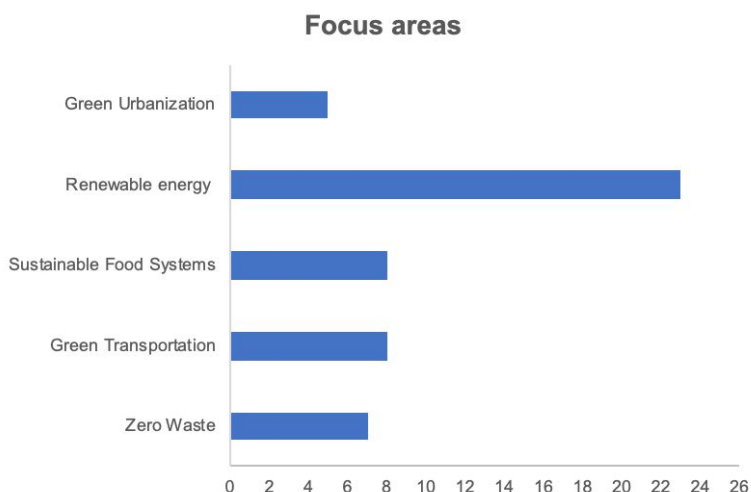


Figure 4. Our data collection of 41 climate mitigation initiatives categorized into five focus areas, with some initiatives falling into more than one category. Focus areas were determined based on the initiative's mission and their current/past work in mitigating GHG.

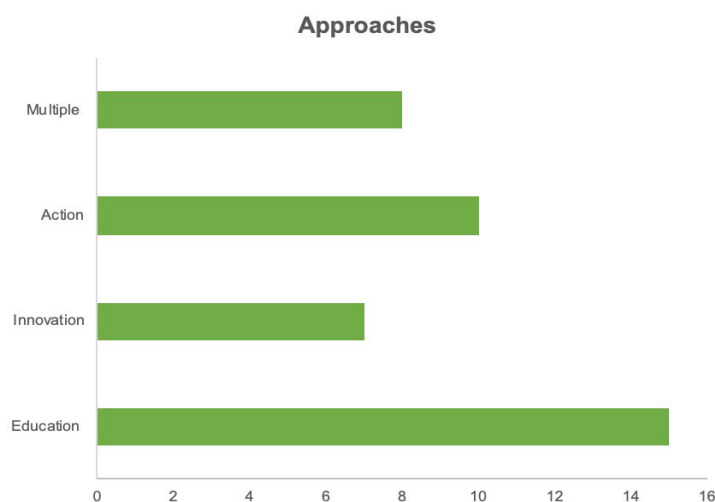


Figure 5. Our data collection of 41 climate mitigation initiatives categorized into three approaches, with some initiatives falling into more than one category, which is indicated by the "multiple" category. Focus areas were determined based on the initiative's mission, their current/past work, and intended audience in mitigating GHG.

Based on these findings, we can identify a trend towards initiatives that focus on renewable energy, as there is a large gap between the number of these initiatives and the others. There is a less evident trend in initiative approaches, although education is found to be the highest. Our data suggest that there is a lack of initiatives that focus on green urbanization, and use innovative approaches to mitigating greenhouse gases in Metro Vancouver. These conclusions are based on responses to our Google Form and our initial database. It should be noted that our

sample size of 41 initiatives is not exhaustive, and a larger sample size could alter conclusions drawn about trends and gaps in the region.

From section 3.1, we identified that the top resource needed is funding, and the top resource offered is partnership. The remaining categories of resources also show there are many pathways for collaboration, but to a lesser extent. Collectively thirteen initiatives indicated they had 34 resources to offer, but 52 resources needed. This imbalance highlights that currently in Metro Vancouver, there is a shortage of resources available to climate initiatives. For example, funding is determined to be the top needed resource, yet is only offered by 1 initiative. This could mean that there is only one potential pathway for collaboration that would fulfill the initiatives' need for funding, which results in limiting the potential success of the remaining initiatives that require funding. This discrepancy also occurs for volunteers, public space, professional networks and tools, where the number of initiatives that are able to offer such resources does not satisfy the number that need them. Although this does not necessarily limit collaboration, it is clear that there are gaps in the resources of climate initiatives in the region.

From Figure 6, we see that 92% initiatives exist in Vancouver, and the remaining municipalities of Metro Vancouver house a much smaller sample size of initiatives, but remain fairly evenly distributed among themselves. We are able to conclude that there are major gaps in the spatial distribution of climate mitigation initiatives in the Metro Vancouver region, and a clear trend in the majority occurring in Vancouver. These gaps could be based on population sizes, local governments, NGO opportunities, etc. and give insight to future climate initiatives in areas that are more highly populated with existing initiatives. Once again, it must be emphasized that our response sample size of 14 is only 37% of the total initiatives that were sent the Google Form; thus, we are unable to conclude that these trends and gaps apply for all climate initiatives within the entire Metro Vancouver region, as more responses could alter our conclusion.

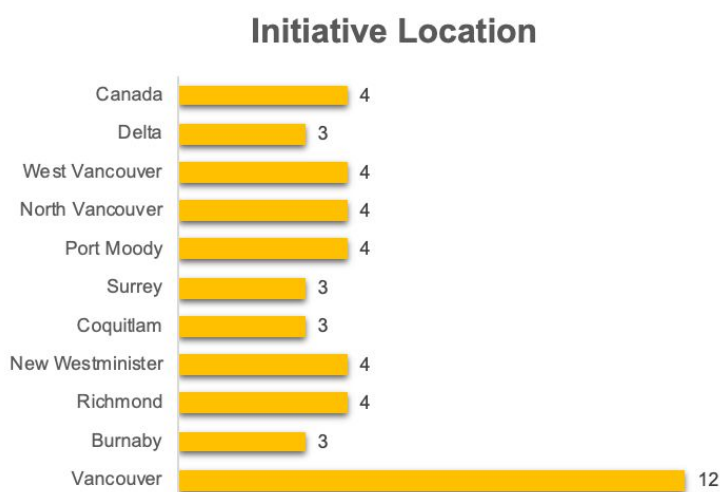


Figure 6. The location of climate mitigation initiatives from data collected through our Google Form which asked where initiatives are active, and allowed for selection of one or multiple regions.

4.0 Future Directions

Moving forward it would be valuable to expand the scope of this project to include a broader range of climate initiatives. Due to our limited timeframe there are also other initiatives that fit our selection criteria (see Appendix D) that were suggested by users of our Google Form, or project partners, that should be included when continuing this project. In the future, this project could explore whether initiatives have attempted to collaborate since the release of our map. Their potential success could give insight into what positive collaboration looks like within the climate initiative world and could be used as examples to be replicated for other collaborations. Otherwise, reaching out to initiatives to determine barriers in collaboration, and trying to facilitate meaningful collaboration between them could result in a more impactful mitigation of climate change than this map currently allows.

The Google Form we created was determined to be a good way to reach out to initiatives. It was relatively quick and simple to make, and the responses indicate that it is an effective way of communicating and collecting information, which can be further examined to make this project incorporate citizen science. We created a new Google Form (see Appendix E) that can be used by our partners going forward, where we improved the clarity of our questions and made it applicable to a wider range of climate initiatives. These updates were based on any perceived confusion from our original form and with the intention of it being used as this project progresses and evolves. In order to utilize citizen science, our partners will need to determine a way for the information provided in our new Google Form (or other surveying platforms such as Survey123) to be automatically added to the map. This will be a challenge to overcome for the map to become self-sustaining in the future, further research will need to be conducted in the field of computer programming and software development to determine a way to automatically add this information.

Ultimately, instead of simply listing the resources needed and offered by an initiative and their location, we would have liked to use a mapping software such as GEPHI that automatically creates a network map linking initiatives (see Appendix F for an illustration of the software). We did briefly utilize GEPHI to explore this possibility, however we realized that the result would not be user-friendly, self-sufficient, or easily presentable to the public. Our “match-making” model is useful in showcasing pathways for potential collaboration amongst initiatives. Our community partners, with the help of Iva from Buddy Up!, will be moving forward with this modelling idea to explore the development of a software that is self-sustaining. Currently, we were unable to get this far based on a lack of resources (funding and software design), but it should be noted that this project is not limited to our work and has great potential for the future.

5.0 Conclusion

The 2018 IPCC report on climate change states the urgency at which we must all act in order to take meaningful steps that are required to mitigate climate change. In order for humans to address such a complex problem, it is valuable to break down climate change into its

contributors and drivers and tackle these smaller factors. Due to the interaction and feedback loops that exist among drivers, whether they be natural or man-made, they are resulting in this larger, overarching problem of climate change.

This project looks at greenhouse gas emissions as a driver of climate change, and aims to highlight and connect climate initiatives that have efforts in reducing emissions, in order to create and encourage meaningful action against climate change. We focused on Metro Vancouver and initiatives that exist within the region to collect data on and map. From this project, we are able to conclude that we found 41 initiatives that satisfy our criteria of being a GHG mitigation initiative, but understand that this is just a “dip” into the large pool of initiatives that exist in the region, and there are gaps in the spatial distribution of initiatives sampled, with Vancouver hosting a much larger portion. From the initiatives sampled, we determined potential for collaboration through the resources initiatives have and can offer. We found that the top resource needed was funding, and the top resource offered was partnership. From this, we determined that there are gaps in initiative resources in Metro Vancouver, such that there are more resources needed than offered. Our data analysis and ESRI Story Map gives initiatives the necessary information for where they could begin looking for collaboration and the pathways in which it could exist. Our ESRI Story Map should not only be used by initiatives, but also by the public looking to get involved in GHG mitigation, as the Story Map allows users to spatially view initiatives and find ones that match their interest or ones that they can assist in offering resources. Our ESRI Story Map will be publicly hosted on our partners website, where it can be accessed. The potential for promoting collaboration amongst initiatives and the public through this project will not end here, as our community partners plan on applying for funding in the future to create an interactive, self-sustaining software that is able to match-make and highlight those potential collaboration pathways in Metro Vancouver. We hope that the data we have collected and presented sparks excitement in the future of climate change initiatives in the region and their work towards mitigating greenhouse gases, as we all fight for a more sustainable future.

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8.0 Appendix

- A. [Initial Google Form Responses to the Form](#)
- B. [ESRI Story Map](#)
- C. [Spreadsheet of initiatives](#)
- D. The following is a list of initiatives that fit within our framework that were either suggested through our Google Form questionnaire or by project partners, that should be considered first when updating this project with new initiatives.
 - Climate Strike Canada
 - Wet'suwet'en solidarity movement
 - Burnaby Mountain Watchhouse in support of the Tsleil-watuth nation
 - B.R.O.K.E
 - Greenpeace
 - Dogwood
 - Bold Actions for a Climate Emergency by City of Vancouver
 - Environmental Youth Alliance
 - Greenbloc by Evergreen
- E. [New Google Form](#)
 Are you a climate initiative in the Metro Vancouver region who would like to be a part of this map? Fill out this form with information about your initiative and it will be reviewed before being added to the map. Thank you for your support in this project!
- F. An image of the Gephi user-interface based on a preliminary “matchmaking” of arbitrary individuals based on resources and needs. We contemplated this software, but decided to use ESRI Story Maps as a deliverable of this project.

