LOCAL TERRESTRIAL ECOSYSTEMS & CLIMATE CHANGE

Context: The latest (2022) International Panel on Climate Change (IPCC) report states that because of human activities, Earth:

- is currently 1.1°C warmer than in preindustrial levels;
- is already experiencing impacts (see Gabriola specific below); **Need for adaptation**
- is likely to hit 1.5°C of warming within 20 years, with a narrow pathway to stay below that warming target; **Need for mitigation**
- must reach net-zero emissions by 2050 to avoid catastrophic warming, which means that emissions must be halved by 2030.

Gabriola specific:

- More extreme storms: tree damage, power outages, infrastructure damage;
- More extreme dry spells: drought and increased fire risk, reduced water supply, saltwater intrusion risk to groundwater.
- Intense rain events: flooding, slope failures, impacts on tree roots, etc.
- Temperature changes: disruption to seasonal timing of plant and animal life-cycle events, new invasive species, increasing danger of more frequent heat domes (atmospheric heat waves). (Islands Trust Conservancy, 2018)

Temperature changes	1970-2000	2040-2070	2070-2100
Annual avg. hottest day	30°C	33°C	36°C
Days (avg) over 30°C	2	10	27
Frost days	40	7	1
Max 1 day total precip.	41mm	47mm	50mm

(Pinna Sustainability, 2020) Based on business as usual

Impact: Due to the hotter temperatures, many of our flora and fauna species will no longer be able to thrive in this climate. Different species, more typical of those found in climates to the south of us, will start to replace them. Specific impacts on our ecosystems include:

Trees[1]: Stress created by warmer temperatures, increased summer droughts and increased winter rainfall have resulted in numerous impacts on local trees. In particular Arbutus trees, Western Red Cedars and Douglas Firs are dying due to:

- Heat and drought stress leading to compromised tree health;

[1] *Information came from various sources including: Gabriola Lands and Trail Trust, District of Highlands Sustainable Land Use, and Raincoast, Islands Trust.*

- Reduced moisture within the tree shrinks its inner core, creating space/habitat beneath the bark for insects;
- Insects taking advantage of the new habitat promote additional stress; and
- Natural fungal leaf blights move in, increasing the decay to stressed trees (particularly noticeable for Arbutus trees).

Plants: Weather extremes increase the likelihood of forest canopy loss, thus affecting the local soil ecology, impeding beneficial interactions between plants, microbes and mycorrhizae, and increasing the vulnerability of the forest understory to disease and infection. (Raincoast, retrieved 2022)

Habitat and Species: Climate Change is causing habitat and corresponding species loss. As land converted to human use goes above a 30–40% healthy ecological threshold, the number of species in a given habitat decline more rapidly. Gabriola is at approximately 28%. (Islands Trust, 2019)

Birds: More than 250 bird species live in or migrate through Gabriola. Their food sources and habitat are being affected by the impact of climate change on plants, trees and insects. The Double Crested Cormorant and the Marbled Murrelet have both been designated as Species at Risk. (Islands Trust 2019)

Insects: The decline in the numbers of insects and of insect species is increasingly well documented. Insects play significant roles, both as food and in the growth of food for many organisms. Insects are also recyclers, decomposing plant matter and animal dung and contributing to the organic content of soils. (Hainze, 2021)
Pollinators ensure the continuation of many plant species. Changed flowering times of plants and trees due to climate changes is causing lack of pollination for certain species. (Habitat Acquisition Trust)

Eco-crisis Region: Eastern Vancouver Island has been named one of nine "Eco-crisis Regions" by the Nature Conservancy of Canada (2021), where wildlife and its habitats are the most diverse and under the greatest threat, due to the combined impact of humans and climate change.

Mitigation through Ecosystem restoration: Healthy wetlands, grasslands and forests mitigate the impacts of climate change, while also cleaning our air and water. Healthy ecosystems:

- store carbon (Gabriola's forests sequester 13,417 tonnes C02e/year[2]);
- store water for our ecosystems to access in times of drought;
- conserve and restore habitats for species at risk, migratory birds and marine wildlife. (Islands Trust Conservancy, 2018)

The Nature Stewardship program (Gabriola Land & Trails Trust) provides extensive information and support to Gabriola residents, encouraging us to protect native species and enhance conservation on private property (the majority of land on Gabriola is privately owned), as well as in Gabriola's public spaces.

[2] *For context, in 2019, personal vehicles on Gabriola emitted approximately 7,260 tonnes of C02e.*

FOOD SECURITY & CLIMATE CHANGE

Context: The latest (2022) International Panel on Climate Change (IPCC) report states that because of human activities, Earth:

- is currently 1.1°C warmer than in pre-industrial levels;
- is already experiencing impacts (see Gabriola specific below); **Need for adaptation**
- is likely to hit 1.5°C of warming within 20 years, with a narrow pathway to stay below that warming target; **Need for mitigation**
- must reach net-zero emissions by 2050 to avoid catastrophic warming.

Impact of Weather Changes on Gabriola Food Production

- BC is predicted to have wetter conditions during winter and spring, and drier/drought conditions during summer.
- Increased "extreme" weather events such as windstorms, forest fires, snow, hail, droughts and flood pose risk to food production.
- Increased need for irrigation during summer, with possible water shortages caused by reduced precipitation, limited water storage capacity and increased population.
- Changes to weather result in need to change historic growing strategies for different crops. A long, wet spring in 2022 resulted in delays for many crops.
- Different pollination times due to weather changes impact timing for local pollinators. In 2022 Gabriola cherry and pear trees were insufficiently pollinated, resulting in poor crops.
- Some crops requiring hot, dry heat that were challenging to grow here previously can now be grown more easily (melons, peppers, etc.).

BC's Reliance on Imported Food:

- Approximately half the province's food is imported from other regions in Canada or other nations.
- Dairy products are the most "local" category of food.
- Fish and meat are BC's largest "crops" by value.
- Most of BC's fruit and vegetable supply is highly dependent on the state of California.
- California is suffering from long-term drought and is likely to suffer further as climate change progresses.
- There has been a major decline in production of tree fruit in BC over last quarter century, due to Okanagan orchards switching to intensive grape production for wine.
- 50 years ago, 85% of food consumed on Vancouver Island was produced locally; today only 5%.
- 13% of BC farms are on Vancouver Island.
- The following table is a snapshot of how the islands in the Island Health Region are 50% self-sufficient in some food categories, but heavily reliant on imports in many other categories:

Food Categories	Self-Sufficiency Index (%)
Vegetables	17.3
Fruit	8.8
Grain (human consumption)	1.0
Meat, poultry	16.0
Dairy	40.6
Eggs	53.0
All Above Food Categories	22.3

Local Self--Sufficiency Index (%) for Major Food Categories in VIHA Region, based on Ostrey (2011)

- Only 40% of BC citizens consumed recommended quantities of fruit and 35% consumed recommended amounts of vegetables. Low regular intakes of fruit and vegetables are associated with diet-related chronic illnesses like diabetes (Ostrey, 2011)
- Approximately 70% of fats and vegetables, 60% of cereals fruit and nuts and fish, 50% of shellfish and 35% of meat imported into BC came from the US. Fifty-eight percent of BC's meat came from Australia and New Zealand. (Ostrey, 2011)
- Worldwide climate shocks are already resulting in crop shortages, creating food shortages that have pushed up global food prices, leading to famines and climate refugees.

GHG Emissions from Food Production and Consumption

- The breeding and raising of animals for food contributes more to global warming than the transportation sector (FOA, United Nations, 2006).
- Manufactured fertilizers are high emitters of GHGs due to the energy intensity required to make ammonia, and the unused portion of nitrogen fertilizers that releases nitrous oxide into the atmosphere (nitrous oxide is 300 times more potent than $C0_2$).
- Mechanized farming is fossil-fuel intensive.
- The farther a food item is transported, the higher its associated GHG emissions.

Food Choices

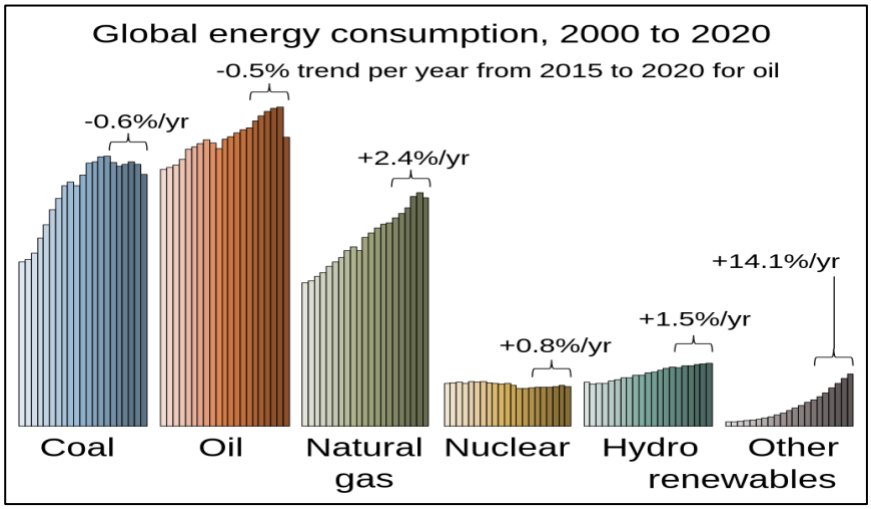
- The International Panel on Climate Change recommends reducing or eliminating consumption of meat (especially beef), milk, cheese and butter.
- Eating locally grown food reduces GHG emissions, while increasing food security and food sovereignty.*
- Buying food that does not use harmful fertilizers and pesticides (e.g. certified organic, permaculture) reduces those impacts.

** Food Sovereignty – "The peoples' right to define their own policies and strategies for the sustainable production, distribution and consumption of food that guarantees the right to food for the entire population, on the basis of small and medium-sized production, respecting their own culture and …diversity." (World Forum on Food Sovereignty, 2001)*

LOCAL ENERGY USE & CLIMATE CHANGE

Context

The majority of greenhouse gas emissions (GHGs) are from fossil fuel energy use. This fact sheet will focus energy use in buildings and embodied energy. Energy used for transportation will be presented in a separate fact sheet. The graph below includes all energy use except that used in agriculture.



Global Proportions of energy ("Other" is solar, wind and biomass) (from Wikipedia)

Global Emissions from Fossil Fuels
The biggest global increase in CO2 emissions by sector in 2021 took place in electricity and heat production, which jumped by over 900 Megatons. Emissions per capita is substantially higher in rich countries than the world average.

Canada: In 2020 45% of GHG emissions was from Stationary Combustion Energy Sources, with the largest sources from oil and gas extraction (29%), Public Electricity & heat production (18%), Manufacturing (11%), Commercial & Institutional (10%), and Residential (10.5%).

British Columbia: In 2020 the largest emitting energy sectors in B.C. outside of transportation are from the production, processing and use of oil and gas (21%), and manufacturing and heavy industries (including smelting, cement, and chemicals) at 16%.

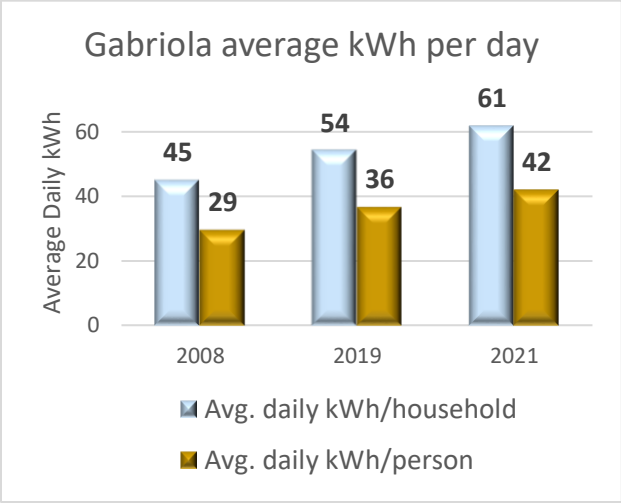
Gabriola Specific

Energy Use in Buildings

- A greenhouse gas emissions inventory was carried out for Gabriola for 2008 (Island Futures, 2010). At that point the energy used for buildings was from wood stoves, propane, furnace oil and electricity. Greenhouse gas emissions from the latter three sources were:
  Electricity: 1279 $C0_2e$ Propane: 1370 $C0_2e$ Furnace Oil: 258 $C0_2e$
- **Wood heat** creates emissions if the wood is from trees that are alive when they are cut down, whereas heating with dead wood is carbon neutral. However, even if the wood is dead, heating with wood produces particulates which can be harmful to our health.
- **Solar and Wind:** Solar has been installed on several community buildings (GIRO, Commons, GAC) and many individual households have installed their own systems. Solar panels on Gabriola can generate 3.5

KWh per 1 KW of installed capacity. Wind generators need height and are ineffective in forested areas. There is noone using wind power on Gabriola on a significant scale.

- **Small Hydro:** A small hydro generator at Hoggan Lake (golf course) can produce up to ~200 MWh/yr.
- **Electrical Use:** Gabriola didn't have electricity until the 1950's. Gabriolans used 43.5 GWh in 2008, 59.1 GWh in 2019, and 68.73 GWh of electricity in 2021 (for daily household use see chart). There was a population increase of approximately 500 from 2008 to 2021. BC's electricity is low in C02e (84% hydro), but 9% comes from natural gas.



- **Heat Pumps:** Since 2010 the SG heat pump program has offered wholesale prices to Gabriola residents, resulting in 890 heat pumps installed on Gabriola. The switch to heat pumps from baseboard heaters drops electricity use 2/3; a switch from furnace oil or propane results in substantially less GHG.
- **Other energy uses**: Gabriolans also use energy for cooking, hot water, lights, computers and appliances. Electricity is the primary source for these uses, although propane is also used for cooking and hot water. Gas and diesel are used for generators.

Embodied Energy Use

- Embodied energy is the energy used to produce the products we buy. For example, the global production of clothes and shoes produces GHG emissions equivalent to global marine traffic and international air travel combined.
- Embodied energy attempts to measure the total energy consumed in a product's entire lifecycle. This lifecycle includes raw material extraction, transport, manufacture, assembly, installation, disassembly, deconstruction and/or decomposition.
- Some examples (from Energy Education, University of Calgary):

Item	Embodied energy (MJ/unit)	Kg CO_2e (using coal as energy source)
Coffee maker	184	173
Smartphone	1,000	940
Washing machine	3,900	3666
Laptop	4,500	4230
Refrigerator	5,900	5546
Cell tower	100,000	94,000

Emission Factors for 1 Gigajoule of energy produced from various different sources (kg CO_2 equivalent):

Coal: 94	Fuel Oil: 74	Diesel: 74	Gasoline: 71	Propane: 63	Natural gas: 53	BC Electricity: 2.17

data from the US Energy Information Agency for fossil fuels and Government of Canada for BC Electricity.

CLIMATE CHANGE: REDUCING CONSUMPTION and RETHINKING WASTE

Context: The latest (2022) International Panel on Climate Change (IPCC) report states that because of human activities, Earth:

- is currently 1.1°C warmer than in preindustrial time
- is already experiencing multiple impacts; **Need for adaptation**
- is likely to hit 1.5°C of warming within 20 years, with a narrow pathway to stay below that target; **Need for mitigation**
- must reach net-zero emissions by 2050 to avoid catastrophic warming.

Impact of waste on Climate Change

- When food, cardboard, natural fibres, branches, and other natural materials decompose they release carbon dioxide and methane.
- Methane has more than 80 times the warming power of carbon dioxide over the first 20 years after it reaches the atmosphere.
- Pollution in our eco-systems, both marine and terrestrial, damage the capacity of those eco-systems to act as sinks for the CO_2 in the atmosphere.
- There is a hierarchy of actions we can take to reduce our climate impact: Refuse (don't buy it), Reduce, Re-use, Re-purpose (use for something else), and Recycle.

Gabriola waste and recycling

- The RDN takes Gabriola's waste to the landfill. In 2008 Gabriola sent 265 tonnes of waste to the landfill, which resulted in 581 tonnes CO_2e. In 2012 the RDN calculated that 36% of residential waste was organic waste and subsequently implemented a composting program to transform the organic material into compost and prevent it from going to the landfill.
- Both GIRO and the RDN take items residents want to recycle. In 2008 Gabriolas put 155 tonnes of recycling into RDN curbside bins.
- GIRO received the following items for recycling in 2018:

PAPER	kg	PLASTIC	kg	METAL	kg	Miscellaneous	amount
Cardboard	60870	Polyethylene	390	Aluminum	4836	Electronics & TVs	58 bags
Mixed Paper	15500	#2	1280	Ferrous	104,118	Car battery	2142 kg
Newsprint	3620	Soft film	2720	Copper etc.	1862	Motor Oil	525 litres
Office Paper	680	Mixed	3850			Paint Cans	5700

Gabriola reuse and repurposing

- There are numerous informal re-use activities on Gabriola with people buying used items through online platforms and garage or yard sales. Both GIRO and the Gabe Shop also sell used items, primarily clothes, household items, and books. In addition, GIRO sells used appliances and construction materials.
- The C2C Threads initiative, which includes the ReLove Local products, repurposes textiles. The Island Futures Biodiesel & Glean initiatives repurpose waste vegetable oil from the restaurants.

Climate Change and the production of stuff

- The production of clothes and shoes results in more GHG emissions than international air travel and marine freight combined.
- Computers, phones, and other communications technology produce 2.1 to 3.9% of the world's GHG emissions.
- Just 16% of plastics worldwide are recycled. Twenty-five % are incinerated, 40% are landfilled and 19% are leaked into waterways and oceans.
- In 2019 the Center for International Environmental Law estimated that the production and incineration of plastics would add 850 million tonnes of GHG emissions to the atmosphere - equivalent to the emissions from 189 coal-fired power plants.
- Scientists predict that plastics will outweigh fish in the ocean by 2050.

Embodied Energy Use in stuff

- Embodied energy is attempts to measure the total of all the energy necessary for an entire product lifecycle. This lifecycle includes raw material extraction, transport, manufacture, assembly, installation, disassembly, deconstruction and/or decomposition.
- Embodied energy does not include the energy used while the product is in use (for example the electricity used to power a kettle).

Some examples:

Item	Embodied energy (MJ/unit)	Kg $C0_2e$ (using coal as energy source)
Coffee maker	184	173
Smartphone	1,000	940
Washing machine	3,900	3666
Laptop	4,500	4230
Refrigerator	5,900	5546
Cell tower	100,000	94,000

Our consumption is out of control!

The overarching "R" is "Rethink"- let's rethink what we can do to create a zero-waste society.

LOCAL INDIGENOUS WAYS OF KNOWING AND CLIMATE CHANGE

From Snuneymuxw website[1]

The Snuneymuxw are a vibrant First Nation of the Coast Salish People, residing in the centre of Coast Salish territory on the eastern coast of Vancouver Island, with villages on the Fraser River and waterways in the Gulf Islands. Snuneymuxw territory encompasses one of the most productive and resource rich areas at the heart of the Salish Sea.

Since time immemorial, the Snuneymuxw People have resided in Snuneymuxw Territory as the first peoples, sustaining their lands, resources, and cultural and spiritual way of life.

Now, in the midst of a climate crisis, Snuneymuxw is driven by the urgent need to heal the Land and its communities. Snuneymuxw First Nation warmly welcomes you to continue the Snuneymuxw legacy of learning from, caring for, protecting, and enjoying the unsparing blessings of this sacred place.

Our Snawayalth are our Teachings – they govern and guide all aspects of our lives. Snawayalth are our laws, values, beliefs, spiritual guidance, and principles for action. They are comprehensive in that no aspect of our lives, and the actions and choices we make, can be understood apart from our Snawayalth.

At the heart of our Snawayalth is a worldview that sees the interconnected relationship between all living things in creation. Seeing this interconnectedness teaches us that all things must be honoured and respected, for they all have a spirit and purpose. This guides us in our daily lives, and in the decisions we make as a community. For example, from our worldview to speak of the "impact" of a decision, means to view the impacts holistically through a lens that recognizes the living spirit within all things, and how everything is connected and relates to one another.

We often express our Snawayalth through stories. The Story for Fish identifies the laws, values, beliefs, spiritual guidance, and principles of action that govern our relationship with fish. Through that story, what it means to fish, how we should fish, the stewardship and governance of our fisheries, and how we relate to the abundant fish communities of our Territory.

[1] https://www.snuneymuxw.ca

HEALTH, WELLBEING & CLIMATE CHANGE

Context
Climate Change is impacting people's health and well-being, both physically and mentally. This fact sheet outlines climate change issues related to the health and well-being of Gabriolans.

Extreme Heat

- Climate change is projected to increase the number, intensity, and duration of heat waves in British Columbia (B.C.). (BC Government, 2022)
- From June 26 – 29, 2021 Gabriola experienced temperatures in the 40°C range.
- An investigation by British Columbia's chief coroner found that 55 people in the Vancouver Island region died as a result of the 2021 heat dome.
- Temperature forecasts for Gabriola based on business as usual:

Temperature changes	1970-2000	2040-2070	2070-2100
Annual avg hottest day	30°C	33°C	36°C
Days (avg) over 30°C	2	10	27
Frost days	40	7	1
Max 1 day total precip.	41mm	47mm	50mm

(Pinna Sustainability, 2020)

Storms, flooding, power outages, drought, forest fires
Gabriola is experiencing:

- more extreme storms resulting in tree damage, power outages, flooding and infrastructure damage.
- more extreme dry spells: drought and increased fire risks, reduced water supply, saltwater intrusion risk to groundwater.
- intense rain events: flooding, slope failures, impact on tree roots, etc.
- increased smoke from forest fires - forest fire smoke is a complex and dynamic mixture of gases and very small particles that can irritate the respiratory system and cause systemic inflammation (BC government, 2022)

Climate Grief
Grief is a form of love: we grieve the loss of what made us feel most deeply connected. With climate grief, it may be loss of the dream of a future for your grandchildren free of the challenges that are currently emerging. It can include the devastating loss of lives and property. Whatever the scope, level or intensity of the loss, the process of grieving evokes the same emotional phases. (Davenport, 2017)

How resilient are Gabriolans?

- Research has shown that when people are working towards solutions their anxiety is reduced.
- People from resilient communities feel they have a voice in issues that are important to them and are able to work together to meet common goals. They also feel that people would help each other out in the event of a natural disaster.
- In resilient communities there are enough health care resources to support the communities physical and mental health needs and there is an emergency plan in place.
- Resilient communities have organized reconciliation events and people feel that reconciliation is important and will make the community stronger.

Table Topics

What are local mitigation and adaptation actions our community can take
related to the following areas?

Extreme weather • Heat-related mortality • Cold-related mortality • Heat-related illness and hospital visits • Mental health effects • Overheating in facilities	**Climate grief and stress** • Increased worry about what is happening • Increased worry about what might happen • Inaction, loss of hope
Storms, flooding • Injuries and mortality • Damage to facilities and infrastructure • Health service disruptions • Impacts to water quality	**Drought** • Longer droughts • Depletion of groundwater sources • Impacts on food supply • Increased fire danger
Infectious diseases • Increasing local risk of vector-borne diseases (e.g., Lyme disease) • Increasing exposure to other viral diseases	**Forest fires** • Local fire danger • Strain on fire department, RCMP, local organizations • Threat to housing, businesses
Air quality, smoke inhalation • Mortality, allergies, respiratory and cardiovascular disease • Mental health effects • Poor air quality in facilities • Closures, evacuation	**Community resilience** • Neighbourhood cohesion, mutual aid • Knowledge & availability of local resources • Emergency planning

CLIMATE CHANGE & ART

Observing art invites us to explore ourselves and the world around us. It prompts learning and a desire to discover something yet undiscovered in our view. Art starts a conversation in the heart and mind, and soon the hands and eyes are in motion. The flow of creative mindfulness happens the moment we see visual imagery or when we reflect on it. Observational drawing and writing give form to imagination and ideas. It gives voice to the inner music of free-flowing creativity and invites the elusive muse to show up and sing along. Listen, what do you hear? Is there a call and response? In this conversation, what do you need to express? How do you feel? Now, what is moving in your soul? Say it, do it, be it. Keep the conversation fluid and unconditional.

Laura Jaquays, 2023

Context

The following lists of authors, poets, film makers, are provided as an opportunity to explore the various ways in which art provides insight into the conversation about climate change.

Poetry

- Rita Wong *undercurrent*, 2015, also:https://www.wlupress.wlu.ca/Books/C/Current-Climate --> *Current, Climate: The Poetry of Rita Wong* - this is a collected works
- Stephen Collis, *A History of the Theories of Rain*, 2021. He's based at SFU, and also wrote *Once in Blockadia* (2016) which includes an opening sequence that cleverly includes transcripts from his trial when TMX sued him for advocating civil disobedience against the building of the pipeline!
- Kim Trainor collection coming out in 2024, *A blueprint for survival | poems* (Guernica) also addresses climate and 6th mass extinction (but isn't out yet)
    - it includes this poem: “Seed 18: Lentil.” *The Journal of Wild Culture.* June 2021:https://www.wildculture.com/article/earth-bardo/1926
    - and its accompanying film (both poem and film include refs. to Keeling curve): https://vimeo.com/792000822/9525c31ebd
- Kathryn Mockler, *Watch Your Head: Writers & Artists Respond to the Climate Crisis*

specific poems: https://chireviewofbooks.com/2019/12/18/10-poems-about-climate-change-to-read-right-now/includes "Thirteen Ways of Looking at a Glacier (after Wallace Stevens)" by Craig Santos Perez

- Gabriel Ojeda-Sagué, *Losing Miami,* (2019)
- C.D. Wright, *Casting Deep Shade* (2019)
- *NO OTHER PLACE TO STAND: AN ANTHOLOGY OF CLIMATE CHANGE POETRY FROM AOTEAROA NEW ZEALAND* https://aucklanduniversitypress.co.nz/no-other-place-to-stand-an-anthology-of-climate-change-poetry-from-aotearoa-new-zealand/

Film

- *A life on our planet, Our Planet* – David Attenborough: Available on Netflix https://www.netflix.com/title/80216393
- *Don’t Look Up:* https://www.netflix.com/search?q=don%27t%20look%20up&jbv=81252357

- David Suzuki: On why climate change is a bigger threat than Covid: https://m.youtube.com/watch?v=XAAi8fLeL1I and On Being Part of Nature: https://m.youtube.com/watch?v=YxLBDNEeMSw

Authors

Books from New Society Publishers: https://newsociety.com

Andrew Boyd: I Want a Better Catastrophe: Navigating the Climate Crisis with Grief, Hope and Gallows Humour

Steven Earle: A Brief History of the Earth's Climate

Harriet Shugarman: How to talk to your kids about Climate Change

Fay Weller and Mary Wilson: Changemakers: Embracing Hope, Taking Action, and Transforming the World

Peter Kalmus: Being the Change: Live Well and Spark and Climate Revolution

Visual Artists

Visual Artists: https://www.climaterealityproject.org/blog/11-visual-artists-taking-climate-crisis
Mixed media: https://fineartamerica.com/art/mixed+media/climate+change
BC artist alliance for climate change: https://fineartamerica.com/art/mixed+media/climate+change

Art and Climate Change around the world

Uganda: A group of young artists, Jabulani Africa (jabulani is a zulu word meaning rejoice), have partnered with Kabarole Research and Resource Centre to organise street art exhibitions on climate change. The artists bring to the exhibition paintings depicting climate change effects and how it is caused. In other cases, the paintings show visitors to the exhibition how to protect the environment. https://www.iied.org/uganda-art-answer-communicating-about-climate-change

Australia: Art + Climate = Change festival https://theconversation.com/climate-science-is-looking-to-art-to-create-change-41185

France: This climate change art installation reminds people of rising sea levels: https://www.trendhunter.com/trends/climate-change-art

Children around the world: Stripping polar bears, crying penguins, pollution and people - Paint for the Planet, a competition run by the United Nations Environment Programme, offers children around the world the chance to showcase their fears and hopes for the planet through art: https://www.theguardian.com/environment/gallery/2008/oct/21/climatechange

Gloria Ip Tung, 14, China

Charlotte Sullivan, 13, England

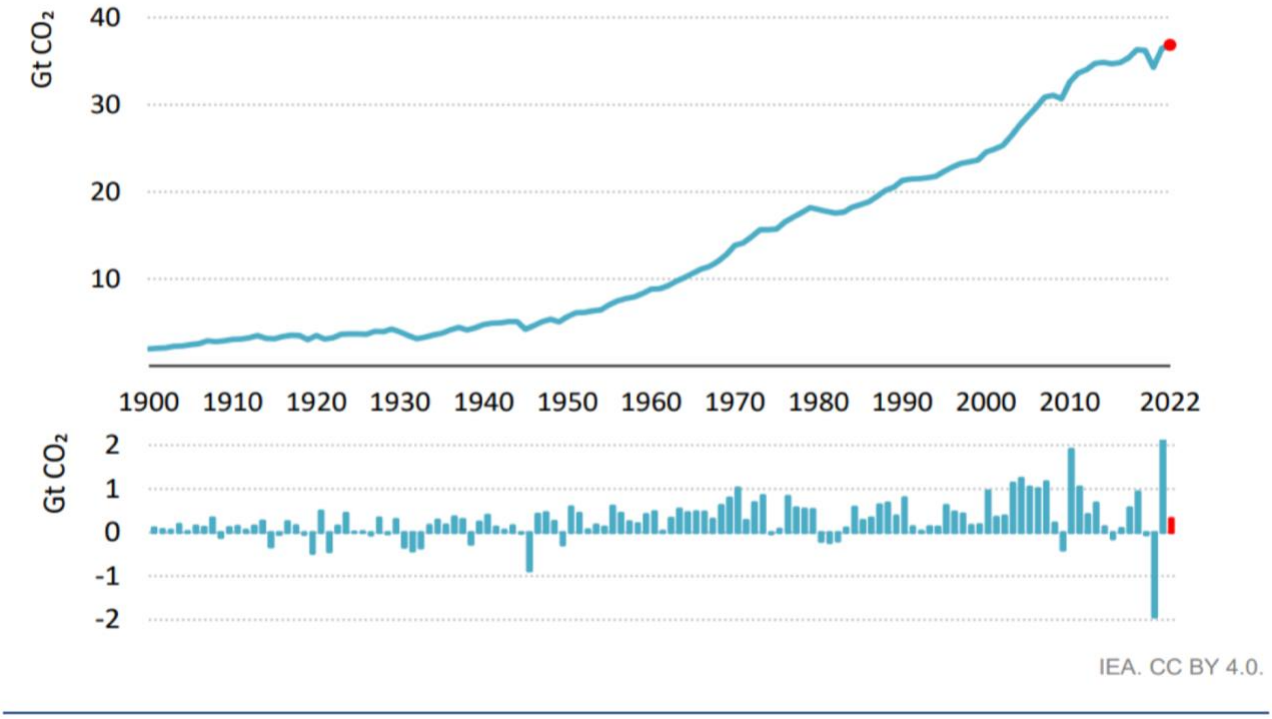
GABRIOLA
Climate 12-12-12
Local impacts – Local solutions

LOCAL ECONOMY & CLIMATE CHANGE

Climate Change is a consequence of the extractive economy (take-make-waste) and is forcing us to confront the inevitable outcome of our consumptive lifestyle: genuine scarcity for which the market has no remedy.

GHG emissions from industry (Source: International Energy Agency 2022)

Figure 1: Global CO_2 emissions from energy combustion and industrial processes and their annual change, 1900-2022



Emissions from energy use in industry: **24%** of total global emissions[1]

Emissions from transporting goods: 5 %	Unallocated fuel combustion: 7.8%
Energy use in commercial buildings: 6.6%	Fugitive emissions from energy production 5.8%

Emissions from Direct Industrial processes: **5.2%**

Cement: 3%	Chemicals & Petrochemicals: 2.2%

Emissions from Waste: **3.2%**

Wastewater: 1.3%	Landfills: 1.9%

Emissions from Agriculture, Forestry and Land Use: **18.4%**

Livestock and manure: 5.8%	Cropland: 1.4%	Rice cultivation: 1.3%
Crop Burning: 3.5%	Agricultural soils 1.4%	Grasslands: 0.1%
Deforestation: 2.25		

[1] Our World in Data, 2022, derived from Carbon Project 2022, based on 2016 data

What is Economy?

The word *economy* originated from the Greek words *oikonomia*, meaning household management and thrift, *oikonomos*, meaning manager and steward, and *oikos*, defined as house, abode and dwelling. Notice the focus is local!

In today's world, economy is the act of exchange. Money has become our predominate means of exchange, extraction underlies wealth, and GDP has become the measure of economic success. These have led to many of the climate change consequences. Fortunately, there are other types of economy, and other ways of measuring success.

Changing the Story

The story underlying the type of economy that created the C02e depicted in the preceding data can be changed. Co-operatives, the sharing economy, the circular economy, and the gift economy—stories focused on the local—can provide us with an economically just, environmentally sustainable economy. These stories can operate alone, or in parallel to the destructive economic systems.

> **Co-operatives**: Co-ops are different from profit-driven, investor-owned businesses. Co-ops are founded on the idea that people—no matter what their economic class or educational levels are—know what's best for themselves. Through cooperation, people work together to meet their common interests. Co-ops empower individuals and encourage healthier, stronger communities by pooling resources and sharing risks. (BC Cooperative Association).
>
> **Circular Economy**: The circular economy changes the linear "take–make–waste" model of extractive economy and turns it into a circle in which reuse, sharing, repair, refurbishment, remanufacturing and recycling create a closed-loop system, reducing the use of resource inputs and the creation of waste, pollution and carbon emissions.
>
> **Sharing Economy:** The sharing economy is based on people sharing goods and services, either free or in an exchange. Examples include the commons (land), library, tool library, car- or bike-share co-ops, carpooling, GIRO, online platforms for free items, buy-nothing communities (buynothingproject.org), and gleaning.
>
> **The Gift Economy:** (excerpts from The Serviceberry: An economy of abundance, by Robin Wall Kimmerer)
> *Gratitude and reciprocity are the currency of a gift economy, and they have the remarkable property of multiplying with every exchange, their energy concentrating as they pass from hand to hand, a truly renewable resource. I accept the gift from the bush and then spread that gift with a dish of berries to my neighbor, who makes a pie to share with his friend, who feels so wealthy in food and friendship that he volunteers at the food pantry. You know how it goes…*
>
> *…[W]hat we crave is not trickle-down, faceless profits, but reciprocal, face-to-face relationships, which are naturally abundant but made scarce by the anonymity of large-scale economics. We have the power to change that, to develop the local, reciprocal economies that serve community rather than undermine it.*

Measuring Success: Frameworks and indices including Doughnut Economy (Oxford), Gross National Happiness (Bhutan), Genuine Progress Indicator (Canada), Human Development Index (UN), Ease of Living Index (India), Gross Ecosystem Product (England), have all been put forward as alternatives to a money-based GDP (Gross Domestic Product). These alternatives measure well-being of humans and eco-systems.

Investing in our Grandchildren's Future

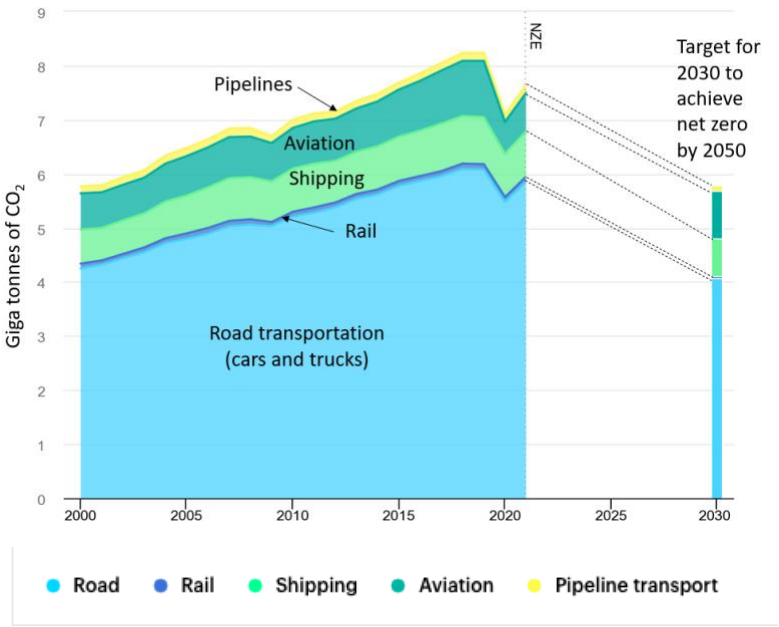
This section is aimed at those who have savings and pensions. Most pension plans invest in fossil fuels and most financial advisors recommend investing in fossil fuel companies. It is possible to take money out of those activities that increase GHG emissions and put that money into local and regenerative initiatives either directly (as savings) or through joining with others to call for disinvestment (for pension plans). The Gabriola Island Community Investment Co-op offers community members an opportunity to invest in local regenerative initiatives (investingabriola.ca).

CLIMATE CHANGE & TRANSPORTATION

Global Context

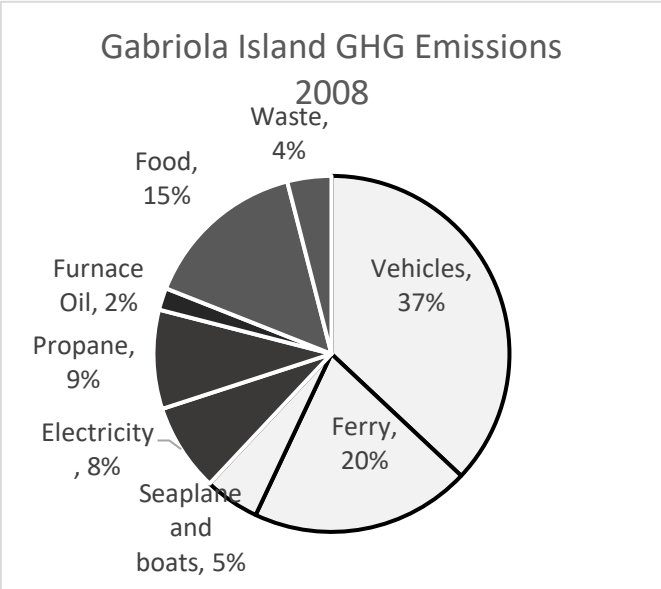
The International Energy Association states that transport has the highest reliance on fossil fuels of any sector and accounted for 37% of C02 emissions from end-use sectors in 2021. There was a decrease in emissions from transportation during COVID. However, emissions are rising back to their pre-Covid levels. Road transport is the largest contributor, with 5.8 6 Gt C02 in 2021, as seen in Figure 1. Shipping produced 0.84 Gt C02 and Aviation 0.71 Gt C02 in 2021. To achieve a Net Zero (NZ) emissions by 2050 goal there would need to be a 3% per year reduction from now to 2030 (NZ depicted in bar to right in Figure 1).

Figure 1: Global C02 Emissions from Transport by Sector



Twenty-five percent of global C02 emissions from transportation sector come from North America and the majority of those emissions come from road vehicles (IPCC). Strategies proposed by IPCC and IEA include a) increase electric vehicles, b) reduce kms travelled, and c) increase vehicle efficiency.

Gabriola and Transportation



A 2008 Gabriola report indicated that approximately 62% of GHG emissions on the island came from transportation, with 37% of those from passenger vehicles (the report did not include transportation of goods to Gabriola). In 2019 it was estimated that personal vehicles on Gabriola emitted approximately 7,260 tonnes, which is 1,513 tonnes higher than 2008.

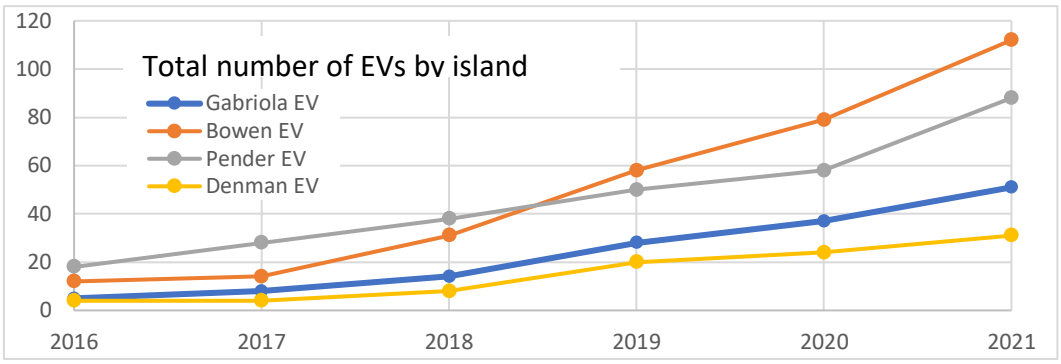
There are numerous strategies to reduce the emissions caused by fossil fuel passenger vehicles including:

Buses and trains: Gertie is perfect for Gabriola travel. Public transit in RDN takes passengers north as far as Qualicum and south as far as Duncan. There is also the IslandLink, which travels south to Victoria and north as far as Campbell River. Trains travel from Vancouver to Seattle for only $40/person.

Car sharing: Car-pooling, Car share apps, and Car share formal and informal co-operatives. Modo is a car share cooperative with vehicles in Nanaimo, Vancouver, Victoria and Kelowna. Members book cars when they need a vehicle

and pay for kms travelled. At the Economy Climate Café it was suggested that we create a transportation co-operative on Gabriola. If you're interested, please feel out the short survey (https://forms.gle/3EJMc4wPHDsdeUkw5).

Electric Vehicles (EVs): The number of EVs on Gabriola is rising but not as fast as on other islands. An initiative to increase the number of EVs to 50% by 2030 is underway on Gabriola. A key concern regarding EVs is the longevity and mining of minerals. The batteries last over 10 years and are recycled either as home batteries or the minerals are extracted and reused. The mineral concerns are addressed in the footnote below[1]. In BC we are fortunate to have very low emission electricity resulting in minimal emissions when driving an EV or and E-bike.

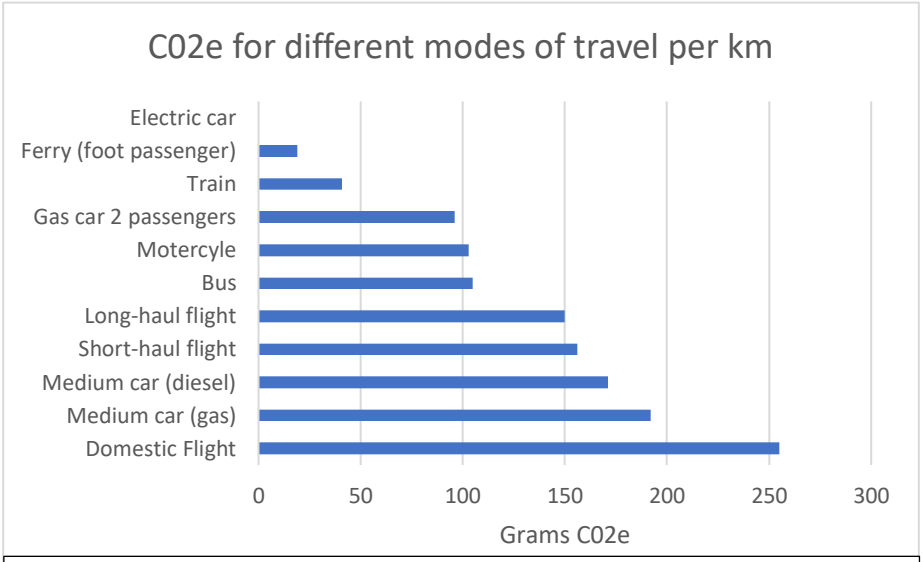


Walking, biking and E-bikes (non-emission travel modes): Fit your non-emission travel mode to your fitness level and your distance.

Reducing kilometres travelled: a) If using a fossil fuel vehicle combine errands and appointments into one trip where possible, b) buy local, c) local vacations, d) walk on the ferry rather than drive and use public transit, bike or Modo.

Alternative fuels: Biodiesel from waste vegetable oil was used on the Gertie buses and is now being used by GIFT (Gulf Island Food Transport) on Gabriola.

Carbon calculators provide us with information about how many C02 emissions we are creating through our various actions, including transportation. There are numerous calculators on the internet. Here is one that takes into account local factors and provides specific calculations for each component: https://www.carbonfootprint.com/calculator.aspx.



Source of data: UK Department for Business, Energy & Industrial Strategy. Greenhouse gas reporting: conversion factors 2019.

[1] Virtually all electric vehicles in use today use Li-ion batteries. That's because they can repeatedly charge and discharge without losing significant capacity. A Li-ion battery has many different metals in it, and some of those are in relatively scarce supply at present and also come with both social and environmental issues. The main materials are cobalt (~7%), lithium carbonate (~7%), nickel (~4%), manganese (~10%), aluminum (~14%), graphite (~16%), other materials (36%) – although variations on these exist. A Nissan Leaf has a battery that weighs just over 300 kg, so that's 21 kg cobalt, 21 kg lithium carbonate, 42 kg aluminum and so on. Cobalt mining is mostly done in the Dem. Rep. Congo and there are both environmental and social issues (e.g., child labour). Much of the lithium recovery is from salt lakes in South America and there are social issues (mostly around water supply).

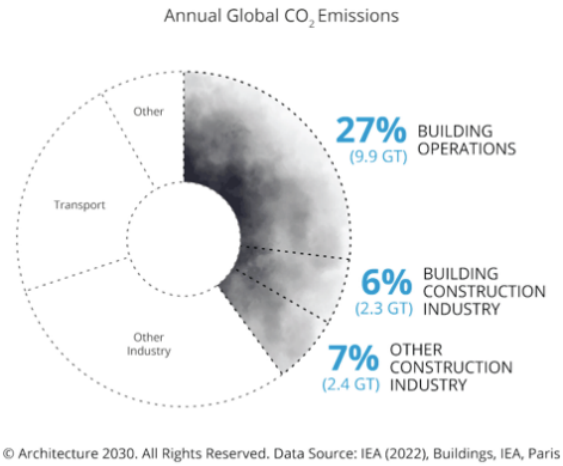
An average fossil fuel car driven 10,000 km/y for 15 y consumes 15,000 L of fuel. That's about 75 large 45 gallon drums, and results in the emission of 35 T of CO_2 to the atmosphere plus particulate matter, nitrous oxides and heavy metals. Fossil fuel vehicles are the largest contributor to climate change. The social and environmental costs of EVs are tiny in comparison to the deaths and damage due to climate change.

GABRIOLA
Climate 12-12-12
Local impacts – Local solutions

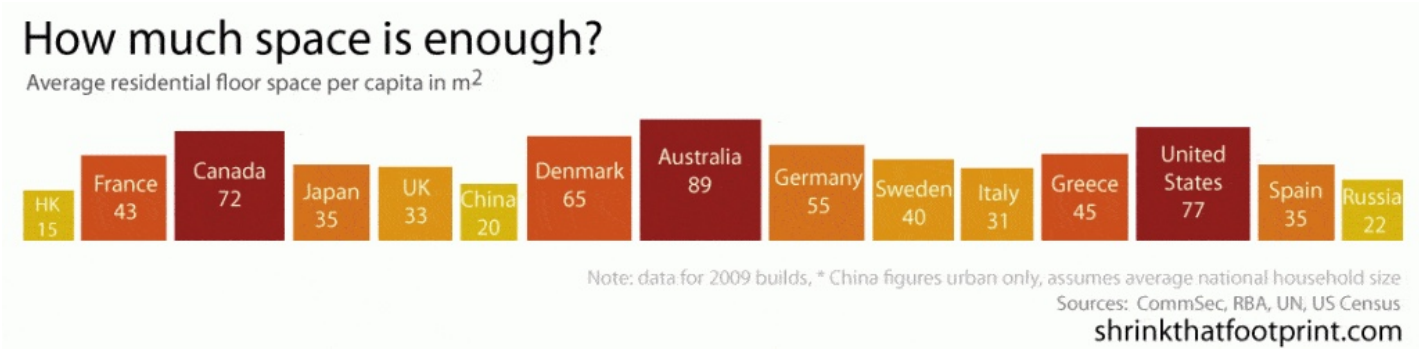
LOCAL BUILDINGS & CLIMATE CHANGE

Global and National Context

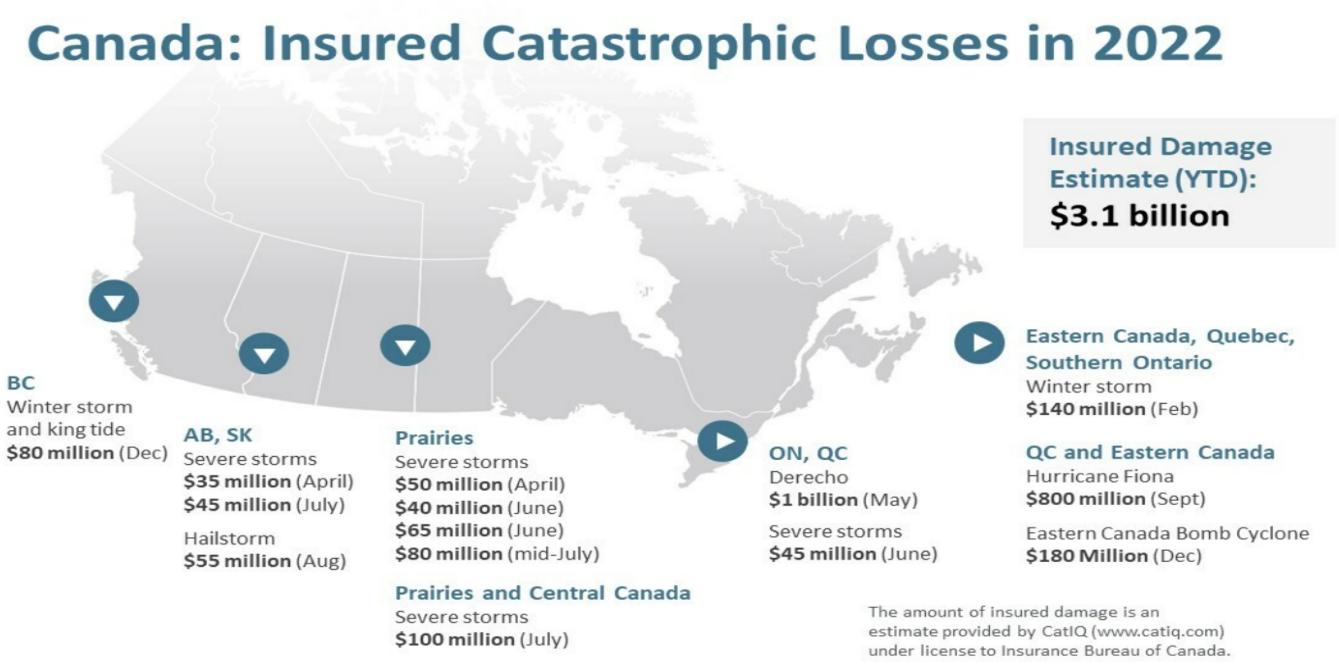
The built environment generates 40% of annual global CO2 emissions. Of those total emissions, building operations are responsible for 27% annually, while building and infrastructure materials and construction (typically referred to as embodied carbon) are responsible for an additional 13% annually.



Building operations account for 12 percent of Canada's national emissions, mostly for space and water heating. In 2020, 64% of the GHG emissions from building operations were from space heating.



Climate change weather events are resulting in substantial damage to the built environment impacting people, homes and communities.



We need to consider where and how we build and renovate our buildings in light of the risk of building damage due to extreme weather events. The dramatic increases in building damage from weather events has resulted in increased insurance premiums and challenges for some to even get insurance.

Gabriola context:

GHG emissions are created through *building operations* (space heating, water heating, etc.), *building construction*, and *building location*.

Operations: Space heating/cooling and water heating are the two biggest ongoing sources of GHG emissions from buildings. Type of heat source, size of building, number of occupants per square foot, and insulation values are the three biggest factors in space heating. For more info on residential energy use see the Climate 12 12 12 Fact Sheet for Energy on our web page: https://sustainablegabriola.ca/climate121212/

Type of heat source: The best option for BC, with our green electric grid, is a heat pump as can be seen by the table below. You'll notice it is also the lowest cost per kWh.

Type	$/unit	Kg C02e per/kWh	$/kWh
Heat pump	$0.14/kWh	0	$0.05
Electric Baseboard	$0.14/kWh	0	$0.14
Wood	$250/cord	depends on whether the tree was cut down or it was dead.	$0.08
Propane	$1.27/litre	0.22 Kg C02e	$0.25
Gas Generator	$1.63/litre	0.25 Kg C02e	$1.34

Click here for information about BC Hydro Rebates for heat pumps and here for SG Heat pump program.

Size: The smaller the living space per person, the less GHG emissions, as there is less space to heat. Space can be reduced by living in a smaller abode (tiny homes are one example) or sharing a house with others. On Gabriola the average household size is 1.9 people. The average number of rooms per dwelling is 5.8 and the average number of bedrooms is 2.5. Of the 3062 dwellings on Gabriola 2,235 are single detached houses. There are approximately 45 apartments and 70 moveable dwellings.

Insulation: The effectiveness of your building's insulation determines how much energy you'll need to heat the space. The age of the building may be a factor in how effective your insulation is in keeping the cold out. On Gabriola there are 180 that require major repairs and most houses are 30-60 years old. (Stats Canada)

1 to 11 years old: 265
12 to 31 years old: 985
32 to 61 years old: 1020
62 years old or older: 105

Click here for information about BC Hydro rebates for insulation.

Building Construction

The manufacture of building materials, such as steel, cement and glass contribute significantly to the GHG emissions from construction. In a recent Canadian study analyzing how newly constructed houses fare when it comes to environmental impact, the researchers found that concrete basements accounted for an average of 56% of total material intensity. The manufacturing of concrete generates 7% of global GHG emissions.

Local builders emphasize the need to build smaller, build airtight, insulate well and reduce the number of windows (or use high efficiency windows) in order to reduce emissions, both from the build itself, as well as long term emissions from energy consumption.

Location

There is an interconnection between emissions from buildings and transportation, one that highlights the importance of location for our homes. When homes are located within walking or biking distance of services, groceries, bus routes and any destination that requires travel, our emissions from transportation drop substantially (as long as we walk or bike rather than drive to those destinations!).

GABRIOLA Climate 12-12-12

Local impacts – Local solutions

WATER & CLIMATE CHANGE

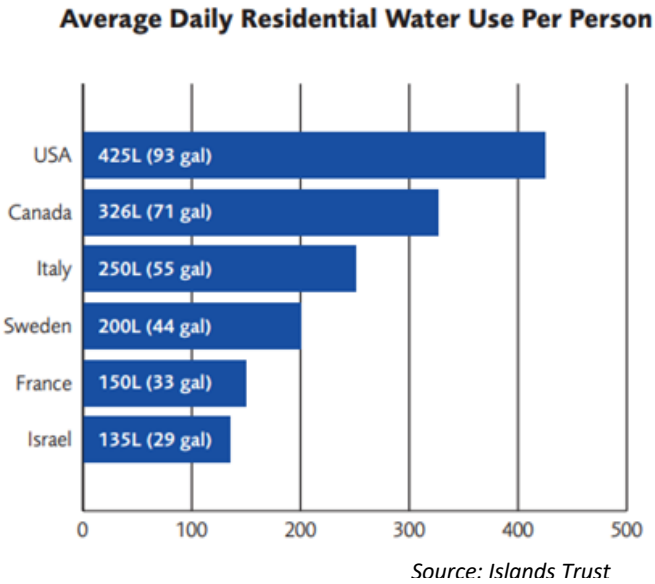
Context

Most climate models indicate warmer, rainier winters and hotter, drier summers in the future for southwestern British Columbia, including the Gulf Islands. Drier summers can result in slower groundwater recharge and greater heat will result in more water losses to evaporation, likely lowering water tables. Heavier rains in the winter may increase the amount of rainwater lost to run-off, escalating erosion damage to streams.

The predicted extremes in temperature and precipitation patterns due to climate changes will affect our groundwater resources. Many of the Gulf Islands, including Gabriola, have a limited ability to store surface and groundwater and lose up to 80% of rainwater as runoff to the ocean.

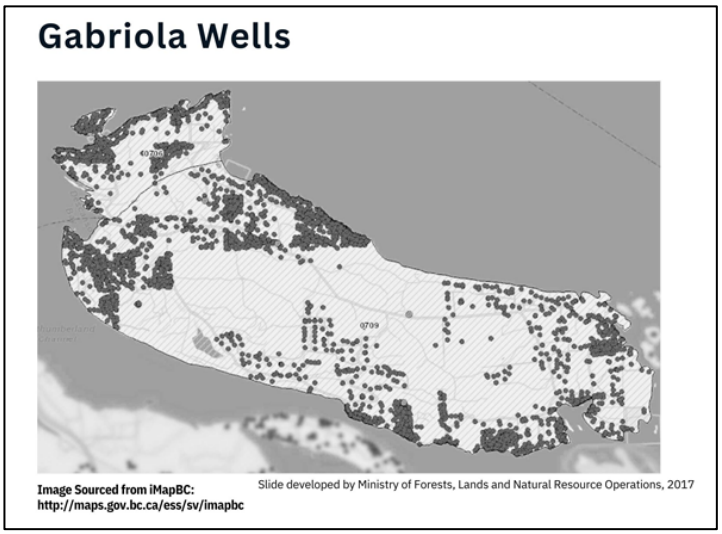
Water Consumption

The average Canadian uses around 330 litres of water daily (indoor and outdoor). Of that, ~10% is used for cooking and drinking and over 50% for flushing toilets and showering. Many water districts on the Gulf Islands report water use levels of 190-230 litres per person per day for full–time resident households. Rainwater-dependent users consume from 90-150 litres per person daily.



Source: Islands Trust

Most water consumed on Gabriola Island is drawn from the groundwater aquifer (water bearing rock fractures); rainwater is harvested for outdoor irrigation and is also used as a potable water source. The total groundwater withdrawal in summer is around three times higher than in the winter. A study of the water balance of the Gabriola Island aquifer indicates the local aquifer is under stress during the summer.



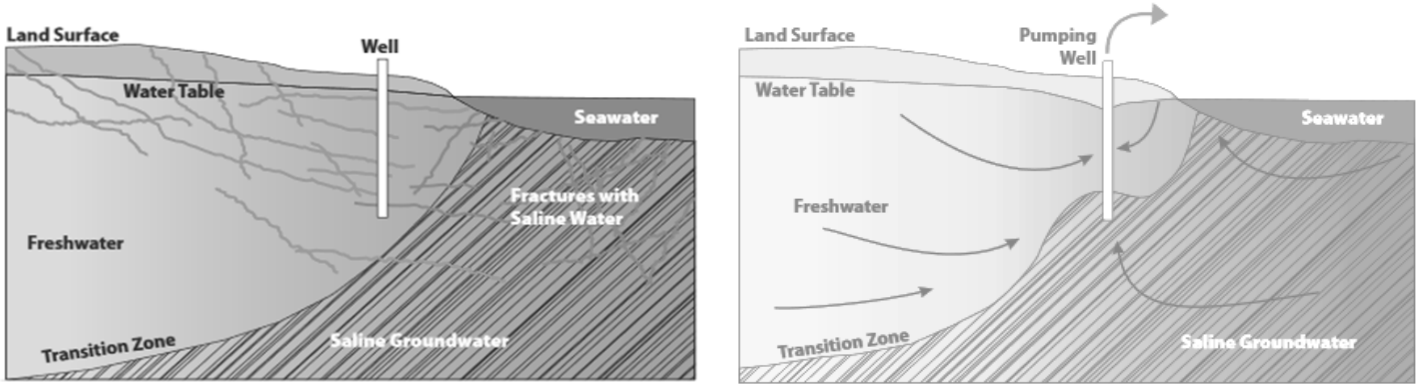
Gabriola Wells

Most islanders depend on well water for a sustained water supply. There are over 300 registered groundwater wells on Gabriola Island (Islands Trust, 2019). The mean depth is ~220 ft and the mean yield is ~8.5 USGPM (32 L/min). As the demand for groundwater increases, so do the well water quality challenges, including sulphur taste and odour, low yields, or saltwater intrusion.

There are 20 observation wells and 2 mapped aquifers, both are fractured bedrock.

Saltwater Intrusion

Saltwater intrusion occurs when seawater is drawn into a freshwater aquifer. Adjacent to the coast, groundwater consists of a freshwater aquifer that sits above the higher-density seawater with a transition zone (a mix of fresh and saltwater) in between. The risk of seawater intrusion into the freshwater aquifer is higher in areas close to the coast with a high density of wells.



The overuse of the aquifers on the Gulf Islands contributes to instances of saltwater intrusion, an increasing number of abandoned wells, and measurable declines in water quality over the summer months. For example, saltwater can find its way to the well via a single fracture in the bedrock. Once seawater intrusion occurs, changes in the aquifer may be irreversible or take many years to recover. Sea level rise will amplify the saltwater intrusion problem, although likely not for several decades. This area is not experiencing relative sea level rise currently because while the sea level is rising, the Earth's crust is also rising because of the melting of the glaciers that were here until about 12,000 years ago.

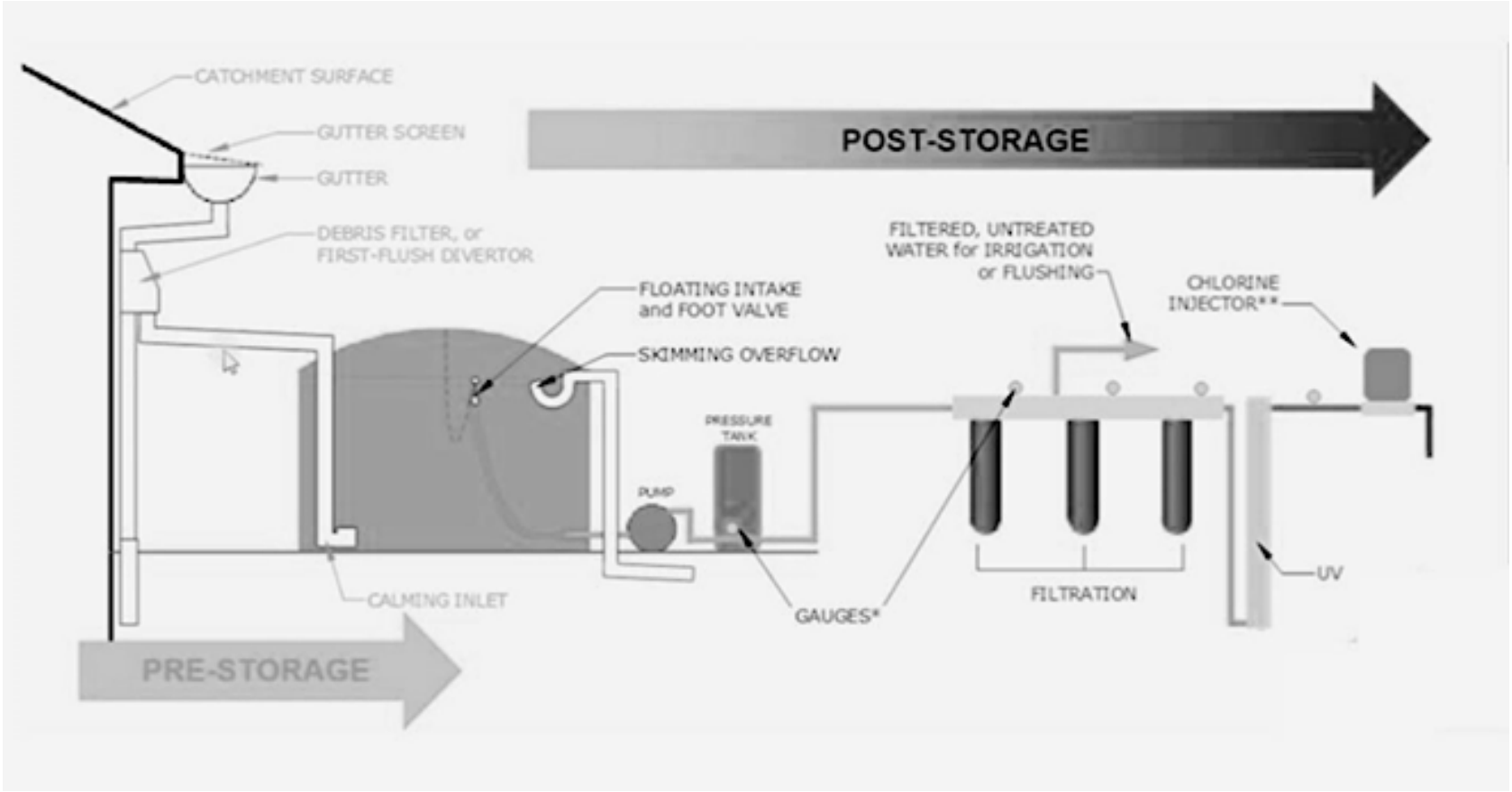
Rainwater Harvesting

Rainwater Harvesting can reduce climate change vulnerability and is used worldwide as an alternative for clean water sources during a drought. Rainwater can increase water availability and reduce demand on groundwater in areas where water is scarce. The benefits of rainwater harvesting systems go beyond home use, helping to reduce storm water runoff, slow down erosion, and mitigate urban flooding.

Rainwater harvesting refers to collecting and storing rainwater for reuse on-site, rather than allowing it to run off. It is suitable for areas with an annual average rainfall of more than 400 mm per year. (Gabriola's averages about 960 mm per year.) Modern rainwater harvesting systems – adequately managed and maintained – are safe and yield good-quality water.

Rainwater can be harvested for domestic, agricultural or commercial uses. The most common domestic uses of rainwater include non-potable uses such as toilet flushing, gardening and car washing, or potable uses such as drinking and cooking, dishwashing, and showering. Harvested rainwater properly treated provides a sustainable source of freshwater and helps alleviate water shortages and reduces reliance on water deliveries.

Resources and Rebates: Find more about saltwater intrusion from the BC Gov. factsheet
Learn more about Freshwater Sustainability from the Islands Trust website
Find your well in: Groundwater Wells and Aquifers directory
Access funding through RDN Rainwater Harvesting Rebate program.
Well Water Testing Rebate https://www.rdn.bc.ca/well-water-testing.



Components of a Rainwater Harvesting System

Pre-Storage Roof – preferably metal. Should be cleaned regularly (once per year is normal) Gutter covers Gutters Rain Leaders Debris Trap (clean several times per year) First Flush Diverter (pipe sized to reject 1st 0.5 mm rain; Use for bypass during pollen season) Banjo Filters (metal screens after FFD) Basket filters (if gravity fill) Transfer Tank (40 gal or so) with small transfer pump controlled by level switches)	**Storage** Cistern (plastic or concrete) Air bubbler (optional) Intake valve (floating is preferred, or intake mounted a few inches above cistern bottom) Overflow (should be same diameter as input line) **Post Storage** Pump and pressure tank Tall filters with replaceable media – 20 and 5 microns (change media every 6 months or so) Ultra-Violet disinfection (standard) 2nd disinfection if required (chlorination ??)

Location: Gabriola Island Weather Station (1981-2006 stats)
Property: Typical location

Collection Area #1: 1500 sq. ft.
Collection Area #2:
Collection Area #3:
Total 1500 sq. ft.

Unbalanced

Max Storage Cap (gal): 7,500 (3 US 3000 gal cisterns)
Usage per day: 70 (317 l per day)
Assumed Rainfall Leve: Avg (gal)
Enter 10% : 20% : 30%: 50%: Max : Avg :Min
Volume Units: gal (Choose one of gal or litre (Imp. Gal.))

Month	Indoor Useage gal/mon	Outdoor Useage gal/mon	Assumed Rainfall inches	mm	Assumed Collection Efficiency	Rainfall Collected gal/mon	Alternate Supply gal/mon	Storage Volume gal/mon
Start								0
October	2,170	0	3.4	86.1	75%	1984	0	**0**
November	2,100	0	6.2	156.9	85%	4096	0	**1996**
December	2,170	0	5.5	140.7	85%	3673	0	**3499**
January	2,170	0	5.8	146.8	85%	3831	0	**5160**
February	1,960	0	3.8	95.9	85%	2504	0	**5703**
March	2,170	0	3.6	92.1	85%	2403	0	**5937**
April	2,100	0	2.5	62.7	50%	963	0	**4800**
May	2,170	0	1.9	47.7	65%	953	0	**3582**
June	2,100	0	1.7	43.1	75%	992	0	**2474**
July	2,170	0	1.0	24.5	65%	489	0	**793**
August	2,170	0	1.0	26.6	65%	530	0	**0**
September	2,100	0	1.3	33.9	75%	782	0	**0**
TOTAL	**25,550**	**0**	**37.7**			**23,198**	**0**	**-2,352** Surplus
Demand	**25,550**			**Supply**		**23,198**		Supply

Balanced

Max Storage Cap (gal): 7,500 (3 US 3000 gal cisterns)
Usage per day: 60 (272 l per day)
Assumed Rainfall Leve: Avg (gal)
Enter 10% : 20% : 30%: 50%: Max : Avg :Min
Volume Units: gal (Choose one of gal or litre (Imp. Gal.))

Month	Indoor Useage gal/mon	Outdoor Useage gal/mon	Assumed Rainfall inches	mm	Assumed Collection Efficiency	Rainfall Collected gal/mon	Alternate Supply gal/mon	Storage Volume gal/mon
Start								0
October	1,860	0	3.4	86.1	75%	1984	0	**124**
November	1,800	0	6.2	156.9	85%	4096	0	**2420**
December	1,860	0	5.5	140.7	85%	3673	0	**4233**
January	1,860	0	5.8	146.8	85%	3831	0	**6204**
February	1,680	0	3.8	95.9	85%	2504	0	**7027**
March	1,860	0	3.6	92.1	85%	2403	0	**7500**
April	1,800	0	2.5	62.7	50%	963	0	**6663**
May	1,860	0	1.9	47.7	65%	953	0	**5756**
June	1,800	0	1.7	43.1	75%	992	0	**4947**
July	1,860	0	1.0	24.5	65%	489	0	**3576**
August	1,860	0	1.0	26.6	65%	530	0	**2246**
September	1,800	0	1.3	33.9	75%	782	0	**1228**
TOTAL	**21,900**	**0**	**37.7**			**23,198**	**0**	**1,298** Surplus
Demand	**21,900**			**Supply**		**23,198**		Supply

Climate Change & Action! — Overview

An organized summary of the major brainstormed ideas from all Gabriola Climate 12-12-12 Climate Cafes, to be displayed for general dot-votes (to initially prioritize), and then to focus the Action Teams.

Action Areas (8)

1. Agriculture & Food Security
2. Biodiversity
3. Buildings & Energy
4. Economic Change
5. Transportation
6. Health & Well-Being
7. Waste Management
8. Water

\+ The Arts

\+ Indigenous Ways of Knowing

Tools for Action (6)

1. Community Action — CA
2. Neighbourhoods — N
3. Advocacy — Adv
4. Education — Edu
5. The Arts — Art (could inform every issue, and have its own Action Team)
6. Indigenous Ways of Knowing — IWoK (could inform every issue, and have its own Action Team)

Convenors

While Action Teams will have somewhat fluid membership, one person will be selected by the group to convene their meetings. While certain tasks, such as note-taker and facilitator, can be shared or rotated, it is best to have a consistent person whose responsibility it is to ensure that meetings are set, notes are taken, and to represent the Team at monthly “Intersection” meetings.

A Team Convenor is expected to be a good listener and to conduct meetings with Respect, Inclusivity (openness to new ideas and people), Flexibility, and Kindness.

Note: Words in [square brackets] are interpreted or added by the coordinators.

The ▲ symbol denotes actions that also appear under another Action Area, indicating the possibility for collaboration and need for coordination between teams.

THE PERMIT SONG

by Luke Wallace, lukewallacemusic.com … lukewallace.bandcamp.com/track/the-permit-song

I don't need your permit to build myself a home
I do not need your license to sell the things I've grown
And I don't need your papers, I ain't gonna sign your line
Or waste my time on something like that, something like that

Show us your papers
Show us your papers
Show us your papers
Show us your papers

Show all your papers and your permits
And your license and insurance
To the inspector, with his clipboard
When he comes right to your front door
With his clauses and conditions
And his fine print and prohibitions
Trying to sell shit I don't believe in
So I tell him, sir

Show me your papers
Show me your papers
Show me your papers
Show me your papers

Are we going backwards? Is it rewind?
Is it red lights? Is it stop signs?
With the tankers and the pipelines
And the bankers and their war crimes
And this country, like a nation
Which is more like a corporation
Taking money and donations
To oppression the liberation
Of the folks on the reservations
With not an ounce of reconciliation
Or a dollar for clean hydration
Can you hear em saying

Show us your papers … Show us your papers
Show us your papers … Show us your papers

I don't need your permit to build myself a home
I do not need your license to sell the things I've grown
And I don't need your papers, I ain't gonna sign your lie
Or waste my time on something like that, something like that
Something like that