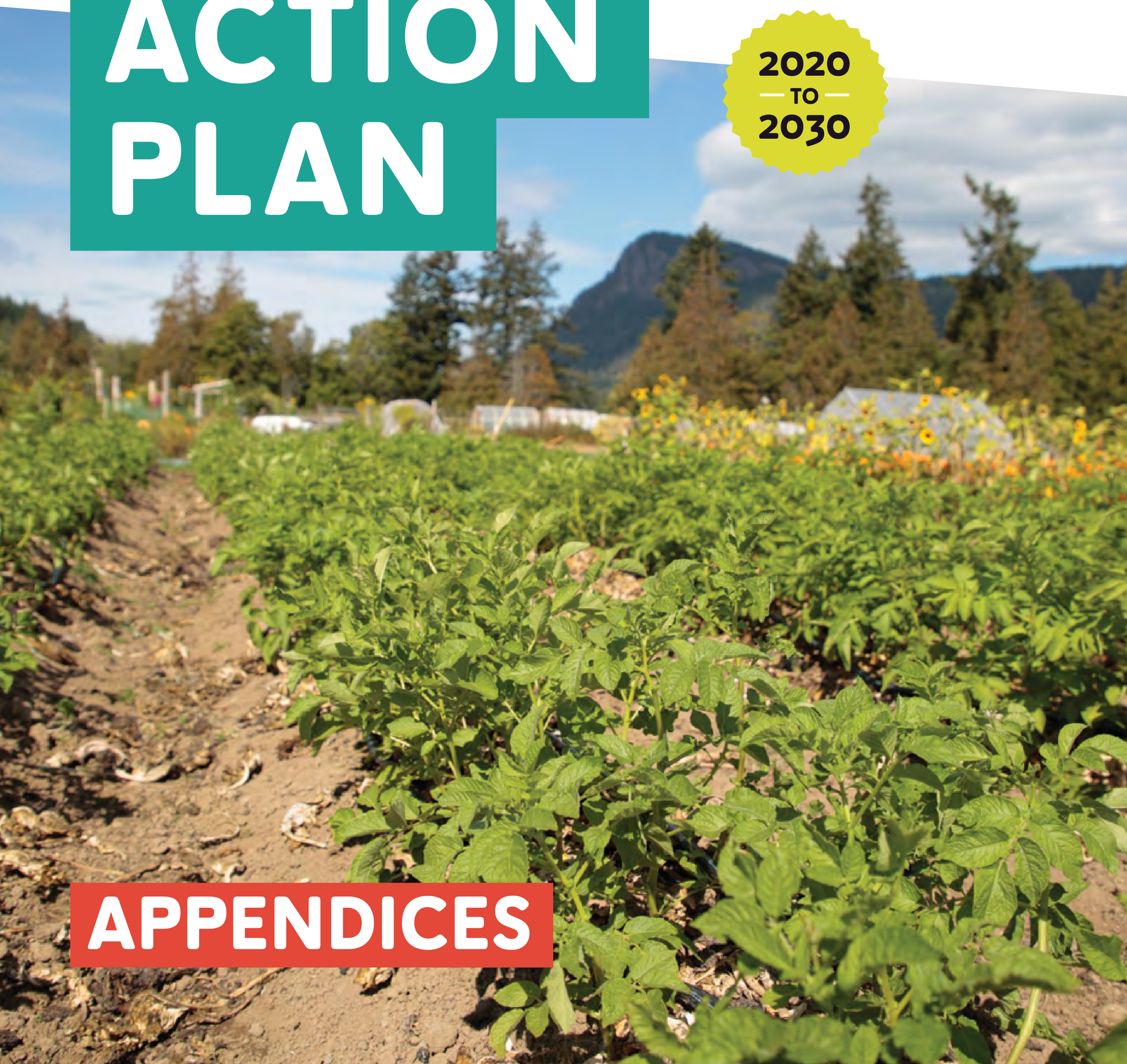
Transition Salt Spring

SALT SPRING ISLAND CLIMATE ACTION PLAN

2020 TO 2030



APPENDICES

This section of the Salt Spring Island Climate Action Plan 2.0 is offered as a standalone document for the convenience of our readers. Note that the standalone documents are missing the context for the plan as a whole and any references or other appendices. For a PDF of the whole Plan which includes all references, or for access to any of the appendices and climate risk maps and data go to http://transitionsaltspring.com/responding-to-climate-change

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APPENDIX 1: SALT SPRING GHG EMISSIONS INVENTORY

This appendix provides a defensible account of current emissions to inform climate action planning. The inventory is incomplete and imperfect. CAP volunteers intend to strengthen the data over time by adding categories currently missing, such as embodied emissions associated with construction and manufactured goods. It is our intention that all data will be reviewed and updated as new information becomes available.

The volunteers working on this report, and on previous data estimates, have been challenged by a general lack of data and by inconsistencies and anomalies in available data from provincial government agencies. A continuous improvement approach to inventories and climate action planning by all levels of government would be very helpful.

Successive groups on Salt Spring have been collecting data since 2004[1] in an attempt to estimate and track emissions. Community Energy and Emissions Inventories (CEEI) data, provided by the Province of BC in February 2014, are available for SSI for the years 2007 and 2010.[2] In July 2020 the CRD released an emissions inventory for the CRD region[3] including a breakdown for SSI.[4] The new CRD data for transportation, buildings, and solid waste have been incorporated in Table 1 below. There are many areas where data are uncertain or lacking. The figures provided here are therefore rounded and are intended to convey the relative magnitude of GHG emissions by sector. 'Total' GHG emissions estimates are the total of the elements we have included. They do not represent the total GHG emissions that islanders are responsible for. The actual total number will be much greater.

Table 1. SSI Community GHG emissions estimates

Not included in the table below are GHG emissions from construction, non-food purchased goods, refrigerant gasses from cars and appliances, off-island travel, including flights and cruises, off-island emissions from video streaming, for example.

	2007	2018	2030[5]	2030 targets
1. Population, rounded up to nearest 100 (CRD & StatsCan data)	10,000	11,100	12,000	12,000
Direct (on-island) sources of emissions		**Emissions, tonnes CO_2e[6]**		
2. On-island transportation (2007 & 2018 CRD data)	32,400	31,700	30,900	16,000
3. Buildings (2007 & 2018 CRD data)	4,600	4,500	5,000	3,200
4. Clear-cut logging	16,000	16,000	16,000	8,000
5. Solid waste (2007 & 2018 CRD data)	3,100	1,700	800	400
Subtotal direct emissions	56,100	53,900	52,700	27,600
Other sources of emissions		**Emissions, tonnes CO_2e**		
6. BC Ferries	22,500	17,400	15,600	3,000
7. Food, based on 80% of 7t CO_2e per capita	56,000	62,200	67,200	30,000
8. Commercial freighter anchorages	-	10,000	10,000	0
Total emissions including ferries, food, and freighters	134,600	143,500	145,500	60,600

Table 2. SSI per capita GHG emissions

Table 2 repeats the data from Table 1, broken down on a per capita basis. In 2018, each islander was responsible for almost 13 tonnes of GHG emissions, excluding individual emissions from airline flights, cruise ship vacations, cloud-based communications and streaming videos, clothing and other purchases.

Not included in the table below are GHG emissions from construction, non-food purchased goods, refrigerant gasses from cars and appliances off-island travel, including flights and cruises, off-island emissions from video streaming, etc.

	2007	2018	2030[7]	2030 targets
1. Population, rounded up to nearest 100 (CRD & StatsCan data)	10,000	11,100	12,000	12,000
Direct (on-island) sources of emissions	**Emissions, tonnes CO_2e[8]**			
2. On-island transportation (CRD data for 2007 & 2018)	3.2	2.9	2.6	1.3
3. Buildings (CRD data for 2007 & 2018)	0.5	0.4	0.4	0.3
4. Land-clearing, logging	1.6	1.4	1.3	0.7
5. Solid waste (CRD data for 2007 & 2018)	0.3	0.2	0.1	0.0
Subtotal direct emissions	5.6	4.9	4.4	2.3
Other sources of emissions	**Emissions, tonnes CO_2e**			
6. BC Ferries	2.3	1.6	1.3	0.3
7. Food, based on 80% of 7t CO_2e per capita	5.6	5.6	5.6	2.5
8. Commercial freighter anchorages	0.0	0.9	0.8	0.0
Total emissions including ferries, food, freighters	13.5	12.9	12.1	5.1

Notes to Table 1 and Table 2

1. Population estimates from CRD and StatsCan[9]. Population grew 11% between 2007 and 2018.
2. On-island transportation covers all vehicles registered on Salt Spring including large commercial vehicles, buses, motorhomes, motorcycles and mopeds, vans, pickup trucks and SUVs, large and small cars, and off-road vehicles such as excavators, tractors, ATVs and boats. The target is equivalent to a 34% annual increase in replacement of gas-fuelled vehicles with electric vehicles (compared to 58.5% actual annual increase from 2011-2019).
3. Buildings include operational energy use: electricity, oil, propane, and firewood. GHG emissions appear to be relatively constant, but need substantiation. BAU projection to 2030 assumes 10% growth from 2018. Target assumes 30% reduction in emissions over 2018, to be achieved through fuel switching and energy efficiency and conservation measures.
4. Land-clearing, logging: comparing forest cover from satellite imaging between 2009 and 2017, 34.5 hectares of forest loss from clearing was measured (areas less than 750 square metres were not included) which averaged out to the clearing of 11 ha/yr. Salt Spring's forests typically store 250–325 tonnes of carbon / hectare, equivalent to 900–1,200 tonnes of CO_2/ha. Two-thirds of these emissions will be released upon clearcutting and associated slash-burning/decomposition, even factoring in storage in long-lasting wood products. The rest will be released from the soil over the next 17 years. The 2030 target assumes around a 50% reduction in clear-cutting.
5. Solid waste emissions estimates include methane generation from organics. Of 3,800 tonnes of waste shipped to Hartland landfill from Salt Spring in 2018, about 950 tonnes was estimated to be organic waste that will generate methane, CH_4, as it decomposes. Hartland

landfill now recovers some of that methane, which accounts for the drop in emissions between 2007 and 2018. The twelve-year GWP of methane is much higher (83) than its 100-year GWP (25). The CO_2e figures provided therefore understate the short-term impact of organic waste. The target assumes a 50% reduction in CH_4 generation due to diversion of SSI organic waste to local composting and other uses.

6. BC Ferries data for routes serving Salt Spring were provided by BC Ferries. Our projection for 2030 is based on emissions decrease of 1.05% per year. The target assumes electric ferries on Fulford and Vesuvius routes.

7. Food estimated at 80% of the US figure of 7 tonnes CO2e per person per year. This is considerably higher than previous estimates. See Appendix 5 for details. Target is aggressive and assumes most islanders adopt a largely vegetarian diet sourced from our region.

8. Commercial freighters data were provided by C. Rohner.[10] These data are not generally included in community GHG inventories because the emissions from international marine traffic are not assigned to individual countries. However, when freighters are parked in our local waters, polluting our airshed and waters, they become a local problem. BAU projection assumes commercial freighter anchorages unchanged. Target assumes no freighter anchorages.

Sources of GHG emissions

Direct community GHG emissions are those released on SSI or in the immediate environs. They include CRD estimates of tailpipe emissions from our vehicles, wherever we may be driving them, based on assumptions of average Vehicle Kilometres Travelled (VKT) per year, and emissions factors which vary based on the type of vehicle. Direct emissions attributed to our community also include GHG emissions related to on-island electricity use, even though those emissions occur at distant generating stations. Since 2004, when SSI undertook its first GHG emissions inventory, SSI has included emissions from BC Ferries attributable to Salt Spring routes. Salt Spring has also included indirect GHG emissions estimates for the food we eat.

In 2020, SSI added estimated annual GHG emissions from the freighters now anchored in our waters. Also included are estimated annual GHG impacts of land clearing and logging, and estimates of the CO_2 removed from the atmosphere each year by our forests. These estimates were generated by teams of volunteers researching, mapping and, in the case of the land clearing figures, ground truthing the numbers. Separate summary reports and maps are available.

A different approach for community GHG emission inventories

Salt Spring does not follow international or regional protocols for our Community GHG emissions inventories. SSI includes some additional GHG emission sources and excludes others where we have no information. We do not always organize the sources in the sectoral categories used by other communities. For a recent example of the standard approach, see the District of Saanich 2018 Emissions Inventory Report.[11] Part of the reason for the difference is lack of funding, but more importantly, we have organized our sources and sinks in a way that makes sense to us for community and individual GHG planning purposes.

This approach is controversial, especially for the indirect GHG emissions associated with the food we eat. Because of the controversy and complexity of this topic, a separate appendix describes food system GHG emissions in detail. Indirect emissions from the food system are part of a much larger category of global and life cycle emissions not generally included in community emissions inventories, but which in our view should be. Food provides an example: 30% of global anthropogenic GHG emissions comes from the food system, and annual per capita GHG emissions for the average US food cart are about 7 tonnes. For comparison, average annual per capita GHG emissions for Canada are 22 tonnes.

Virtually everything we do or purchase has a GHG emissions cost associated with it. If we are to understand the climate impact of our purchases and lifestyle choices, and if local government is to make informed planning and purchasing decisions, it is critical that the total associated GHG emissions impacts are known, including, but not limited to, the direct operating or tailpipe emissions. This information is essential for the science-based decision-making needed in the evolving climate emergency. The COVID-19 pandemic provides a good example of the importance of applying science-based decision-making early in an emergency situation.

What the numbers indicate

With the caveat that all estimates are uncertain, and that some sources of emissions are direct (emitted on Salt Spring), while others are indirect (emitted elsewhere for goods consumed on Salt Spring) the largest source of Salt Spring's GHG emissions in 2018 is related to our food. On-island transportation, BC Ferries, and logging and land clearing, in descending order, were the next largest sources of emissions, with commercial freight anchorages close behind. Emissions from building energy use—including electricity, propane, heating oil and firewood—and organic waste were the least of all the included sources. However, this is not to say they are less important as a target for our actions, because of the embodied energy of the construction materials used, and because they represent areas where islanders have a measure of control.

The 2030 targets column in Table 1 indicate where savings can be made to meet the objectives of GHG emissions reductions of 50% by 2030. The assumptions for the reductions are provided in the notes to Tables 1 and 2. They show it is possible to meet the targets, but it will be challenging.

Emissions from clear-cutting

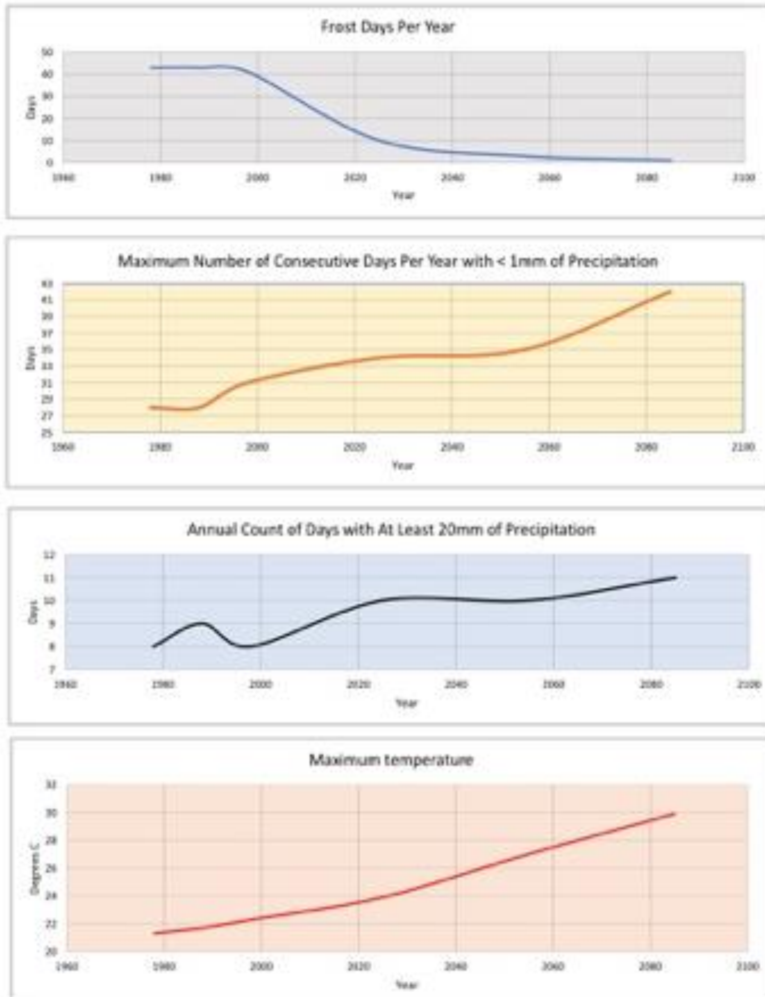
Anthropogenic modifications of the forest like clearcutting, deforestation (removing forests permanently), slash-burning and fires reduce the carbon sink and add GHG emissions to the atmosphere. The provincial inventory calculates these anthropogenic emissions but does not include them in the official overall emissions even though they constitute at least 50% of the total. It is essential that Salt Spring tracks and monitors the carbon being sequestered by our forests and the carbon being emitted by anthropogenic sources: clearcutting and slash-burning. Without these figures we are not telling one of the most critical parts of the climate story.

APPENDIX 2:
SALT SPRING ISLAND CLIMATE CHANGE RISK ASSESSMENT

In 2018 and 2019 we experienced what can be considered a perfect storm of weather extremes. On a single day in December 2018, Salt Spring experienced what was called a “once-in-200-year” windstorm that resulted in the most expensive loss of electrical infrastructure in BC Hydro’s history, extended widespread power outages, and the loss of water supply, as well as scores of damaged and impassable roads. Trees in our drought-stressed forests fell by the thousands, damaging houses and requiring removal.

This disaster was followed by a period of extreme cold with as much as 1.5 metres of snow that reduced spring water recharge and added to the severity of what was a very dry spring. Our lake and aquifer levels started 2019 in drought. The impacts were widespread: poor food crop yields, heightened fire risk, and further stress on increasingly fragmented forests, with knock-on effects on the health and diversity of wildlife.

To cap off an annus horribilis, a dry October and November, combined with existing low water levels, renewed the potential for a spring drought in 2020. Sadly, based on climate models for our region, this volatility is our new normal.



Source: PCIC Climate Explorer, CanESM2, rcp8.5, Salt Spring Island polygon.

The four graphs show how our weather cycles are expected to change over the next 80 years. From top to bottom: winter frost periods will be dramatically reduced, with implications for overwintering pests and extended growing season for some food crops. Although the same annual precipitation is expected, on average, there will be less rain in the summer and droughts will become longer and more severe. However, more rain will come as heavy downpours in the winter months. Most warming will be realized through the winter months as the lack of low temperatures. This is reflected in the final graph, showing the average annual maximum temperature increasing

Key climate risk themes

In CAP 2.0, there is an overall emphasis on enhancing forest and freshwater health and biodiversity to reduce or mitigate various climate risks including fire, drought, and deterioration of water quality. The following represent key actions that have guided the development of this Plan.

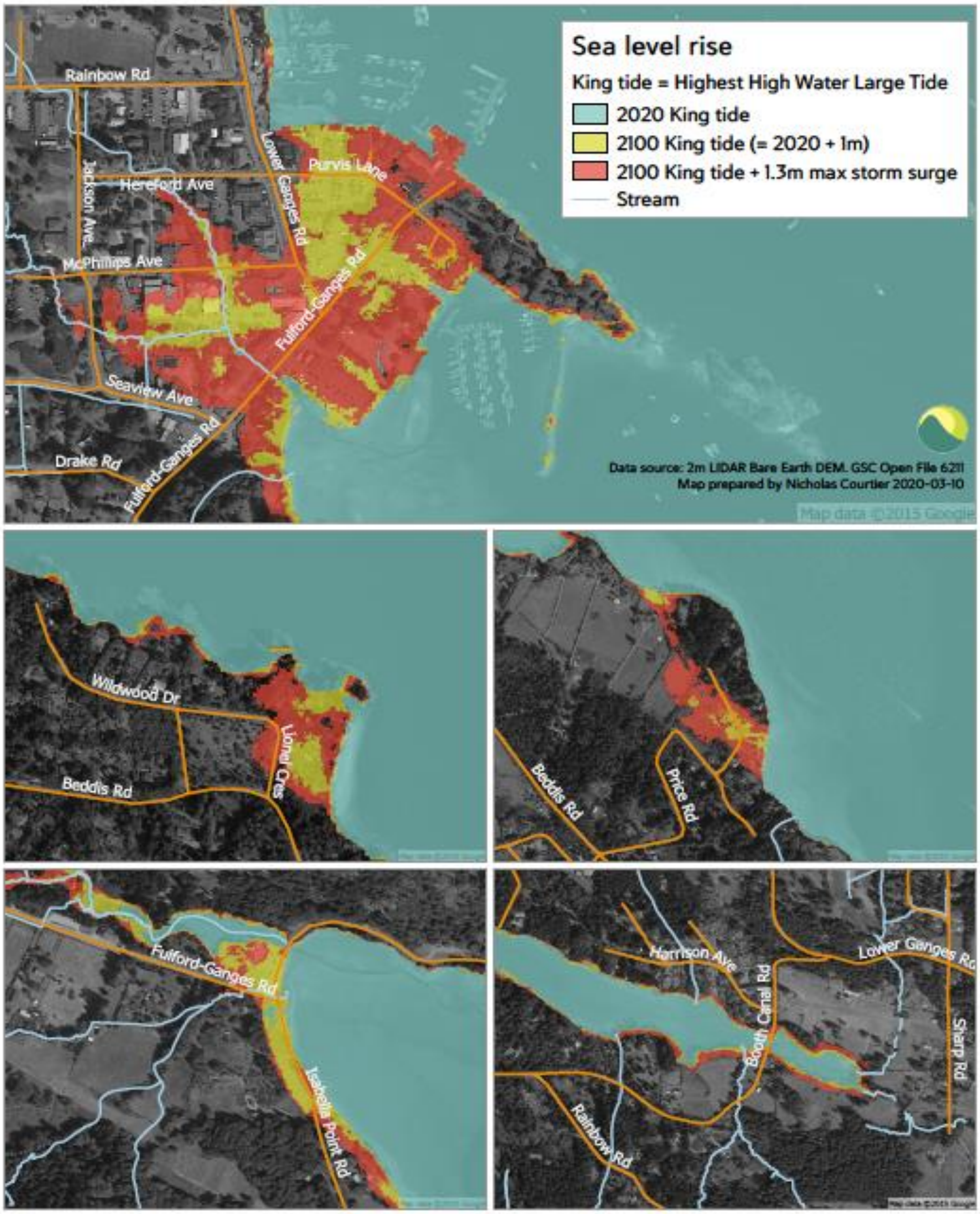
1. Develop and maintain climate risk maps supported by routine aerial and other

monitoring to inform climate risk reduction activities.

2. Manage fuel loads in forests to reduce fire risk through slash removal, chipping, biochar, or other low/no combustion methods.
3. Link shared climate change risks to opportunities for shared action (e.g., fire risk management and watershed protection).
4. Protect the forest understorey by limiting browsing by over-abundant deer and rabbits, and through ecosystem restoration, plantings, and invasives removal.
5. Plant appropriate species, especially in exposed areas such as on southern slopes, and remove highly flammable invasives such as broom and gorse.
6. Ensure that the Coastal Douglas-fir Development Permit Area contains strong enforceable protections for aquifers and recharge areas, and develop a forest fire Hazard Development Permit Area.

The Salt Spring Island Climate Risks Mapping Project

Given that the best available data is pointing to increased climate risks globally, our forests working group wanted to know in more specific terms how climate change is likely to affect our island. To do this, they developed a series of maps especially for CAP 2.0, using BC climate data from the Pacific Climate Impacts Consortium and other sources. These maps inform the goals, strategies, and actions laid out in the Plan. Thanks to the Islands Trust and a private donor for financially supporting this critical work.



The Salish Sea region is expected to experience less change relative to some other regions of North America, and will serve as a climate change refugium for many species of trees, herbs and medicinal plants, native foods, and wildlife that will lose their abilities to survive in other regions. Nevertheless, threats are increasing in the form of increasingly erratic and extreme weather patterns and storms. Increased drought and heat are stressing trees and negatively impacting biodiversity, wildlife, and watersheds. Unintended consequences of land management practices can exacerbate risk. Increased forest fragmentation can create wind channels that funnel storms and lead to increased wind throw (fuels). Sea level rise will change local aquifers, streams and shorelines in some parts of the island, with implications for groundwater and habitability. Ultimately, these cascading natural systems impacts lead to problems in agriculture, in the economy, and in human health.

The group's analysis shows that not all parts of the island will experience the same weather extremes. Some areas are likely to see more change than others, especially those at higher elevations like Mount Sullivan, Mount Tuam, Mount Bruce, Hope Hill, and Mount Erskine, which are expected to experience a greater increase in extreme high temperatures. Fire risk is driven by factors such as the duration of heat waves, the type and condition of forests and vegetation, topography, accessibility, and the extent of fire suppression and other land management strategies (Mike D Flannigan, 2005) (van der Kamp DW, 2014). Extreme heat, drought, and the loss of soil moisture will affect forest and soil health, and our agricultural productivity. Key changes for Salt Spring and other Salish Sea islands include:

- Generally increased temperatures in all seasons. Winters will experience the greatest warming, particularly at elevation, with a near absence of frost days during most winters. Spring will experience less dramatic warming. All of these changes have direct implications for island water.
- More severe weather in the form of heavy rainfall, extreme temperatures, windstorms, and hail. Heavy rainfall will account for most of the rain through the autumn and winter months. Extreme weather events will be both more intense and more frequent.[12]
- Hot summer days will become more numerous and extreme. There will be warmer days, with average summer highs of 30°C and 50% fewer days with frost. This will amplify overall heat leading to increased water temperatures, evaporation, and drought. This in turn will compromise soil health, water availability, and ecosystem health and diversity, decreasing the ecosystem's ability to recover from shocks.
- Rain-free days will increase by 50%. Low water levels going into autumn can combine with decreased winter rainfall to lead to spring drought and poor growth in wild and cultivated areas.[13]
- Multi-year drought will be more common, exacerbating impacts from storms and extreme weather. Enhancing natural water recharge and storage in wetlands will be necessary to preserve surface and groundwater both for ecosystem function and potable water.
- Less predictable seasonal weather will include the timing and amount of rain and increased temperature variability. Changing rainfall patterns are expected to differ along north-south and west-east parts of SSI. These changes will have significant impacts on ecosystems, agriculture, infrastructure, our economy, and daily life.
- Sea level rise through storm surge, inundation, and salt-water intrusion is projected to increase by 0.5 metre by 2050 and one metre by 2100. Impacts will be most severe in the areas of higher population density like Ganges and Fulford.[14]

Understanding risks and increasing resilience in an era of climate change

Through the Climate Risk Mapping Project, we set out to understand how climate change impacts are likely to affect our water, forests, and fire risks. We engaged local experts with

Salt Spring Island Fire Rescue, environmental educators, scientists, and local government officials over several months to contextualize risk and identify some of the key priorities and concerns for Salt Spring.

What became clear is that we face a situation where one set of actions sets of a chain of unintended negative consequences or co-benefits. For example, if we continue to log as we have been doing, we will further compromise our water supplies, making us more vulnerable to fire. But the positive chain reaction potential is equally true. The chart below summarizes the risks we face, and the opportunities they present to maximize positive synergies and reduce negative feedback loops.

Risks	**Opportunities**

• Clear-cut logging and reduced forest health increase fire risk, decrease groundwater recharge and freshwater levels, further increasing vulnerability of trees to fires and storms
• Exposed, dry soils allow highly flammable invasive plants like broom and gorse to spread on slopes, clear-cuts, and under transmission lines, increasing fire risk to homes and infrastructure
• Overpopulation of deer and rabbits leads to over-browsing which leaves forest soils denuded and exposed to further desiccation, loss of mycelium, and weakened trees more susceptible to wind and fire
• Loss of soil carbon following clearing loads carbon into the air, oceans, and freshwater systems for years, multiplying climate change impacts
• Combustion of woody debris results in health impacts, contaminated water, and ground level ozone
• Fires and firefighting deplete watersheds and damage ecosystems; the 1982 Mount Maxwell fire required 0.5 million litres of water to fight
	• Chipping and composting woody debris create an excellent lower-carbon alternative to open burning and a local source of nutrient for local agriculture
	• Perennial vegetation in gardens and farms acts as a fire break and also helps increase water retention and flow, enhancing overall water quality
	• Coastal Douglas-fir, Garry oak, and wetlands increase biodiversity and groundwater recharge; they support well water quality and quantity and build fire resistance
	• Increased capacity of agencies to collaborate effectively to build ecosystem and community resilience
	• Old-growth trees provide structural and ecological value within forests, increasing resilience to climate change while enhancing diversity
	• Canopy forests with robust native understorey:
	  ○ moderate air and water temperatures
	  ○ protect shores from erosion
	  ○ increase soil moisture, enhancing forest health and biodiversity
	  ○ suppress invasive colonizers that limit growth by native plants

The role of forests and natural ecosystems

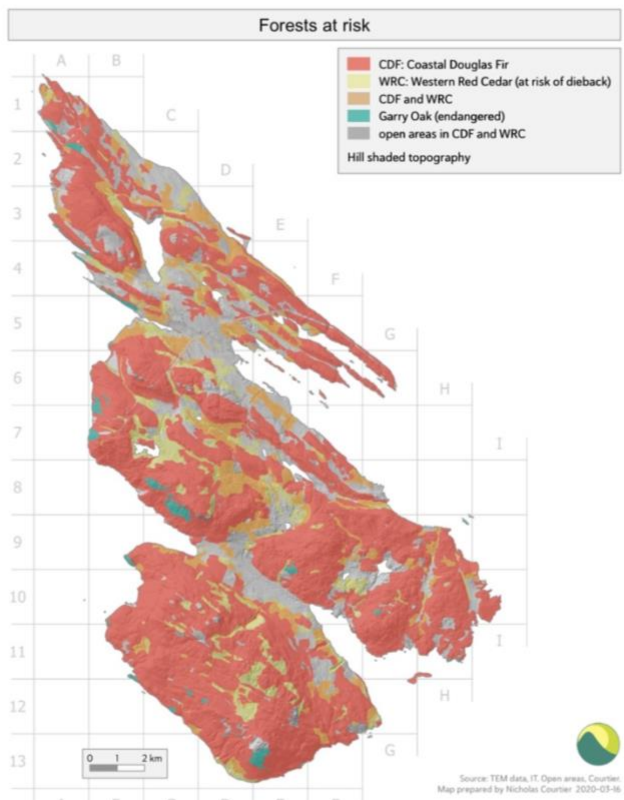
The growth and productivity of our coastal forest systems and natural water cycles are already changing in response to shifts in temperature, rainfall, and weather variability. This has implications for our lakes, wetlands, and the wildlife that rely on them. These stressors are made worse by land-use policies and individual actions that ignore climate change.

Increasing forest fragmentation is significantly compounding stresses on forests and watersheds from decades of drought and increasing weather variability. Over 200 hectares of forest were disturbed between 2004 and 2014 – 166.7 ha from rural development and roads, and 34.9 from land-clearing and logging. Presently, forest disturbance is increasing. During some of our worst dry years—between 2009 and 2017—some 86.5 hectares of forest were removed. That's equivalent to the loss of more than 120 soccer fields or 15 every single year. This loss has created heat sinks, exposed fringes of trees to windfall vulnerability, and degraded overall ecosystem health. Forest clearing has increased since 2017, with unknown consequences.

Clearing of trees over this eight-year period contributed over 10,800 tonnes of carbon emissions. That's equivalent to one year of emissions from almost 10% of Salt Spring residents. It takes 80-110 years for a forest to regain through growth the carbon lost to the atmosphere from its earlier removal. Preserving and enhancing our forests by restricting and managing large-scale tree removal constitutes one of the simplest and most cost-effective ways of reducing GHG emissions, our vulnerability to fire, and the risk of water depletion.

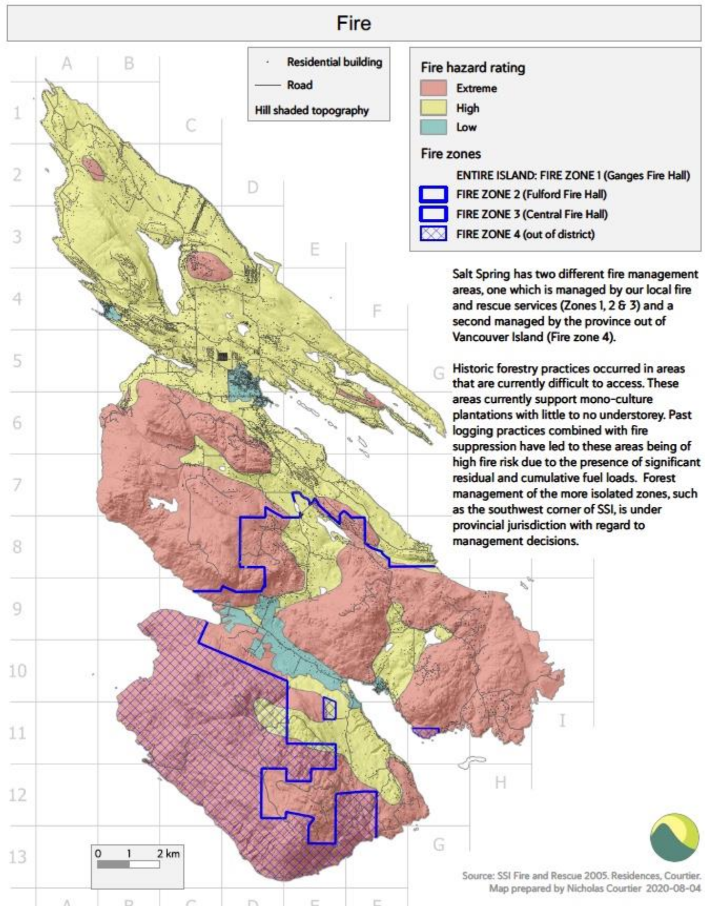
Climate change is also causing shifts in the timing of wildlife's breeding and feeding, and amongst pollinators and flowering plants. Forest fragmentation and the loss of year-round wetlands also impact marine species like spawning salmon, freshwater species like red-legged frogs and terrestrial species like the sharp-tailed snake.

Our forests and native ecosystems are changing and degrading in ways that are challenging to predict. We must develop climate-smart policies that enable our coastal forest ecosystems to adapt successfully in response. This will help retain intact healthy natural areas to provide the ecological and support services that both wildlife and our community depend on. The strategies that are needed on Salt Spring will differ from those employed elsewhere due to local differences in climate and extreme weather.



Managing our fires and water risks

The current fuel load from clear-cutting and downed trees from storms requires that policies and fire management strategies be developed. Controlled burning, slash removal, composting, chipping or biochar manufacture, along with enhancing the health of forests and increasing soil moisture content all need to be part of these strategies. Our most abundant forest type, the Coastal Douglas-fir, is recognized for its potential to slow the spread of fire, making its preservation critical. Forest fires most often start in clear-cuts where there is ample dry debris. It is important to note that areas at highest fire risk, especially Fire Zone 4, are difficult to access and have high fuel loads from historic logging activities. Restoring understorey/vegetated fire breaks will be an important fire risk reduction strategy in these areas.



The destruction of forests, drying of wetlands, and the loss of water recharge and water-retention capacity of soils during periods of drought all contribute to turning woody materials that are healthy for wildlife and forests into fuel loads that create fire risk. Many native understorey plants are also known to slow fires, so both forests and wetlands work to reduce fuel load and fire risk. Drought – which is often coincident with peak water consumption – directly affects the health of our forests by exacerbating soil desiccation, thereby further increasing fire risk.

Dry exposed south-facing slopes present an increasing fire risk for Salt Spring. These areas are subject to numerous pressures that reduce plant regeneration, such as erosion of exposed slopes and over-browsing by deer. The incursion of flammable broom and gorse, as well as dying trees, logging debris, and burn piles are all potential sources of intensified fires over the coming decades. Conversely, healthy ecosystems at higher elevations and on slopes, especially those with “benches” that are moist and well-vegetated, contribute to recharge all year and reduce fire risks.

Detailed climate risk mapping which locates and describes the relationships between forecast zones of extreme heat, changes in rainfall patterns, water recharge areas, and emergency services access provides an opportunity to develop land-use policies that reduce future risks. While it is true that existing Islands Trust policies provide for groundwater protection and water sustainability, these need to be updated to recognize the synergistic impacts of various climate change risks together with how we use land.

The incorporation of development permit areas (DPA) has potential to help Salt Spring preserve and protect island ecosystems while adapting our community to climate risks. However, other tools need to be explored as well, given the previous failure of DPAs to achieve their stated objectives. Protecting ecosystems that provide myriad ecological services to human and non-humans alike is significantly less costly than replacing ecosystems and built infrastructure that have been lost due to fires and storms. The Trust's proposed Coastal Douglas-fir DPA needs to incorporate robust features, such as those found in the Cowichan Valley Regional District's draft Aquifer Protection DPA,[15] while emphasizing the complementarity between enhancing water recharge, decreasing fire risk, protecting the uplands of fish-bearing watersheds, and encouraging a diversity of wildlife and wildlife corridors. A forest fire Hazard DPA could similarly be defined with the assistance of Salt Spring Fire Rescue, Emergency Services, hydrologists, and conservation experts to help implement locally relevant FireSmart measures.

In summary, enhancing forest health, protecting freshwater, and building biodiversity will reduce fuel loads, fire risks, water contamination, windfalls, and other hazards. This saves lives, buildings, infrastructure, and costs to our local economy. There is tremendous potential when we begin to facilitate rather than block these synergies. Think of the well-documented synergistic potential, for example, of combining greywater use, water catchment, and wetland restoration for ecological diversity and water conservation.

Our current regulatory apparatus, however, needlessly complicates the implementation of the types of measures required to restore ecosystems to help protect our community from fire risks, for example. By adopting a systems approach that recognizes interconnections, synergies and the value of resilient, integrated ecosystems, we also get stronger, more prosperous communities.

We need to better understand how our actions affect freshwater health and fire risk, so that we can enshrine these understandings in how we do things.

APPENDIX 3: THE CO-BENEFITS OF CAP IMPLEMENTATION

We received many questions during our public engagement about the costs of the climate action we are going to need to decrease the multiplying risks we are facing. When thinking of climate action, we often think of sacrifices. 'Shivering in the dark' is the classic one, which is of course untrue since increased energy efficiency done well leads to better home comfort.

The fact is global economic growth is already far less dependent on fossil fuels than it once was (Deutch, 2017). Between 2014-17, global emissions growth actually flatlined, while economic growth increased significantly (Deutch, 2017). These trends are not accidents and are the products of a social and political consensus. 'Decoupling' of economic prosperity and fossil fuel use is happening everywhere where strong supportive policy environments exist.

Decarbonizing our economy is now driving the types of profound shifts we saw with the rapid growth of information technologies. It has upended business models in many sectors (think retail, think television networks) and given birth to scores more. Salt Spring is no exception to this trend. Implementing CAP 2.0's actions will have wide-ranging positive impacts on the economy, jobs and in harder to quantify but important areas like public health, and quality of life. Here is a summary of the co-benefits we can expect based on observed global trends.

Increasing our disposable incomes

GHG reductions will permanently reduce expenditures on gasoline, diesel, propane and fuel oil, resulting in more money available for other expenditures. For example, if by 2030 the recommended change to electric passenger vehicles is achieved (6000 vehicles) annual consumer savings could be in the range of $6 million in fuel, and $2 million in maintenance and repair.

Improving public health

Public health co-benefits from climate action can increase public buy in for GHG mitigation and adaptation strategies while increasing their overall value. On Salt Spring, decreasing emissions on everything from forestry slash, to fossil-fueled transportation and forest fires contributes significantly to cleaner air and better health outcomes. Improving active transportation options for walking and biking, improving our forests, and increasing the amount of island-grown organic food all help to improve public health and quality of life.

Money does grow on trees

Increasing BC's carbon tax to reflect its actual cost will result in more funding for carbon sequestration activities. Think forests. We need to provide property owners with an economic incentive to keep their lands forested. From an 'ecological services' point of view, trees are more effective alive than dead in helping to prevent flooding from storms, degraded water quality, drought, and forest fires. A field of broom and gorse choked with slash is just a fire hazard. A carbon tax that sends the right price signal could be a boon to Salt Spring.

Improving the visitor experience

People come to Salt Spring to play on its waters, to hike in its forests, recreate in peaceful surroundings, and buy locally-produced food. Protecting the amenities that visitors value is good for our local economy. Maintaining healthy forests and intact ecosystems, expanding trail networks, and increasing local agriculture all build a stronger base for a high-quality visitor experience. By encouraging growth of the things we value, we make tourism a win-win for Salt Spring.

Building better agriculture

Feeding farmers feeds people. And feeding a farm's soil and protecting its surrounding ecosystems buys us resilience in times of increasing drought and erratic weather. Give our farmers access to local nutrients from an on-island chipping and composting facility, and provide them with free training on how to make their land healthier while producing more. Doing this and more makes our island more food secure, keeps our dollars circulating in our local economy longer, provides livelihoods for young families, and helps protect our land and waters.

Adopting low carbon diets

When we shift to a lower carbon diet, we not only lower emissions, but also improve our health. This doesn't necessarily mean a vegetarian diet. Eating local, free range meats and dairy products are usually lower in carbon intensity than feedlot equivalents. And if you add local to the equation, you are doing all sorts of things to help your neighbours.

Building disaster resilience

Strengthening the island's capacity to respond to climate change-related emergencies will make us better able to cope with other disasters such as earthquake, tsunami, pandemic, or food supply disruption however caused. We can do so by building stronger radio networks, increasing CRD support for our POD system, and by including community groups at the table with government to coordinate our climate response.

Driving local employment

Local investment in GHG reduction and climate adaptation will stimulate capital expenditures. This creates jobs and business opportunities, and can even create new ongoing employment in areas such as forest stewardship. Think elevated roadways in areas like the end of Fulford Harbour to avoid a rising sea, selective logging and planting in our forests, tiny and not-so-tiny home construction using certified, island-grown and stamped lumber. We can better use island resources to lower emissions, while improving our forests. We can also prepare for a challenging future while improving social equity on our island.

Revitalizing our village centre

The CRD's own data shows that we need to plan now to avoid painful losses due to sea level rise particularly in Ganges and at the north end of Fulford Harbour. While the planning and development required will take more than a decade, this process gives us a precious opportunity to reimagine Ganges village to make it more lived in, more walkable, more green, more vibrant to visitors and locals alike, and more inclusive. Water is not the issue when we incorporate rainwater storage, greywater and composting toilets.

Supporting local innovation

Implementing comprehensive climate action along with addressing other issues like housing and a lopsided seasonal economy can motivate local entrepreneurs to innovate, and create new products and services to serve people at home and away, bringing economic benefits to our shores. While the COVID-19 rush for land is worrisome on some levels, it is also bringing with it some younger families who telework. Often these are people working in creative fields, which helps bring more cultural life to our island. Innovations in aquaculture and talk of 'blue carbon farming' in our oceans around Salt Spring are giving rise to new enterprises like kelp and shellfish farming which can add diversity in our waters while pulling carbon out of the air.

Buying local

When you buy from an independent, locally owned business, rather than a nationally owned business or distant online retailer, a greater portion of your money is recirculated in our local economy. This also reduces the number of trips we need to make off island to get what we need. These benefits ripple beyond simple emissions savings out to the community to create better livelihoods for our fellow islanders.

APPENDIX 4: FOOD SYSTEM GHG EMISSIONS EXPLAINED

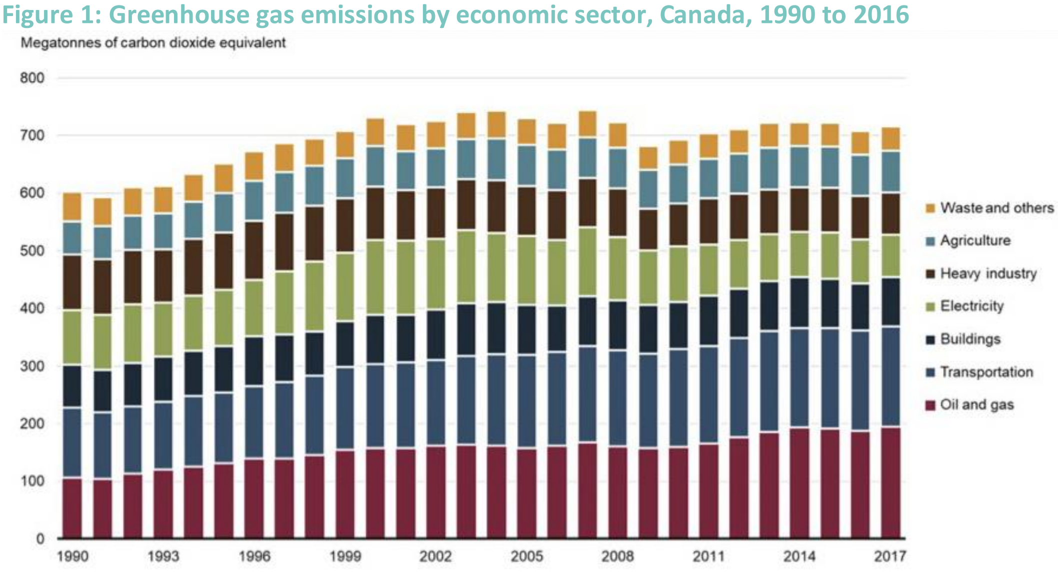
We eat every day, and our food choices have a huge GHG impact. Global GHG emissions from the food system account for about 30% of all anthropogenic GHG emissions (Natural Resources Canada, 2020). Studies from a range of high-income countries found food system emissions contributed between 15% and 28% of overall national emissions (FarmFolk CityFolk Society, 2019). About 20% of Canada's total emissions may be attributable to the food system, of which about half come from agricultural emissions and the balance from post-production (FarmFolk CityFolk Society, 2019).

Food system GHG emissions come from agricultural production—including clearing of tropical forests for beef production, synthetic fertilizers, animal manure, farm machinery, tillage—and post-harvest processing, packaging, transportation, manufacturing, refrigeration, retailing, cooking, and waste.

'Food miles', the distance food travels to reach our plates, are not a big factor. On average, transportation contributes around 10%, a relatively small percentage, to total GHG emissions related to food. This amount varies by item of course and is much higher when food is transported by air.

Research on food system GHG emissions is relatively recent, most of it published in the last two decades. Food system GHG emissions must be identified and separated from the different economic sectors where they are accounted for--waste, heavy industry, and buildings and transportation--and added to emissions from agriculture. Estimates of per capita emissions from the food system range from about 7 or 8 tonnes CO_2e per year for the US to less than 2 tonnes CO_2e per year for the world average (Bajželj, 2013).[16] Because of the complexity, there is much uncertainty associated with food system GHG emissions.

Figure 1: Greenhouse gas emissions by economic sector, Canada, 1990 to 2016



Source: Environment and Climate Change Canada, 2018 FarmFolk CityFolk

Canadian GHG emissions from agriculture

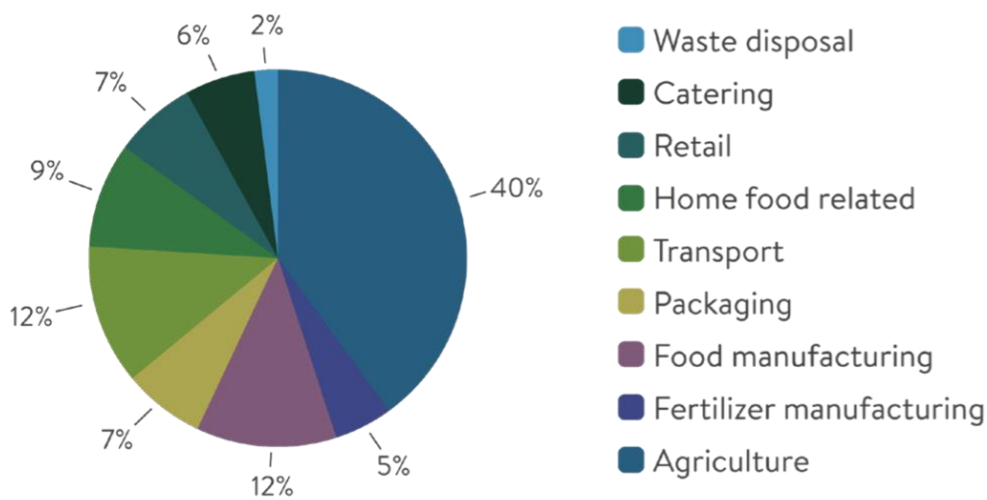
When the federal government cites CO_2e emissions caused by agriculture, none of it is energy- or transportation-related. Those figures are reflected in those sectors, shown in Figure 1. Using the government's "Greenhouse gas sources and sinks: executive summary 2019," which uses data from 2017, they attribute 60 Mt CO_2e to agriculture, which amounts to 8.4% of Canada's total emissions. This is how they come up with the 60 Mt:

- Agricultural soils: 25 Mt
- Enteric fermentation: 24 Mt
- Manure management: 8.0 Mt
- Liming, urea application, and other carbon-containing fertilizers: 2.5 Mt
- Field burning of agricultural residues: 0.05 Mt

Sources of food system GHG emissions

As yet, there is no breakdown of total food system GHG emissions for Canada. Figure 2 shows the breakdown for the UK, where 45% of GHG emissions are attributable to agriculture and fertilizer manufacturing, and 55% to post-harvest activities.

Figure 2: Breakdown of food chain GHG emissions by stage in the UK



Source: Adapted from Garnett, 2008 Farm Folk City Folk

Salt Spring's evolving estimates for GHG emissions from the food system

Three GHG emissions reduction plans have been prepared for Salt Spring: the 2005 SSI Community Energy and Emissions Strategy, the 2011 SSI Climate Action Plan (CAP 1.0), and the 2020 SSI Climate Action Plan (CAP 2.0). Each includes estimates for total food system GHG emissions to give islanders an understanding of the climate impact of their food choices.[17] This approach is not standard practice and gives rise to some double counting (e.g., emissions related to local supermarkets are included in the buildings category and in the food category). However, it gives a much better understanding of the total climate impact of the food system than the standard sector breakdown shown in Figure 1.

Table 1: Total and per capita estimates for Salt Spring's GHG emissions related to food

	SSI indirect per capita emissions from food system	Total SSI indirect emissions from food system for baseline year 2007, population 10,000	Total SSI indirect emissions from food system for 2018, population 11,100
2005 SSI Community Energy and Emissions Strategy	4 tonnes CO_2e	40,000 tonnes CO_2e	N/A
2011 CAP 1.0	2.8 tonnes CO_2e	28,000 tonnes CO_2e	N/A
2020 CAP 2.0	5.6 tonnes CO_2e	56,000 tonnes CO_2e	62,200 tonnes CO_2e

Table 1 shows how our assumptions regarding food system GHG emissions have changed. The 2005 Community Energy Strategy food system GHG emissions estimates were based on energy only. For CAP 1.0, 70% of the previous estimate of 40,000 tonnes GHG was used to account for on-island double accounting and healthy dietary choices. Both 2005 and 2011 estimates were based on energy use; neither considered GHG emissions from methane, nitrous oxide, and refrigerant gases. These gases have many times the global warming potential of CO_2. Both reports therefore underestimated the contribution of the food system to the average islander's GHG emissions.

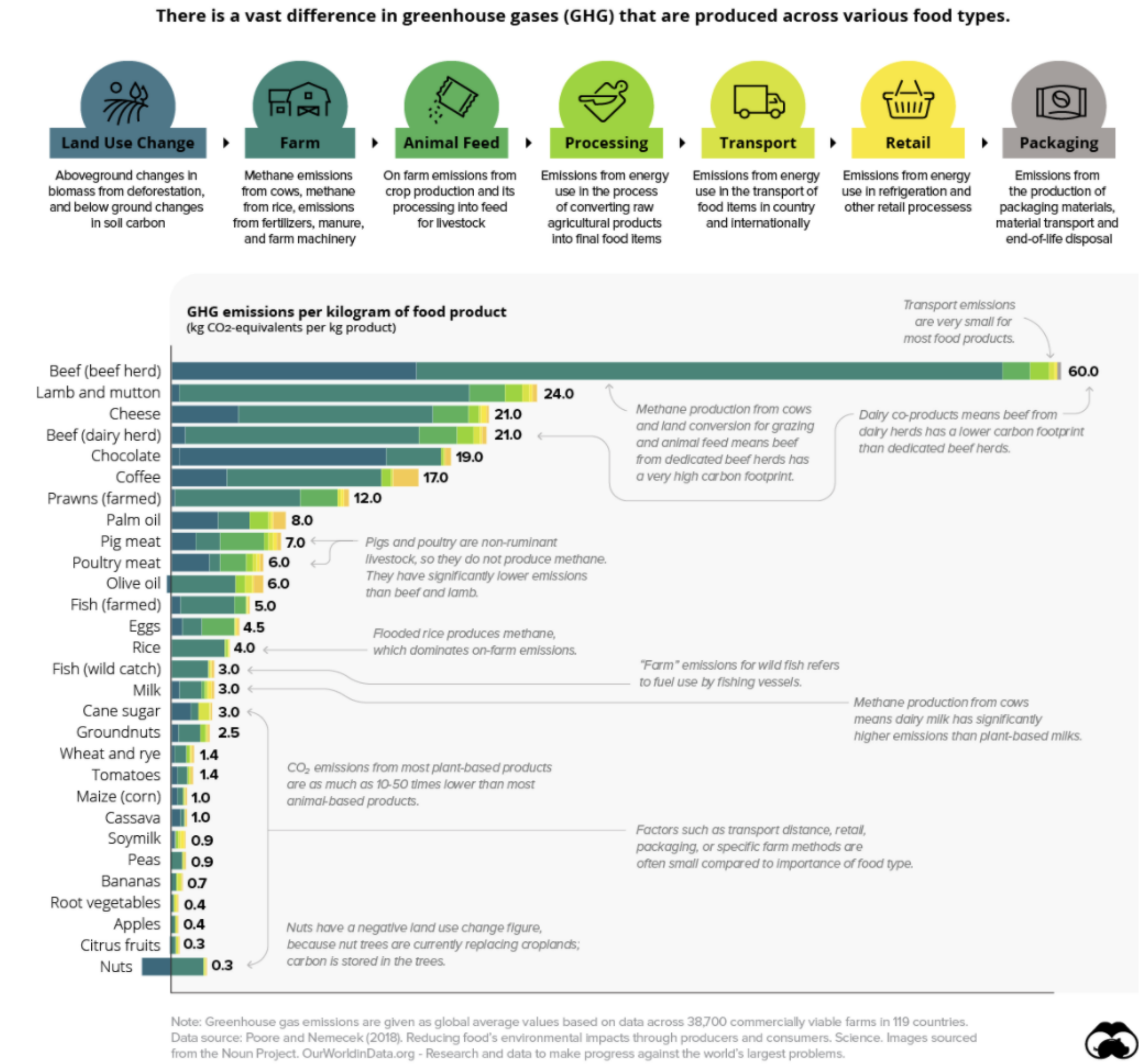
For CAP 2.0 we have used the more recent food system research estimate of 7 tonnes GHG for the average US food shopping cart and, to account for Salt Spring's aging and perhaps more health-conscious population, have taken 80% of that figure. This represents annual per capita GHG emissions of 5.6 tonnes, or 56,000 tonnes for the Salt Spring community in 2007 when the population was about 10,000, and 62,200 tonnes in 2018. While there remains much uncertainty with these numbers, they give a rough idea of the magnitude of the problem.

Other communities

Other communities, including the District of Saanich, combine emissions from Agriculture, Forestry, and Other Land Use (AFOLU). AFOLU GHG emissions are those captured or released because of land-management activities. These activities can range from the preservation of forested lands to the development of cropland. This sector includes GHG emissions from land-use change, manure management, livestock, direct and indirect release of nitrous oxides (N_2O) from soil management, rice cultivation, biomass burning, urea application, fertilizer, and manure application (Stantec, 2018). It may be valuable for consistency between communities to include an AFOLU emissions estimate for SSI, but given Salt Spring's economic and natural areas profile, we consider the "indirect GHG emissions from Food" category, which includes agricultural emissions, to be more useful for local climate action planning purposes.

GHG emissions from everyday food choices

Figure 3: GHG emissions per kilogram of food product



Source: (Poore, 2018)

Figure 3 illustrates why food shopping choices can dramatically affect our climate footprints. A vegetable-based diet that avoids meat—especially feedlot beef—and also avoids cheese, chocolate, and coffee may have less than 20% of the GHG emissions of a meat-based diet. These are general guidelines and may not always apply—grass-fed Salt Spring lamb, for example, may have a lower carbon footprint than energy-intensive hothouse vegetables grown in Delta.

GHG emissions from food grown on Salt Spring

Food grown on Salt Spring is not GHG intensive. There is no large-scale industrial agriculture, there are no feedlots, and there is little mechanization. Most farms are very small and use manual labour and climate-friendly organic and regenerative practises. Less than 10% of the food we eat is grown here on Salt Spring (Reichert, 2010), and as more food is grown locally in response to the climate emergency, that percentage will increase. It is not clear if, or by how much, the community's direct GHG emissions will increase along with food production because regenerative agriculture practices can store soil carbon, which may offset any increases in emissions.

Land use emissions from agriculture are already included in the SSI food system emissions estimates. There is no net increase in planetary emissions related to growing food on SSI versus growing it elsewhere, and as noted above, there may be a decrease due to local regenerative practices. There would however be reduced carbon sequestration and storage if forested land is cleared to grow food, and land clearing should be avoided.

Importance of food system GHG emissions for the Salt Spring Climate Action Plan

Food system GHG emissions cut across recognized sectoral boundaries and including them as a separate line item in community emissions inventories is controversial. Because of the complexity of the food system, the GHG numbers are uncertain. But we are certain that food system GHG emissions make up a significant portion of Salt Spring's individual and community emissions, probably equal to or exceeding emissions from transportation. Food system GHG emissions are therefore a key area for CAP 2.0.

Indirect or embedded GHGs are beginning to be counted for other sectors, such as construction, transportation, and clothing. These embedded emissions will be added to our community emissions inventory in future to provide a more complete understanding of Salt Spring's total carbon footprint.

Acknowledgement

For more information on this complex topic see 'Climate Change Mitigation Opportunities in Canadian Agriculture and Food Systems' (FarmFolk CityFolk Society, 2019). Much of the information presented above is taken directly from their report.

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APPENDIX 5:
PROVINCIAL AND FEDERAL GOVERNMENT ALIGNMENT

The Provincial BC and Federal governments are accelerating their climate work in some areas. In order to take advantage of this and work in concert with senior levels of government, CAP 2.0 attempts to align with them whenever possible. We recommend TSS publicize incentives and new policies to islanders

CleanBC Priorities

- Requiring the sale of all new light-duty cars and trucks to be zero-emission vehicles (ZEVs) by 2040.
- Transforming social housing across the province.
- Improving more than 50,000 public housing units over the next 10 years to make social housing more energy efficient, more comfortable, and more affordable.
- Providing $902 million over three years to support electric vehicle rebates and incentives for making homes and businesses more energy-efficient.
- Making building code changes to support the safe construction of taller wood buildings and inviting eligible local governments throughout BC to become early adopters of this technology. Mass timber construction is lower-carbon than concrete construction, and supports BC's forest-dependent communities by creating a market for value-added wood products.
- Helping communities implement local projects such as energy efficiency or clean energy upgrades to community-owned facilities like municipal halls, band offices, or recreation centres; $650,000 was allocated to the latest round of the Community Energy Leadership Program (CELP).
- Expanding rebates under CleanBC's Better Buildings program to make it easier and more affordable for British Columbians to choose energy-saving products and to save money on home and business. renovations. CleanBC provides up to $14,100 for a home and up to $220,000 for a commercial business to switch to high-efficiency heating equipment and to make building envelope improvements. Details about rebates are available at BetterHomesBC.ca
- Developing a climate preparedness and adaptation strategy, scheduled for release in 2020, to help ensure we're prepared for changing weather and climate risks. To help inform this work, the CAP Team assessed 15 climate risks and their potential consequences by 2050 in a provincial risk assessment. It is the first report of its kind in Canada to examine provincial-scale climate risks.
- Providing new rebates (over $4 million) to support the installation of electric vehicle (EV) charging stations at home and at work. You can now get up to $350 to install a charging station in a single-family home. At your work, condo or apartment, you can apply for a rebate of up to $2,000 per station, as well as 5 hours of free support services from an EV Charging Station Advisor. Find charging station rebates for your home or workplace now.
- Delivering, alongside the BC Trucking Association (BCTA), the heavy-duty vehicle efficiency program. The program will cost-share the purchase and installation of fuel-saving equipment for heavy-duty vehicles, which helps reduce fuel usage and carbon pollution while helping commercial truck drivers save money on fuel.
- Passing new accountability legislation requiring an interim emissions target on the path to our legislated 2030 target of 40% reduction in greenhouse gases below 2007 levels. Separate sectoral targets will also be established following engagement with stakeholders, Indigenous peoples, and communities throughout the province.
- Piloting new electric vehicle (EV) training program for automotive technicians. This program has successfully completed its first pilot and will be available to the public in February. The newly developed program at the British Columbia Institute of Technology (BCIT) trains green fleet technicians who support the City of Vancouver's municipal EV fleet, one of the largest in the country.
- Developing the New Organics Infrastructure Program, which supports 12 composting infrastructure projects across B.C., with more on the way. These projects will help communities keep organic waste out of the landfill, create jobs, and reduce carbon pollution.
- Providing new funding to make sure that homes, businesses, and communities are better protected against the threat of fires. 89 local governments and First Nations throughout BC will benefit from this funding. This builds on previous investments in provincial emergency preparedness for climate risks, including flood mitigation investments in 18 communities.
- Developing the first of a series of hybrid-electric ships designed for future full-electric operation. The ships are fitted with hybrid technology that bridges the gap until shore charging infrastructure and funding become available.
- Providing e-bike rebates for individuals and businesses, including a rebate of $1,050 for the purchase of any type of new e-bike for people who scrap an old vehicle. Additional rebates of up to $1,700 are available for business owners toward the purchase of a cargo e-bike.
- Increasing the number and type of Electric Vehicles sold in B.C. to meet consumer demand.
- Installing over 80 new EV charging stations across the province.

Pan Canadian Framework on Clean Growth and Climate Change

- Supporting carbon tax across Canada
- Protecting and enhancing carbon sinks including forests, wetlands, and agricultural lands
- Increasing renewable electricity generation
- Making new and existing buildings more efficient
- Supporting electrification of transportation

APPENDIX 6:
THE CASE FOR EMERGENCY CLIMATE ACTION CO-ORDINATION

Climate change, like COVID-19, is clearly demonstrating two key lessons: one, that our economies, health, and natural systems are interconnected in ways we did not realize, and, two, that human actions taken in isolation often generate positive or negative consequences elsewhere. In order for us to adequately address climate change, we need to see systems rather than individual parts. Many of the tools already exist to take action on climate change holistically, and these usually generate positive synergies rather than negative feedback loops. The problem is that our institutions were not designed for systems thinking. The adage "it's not my department" illustrates this fact. Coordinated action across silos, organizations, and departments will need to become the norm if we are to avoid the worst climate change impacts.

In order for our community (and indeed all of humanity) to adequately address climate change, some fundamental shifts will be needed in how our institutions are organized and resourced including the following:

1. Lead government agencies and non-governmental organizations currently lack the ability to take leadership roles to respond to climate risks. Additional resources and authorities will be required to address:

    - Lack of fiscal or human resource capacity within organizations. For example, additional capacity within the Salt Spring Island Conservancy would enable them to work with the Island Trust Conservancy, fire ecologists, and Fire and Rescue personnel to reduce fire risks across the island.
    - Lack of adequate jurisdiction, authority, or mandate to act (notably, CRD, IT, SSIC, SSFD). This has created intractable problems, such as in the southwestern part of the island where fire risk is extremely high as a consequence of historic logging and fire suppression practices leaving residual fuel loads. The responsible authority lies with the province, leaving the Local Trust, CRD and Fire and Rescue unable to act directly.

2. The necessary degree of collaboration and coordination among agencies requires integrated decision-making that is the norm among agencies in emergencies like COVID-19. The same collaborative approach will be needed to reduce risks from climate change to our island. Feedback from key stakeholders identifies three priority actions in this regard:

Actions	Next Steps
1.0 Adopt Integrated Decision-Making Approach to Governance	
1.1 IT and CRD lead development and use of an ecosystem-based framework for multi-level, cross-sectoral decision-making and priority setting on SSI	Food and Ag G4; Forest G1, Freshwater G1,2,3; Land Use G1,2
1.2 Establish a coordinating authority to track and engage appropriate partners on CAP 2.0 priorities and gaps (e.g., First Nations, private and business sectors, marine agencies, public health, and food sectors)	Relevant to all Chapters
1.3 Establish linkages with groups within Salish Sea communities in order to pool resources and increase regional coordination of carbon stewardship and risk reduction/adaptation activities (e.g., pilot projects, new tool development, engagement with province)	Transportation G3; Food and Ag G1; Built Infra. G1,3
1.4 Request provincial government support in addressing gaps and developing new planning and management tools (e.g., local tree clearing authority within IT Local Trust Committee)	Forest G1, Transport. G1,2,4; Freshwater G1,2,3; Land Use G1,2

2.0 Develop Capacity to Implement Action Plan	
2.1 IT Local Trust Committee and CRD establish and create enabling environment for Plan implementation by encouraging more active participation from key stakeholders: First Nations, private and business sectors, marine and oceans sectors, and health sectors, etc.	Requires Further Study
2.2 Identify mechanisms to ensure that commitment to action by all relevant stakeholders is established for both urgent (short- or immediate-term priorities like fire risk) and longer-term priorities (resilience of agriculture sector to year-over-year dry hot summers)	Requires Further Study
2.3 Secure funding and new tools to meet the required capacity in local organizations to support or lead the implementation of CAP 2.0 actions	Relevant to all Chapters
2.4 Establish linkages with the BC Ministry of Environment and Climate Change Service Plan for climate adaptation priorities	Requires Further Study
3.0 Increase Knowledge-sharing Locally and Regionally	
3.1 Develop mechanisms to encourage information-sharing and priority-setting across all organizations and residents on SSI, as well as within the broader regional, provincial, and national levels around adaptation and emissions reduction	Relevant to all Chapters
3.2 Create a network of researchers, educators, and other community members to contribute to and support knowledge-generation and sharing of information about gaps and priorities	Relevant to all Chapters
3.3 Establish an information hub to facilitate the collection, validation, and exchange/use of information; identify knowledge gaps with the aim of coordinating information and research among research groups and agencies	Relevant to all Chapters
3.4 Expand risk-analysis to include assessments of capacity and vulnerability	Relevant to all Chapters
3.5 As an act of Reconciliation, settler cultures and institutions must commit to an understanding of the established eco-cultural perspectives of Coast Salish First Nations	Relevant to all Chapters

3. Some of tools we had believed could address key priorities to reduce fire risk and protect water are inadequate for the challenges ahead. The coordinated public health response to COVID-19 shows us what is possible with the wealth of knowledge, skillsets, and engaged community members residing on Salt Spring. There is real potential for the Islands Trust to take a leadership role in developing a regional coordinating framework that considers our island as well as the Gulf "Islands more broadly. The Islands Trust is developing a collaborative approach and exploring an island-wide ('ecosystem' scale) approach to adaptive planning. This could be the start of developing the local and regional adaptive capacity needed to ensure long-term resilience throughout the Salish Sea and fits well within the BC Ministry of Environment and Climate Change Service Plan.

APPENDIX 7: SALT SPRING ISLAND CLIMATE RISK ASSESSMENT DATA

Transition Salt Spring would like to gratefully acknowledge the contributions of Nicholas Courtier and Catherine Griffiths for the creation of these maps and graphs from myriad public datasets, along with the Islands Trust and a private donor for their financial support of this valuable project. In showing changes spatially and allowing areas of common risks to be identified, these maps will contribute to integrated planning and risk mitigation by all island stakeholders (i.e., identifying areas of low, medium or high relative risk, and areas of cumulative risks).

All data for this Appendix are published separately due to their file sizes. They are available for viewing and download at http://transitionsaltspring.com/responding-to-climate-change

ENDNOTES

[1]Salt Spring Island Community Energy Strategy, Energy and Emissions Baseline Data Report, Earth Festival Society, 2004
[2]Salt Spring Island Trust Area 2010 Community Energy and Emissions Inventory, LiveSmart BC, 2014
[3] Capital Regional District 2018 GPC BASIC+ Community Greenhouse Gas (GHG) Emissions Inventory Report, Stantec, 2020
[4] Capital Region District – Municipalities and Electoral Areas, 2007 Base Year and 2018 Reporting Year Energy & GHG Emissions Inventory, Stantec, 2020
[5]Business as usual projections.
[6]CO_2e (carbon dioxide equivalents) is a measure used to compare the Global Warming Potential, GWP, of different greenhouse gasses, GHG, over a period of time, usually 100 years. CO_2 has a GWP of 1. Nitrous oxide (N_2O) has a GWP of 298. Some refrigerant gasses have extraordinarily high GWPs. For example hydrofluorocarbon-23 has a GWP of 14,800.
[7] Business as usual projections
[8]CO_2e (carbon dioxide equivalents) is a measure used to compare the Global Warming Potential, GWP, of different greenhouse gasses, GHG, over a period of time, usually 100 years. CO_2 has a GWP of 1. Nitrous oxide (N_2O) has a GWP of 298. Some refrigerant gasses have extraordinarily high GWPs. For example hydrofluorocarbon-23 has a GWP of 14,800
[9] CRD 2019-2038 Population, Dwelling Units and Employment Projection Report, BC Stats, 2019
[10]Daily Fuel Consumption and Greenhouse Gas Emissions by Bulk Carriers Anchoring in the Southern Gulf Islands, Christoph Rohner, 2020
[11]District of Saanich 2017 GPC BASIC+ Community Greenhouse Gas (GHG) Emissions Inventory Report, Stantec, 2018
[12] Effects will be great for transportation, infrastructure, agriculture and natural systems.
[13]The combination of heat and longer periods without rain will exacerbate the severity of droughts, evaporative loss, and increase the heat loads on island (fresh water and marine).
[14]See the Climate Action Plan for Land Use & Settlement Pattersn for an in-depth discussion of sea level rise impacts and solutions.
[15]Cowichan Valley Regional District. 2020. Electoral Areas Development Permit Areas. Draft 2.0.
[16]Another report, Center for Sustainable Systems, University of Michigan. 2018. "Carbon Footprint Factsheet." estimates per capita GHG emissions from the food system at 8.1 tonnes CO_2e /yr. http://css.umich.edu/factsheets/carbon-footprint-factsheet. Also from Center for Sustainable Systems, University of Michigan: Heller, Martin C., Amelia Willits-Smith, Robert Meyer, Gregory A. Keoleian and Donald Rose. (2018) "Greenhouse gas emissions and energy use associated with production of individual self-selected US diets." Environmental Research Letters 13(4):1-11. https://doi.org/10.1088/1748-9326/aab0ac
[17] Early work by Pimental et al, referenced in the SSI Community Energy Strategy, Baseline Report, May 2004, found that the average American annual shopping cart contained about 400 US gallons of oil equivalents, representing over 4 tonnes CO_2e per person per year for the energy component alone: "The average North American's annual grocery shopping cart represents 1,514 litres (400 US gallons) of oil equivalents (Pimentel D. a., 1996) (Pimentel D. a., 2003). The inclusion of refrigerant gasses, agricultural methane and nitrous oxide emissions further raises the total estimate.