

Watershed

Sentinel



ALL WE
HAVE
IS NOW



Read Islanders launch silent auction in support of the purchase of Lot 302.

Bid NOW or **Donate**

Goal: \$115,000

Raised: \$100,708

HELP them raise
the remaining
\$14,292

www.gofundme.com/f/lot-302-purchase-read-island-bc

February | March 2020

A unique opportunity

exists for the Surge Narrows Community Association to purchase Lot 302 on Read Island, an island at the top of the Strait of Georgia near Quadra and Cortes. **This purchase would create a 40 acre (16 ha) Ecological Reserve** protecting a corridor from Surge Narrows dock to the far boundary of an existing Fish & Forest Reserve at the headwaters of Read Island's most important salmon streams. Purchasing this land would prevent the area being logged and instead allow for nature trails and associated educational opportunities while ensuring this rare, old growth low elevation rain forest remains in its natural state. The current owners have agreed to sell the land for \$150,000 (significantly below the value of the timber on the land). \$50,000 has been generously donated by a local family and business, Coast Mountain Expeditions.

Through some incredibly generous donations not just from locals but from environmentalists worldwide, this community has raised \$100,708. All that is needed now is the balance to reach the \$115,000 target to cover the legal costs for the purchase of and placing covenants on the land, signage and trail building materials. More information on the project can be found at <https://www.gofundme.com/f/lot-302-purchase-read-island-bc>.

This small outer islands community is reaching out to you to help secure the remaining funds required to complete this purchase.

All donations are tax deductible.

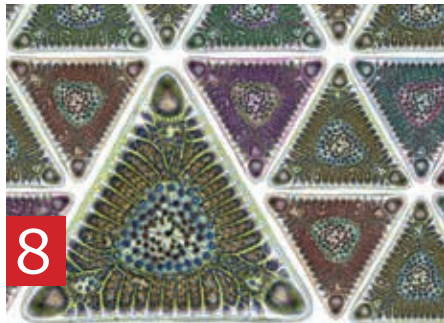
The fundraising committee has also just launched an online silent action which can be accessed through this link: <https://www.32auctions.com/SNCA-Lot302>. It will be live for a month and close at midnight on February 14th.

Please take a look at it and start bidding! While some items will clearly be of interest to locals, others may well be of interest to those who are not residents. So feel free to share. The key to the success of this auction will to spread the word far and wide.

We can still add things to the auction, so if you are inspired just contact Rosie Steeves and she will make sure your item is added.

Phone 604-649-0927
rosie@executiveworks.org

Features



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©LouisMeniquet

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Micro-Heroes

Phytoplankton’s response to the effects of climate change is complex, variable, and enormously important.

The Path Forward

While the world’s leaders dither on climate action, all around the world concrete steps are being taken at a more local level. Cities, local co-ops, neighbourhood groups, schools, farms, and clubs are showing us the path forward, one determined step at a time.

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Editorial

Delores Broten

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On Taxes and Wealth

Lately a handful of wealthy investors and business leaders signed a letter calling for “higher and fairer taxes on millionaires and billionaires.” You bet! Tax reform is badly needed, including an end to those absurd off-shore tax shelters. (See “Tax Havens and the Other Paris Agreement,” Joyce Nelson, WS, January 2018.)

There are far too many greasy fingers in the pot. (Speaking of which, where *is* that BC corruption inquiry?)

Even better would be a change to the root causes of this great inequality – the planet-plundering, community-destroying, ever-expanding demand for growth and profit. That economic model is killing us and our spaceship earth.

Fortunately, there is another kind of wealth at work, quietly and persistently, in all our communities. Folks see a need and step in to make a difference. Could be protection of a forest or a stream. Could be food banks or community gardens. Could be health care, housing, kids’ sports, art festivals. The list is endless.

When you look around, the great wealth of people doing what their communities need is amazing. And it seems each action sparks another.

That is the kind of growth we need.

—Delores Broten, Comox, BC, January 2020

At the ‘Shed

We’re excited to announce that Watershed Sentinel Books is publishing the second expanded edition of Dan Jason’s latest book, *Changing the Climate With the Seeds We Sow*. With beautiful watercolour illustrations by award-winning artist Lyn Alice, Dan’s book profiles plants that are “nutritious, energizing, time-tested, earth-friendly and beautiful,” and their potential in transitioning to a more climate-safe, local, and food-secure agriculture. It will be in print by February 10. Visit www.watershedsentinel.ca/books to order.

Great call: “I love your magazine and your work,” said the voice on the phone. “I’ve been reading it for years. Someone’s been leaving it for pick up at the post office. So I’ve decided it is time to belly up to the bar. I want to subscribe.”

Celebrating! This is our thirtieth year of publication. Starting as a tiny photocopied freebie on Cortes Island, we have slowly morphed into the magazine you hold in your hands. This is a community production and a community achievement. Thank you, readers and funders.

Correction. During editing of Jim Standen’s letter in our last issue, a sentence was modified to read inaccurately. The 4th paragraph begins, “Seventy per cent of batteries have many other uses.” It should read, “A 70% battery has ample capacity for many other uses.” The point being 70% is generally the estimated EV charge retention when you might consider replacing the battery in your EV. The battery that was replaced is available for other uses.

Microsoft aims for carbon negative

Open a window

Microsoft has announced it aims to be carbon neutral by 2030, and by 2050 to have removed enough carbon from the atmosphere to account for all direct emissions the company has ever made. It plans to reach its goal through negative emissions technologies, potentially including creating new forests, tree planting, soil carbon sequestration, bioenergy with carbon capture and storage, and direct air capture.

—*www.theguardian.com*
January 16, 2020

China to phase-out single-use

Plastic policy



China is adopting policies to restrict the production, sale, and use of single-use plastic products. Under the new rules, plastic bags will be banned in major cities by the end of 2020, and throughout the country by 2022, although markets

selling fresh produce will be exempt until 2025. The restaurant industry is mandated to eliminate plastic straws and reduce other single-use plastic items by 30% by the end of 2020. Other plastic items such as utensils and takeaway containers will also be phased out.

—*www.reuters.com*
January 19, 2020

Threatened species lose 15M acres

Burned

Over a billion vertebrates estimated killed by Australia's bushfires could be only the opening foray for threatened species, according to University of Queensland scientists. Using satellite imagery, researchers estimated six million hectares of threatened species habitat has burned, and that 99% of the area burned contains potential habitat for at least one species listed as threatened in Australia. Roughly 70 threatened species are estimated to have had at least half of their range burnt, while nearly 160 threatened species have had more than 20% of their range burnt.

—*www.phys.org*
January 20, 2020

EU to turn from gas power

Gas fired

In a move expected to send shockwaves through the natural gas industry, the EU will exclude gas-fired power from its procurement plan to achieve net-zero carbon emissions by 2050, due to be unveiled in February. The implications of the decision could be felt beyond EU borders by setting the tone for institutional investors and asset managers looking for sustainable investments.

—*www.afr.com*
January 9, 2020

Green hull coating tested

No harm no foul

Australian researchers are set to conduct a year of sea trials testing a marine coating that can take up copper from seawater and release it using electrical pulses, to prevent the growth of unwanted organisms on ship hulls. The technology could overcome environmental concerns with common anti-fouling coatings, which release copper into the water to kill off organic growth such as algae and barnacles, thereby increasing copper in harbour waters around the world. Hull fouling can increase fuel use, damage hulls and pose a biosecurity threat of disease spread.

—*www.theleadssouthaustralia.com.au*
January 6, 2020

California advances microgrids

Decentralize it

California's wildfire-caused power outages have catalyzed its efforts to support microgrids. The state's Public Utilities Commission, Independent System Operator, and Energy Commission have been directed to jointly craft a policy framework that encourages and streamlines the deployment of microgrids, while also reducing greenhouse gas emissions, protecting California ratepayers, and advancing California's progressive environmental goals. The framework could be used as a model for other parts of the United States facing increasingly common and powerful natural disasters.

—*K&L Gates LLP (press release)*
January 23, 2020

Letters

Choose Your Disturbance

As someone who would give up (and has given up) much to have a decent hope for the future of life on earth, including those closest to me, I have considered joining in Extinction Rebellion actions. I hesitate because, by nature, I hate to cause a disturbance.

On the other hand, as time ticks by, the “disturbances” we will encounter are going to be way beyond anything that the Extinction Rebellion group is causing now. They already are.

I spoke with someone who works for a mainstream media outlet not long ago about this. I was heartened that they recognized how serious our situation is. They said something about how “Indigenous people would save us.” Tears started falling down my cheeks. I realized later I was moved that they know how serious the situation is, but shocked that they would think someone else, especially people who have survived genocidal conditions and still face enormous hurdles, would “save” us!

It’s up to all of us.

We need to understand that the best-before date for mega-projects like subsidizing fracking, LNG pipelines, and site C was long ago. Now we know that not only do we contaminate water, exacerbate the climate emergency, and jeopardize the health of workers and others, we lose out financially.

—Jan Slakov
Salt Spring Island, BC

Gateway Copy

I was handed a free copy of your magazine and was bowled over by the quality and selection of articles. I’m particularly grateful to find a well edited and useful publication for consideration by the community climate action group that I belong to. I look forward to reading more as my subscription arrives.

—Phil Lancaster, Gorge Tillicum community
Saanich, BC

Tyee Memories vs Yanni, Yanni, and Yanni

If you were a sport fisherman in the Comox Valley before the 1990s, you know how good the fishing in the Strait of Georgia used to be. Chinook, Coho, and Pink were plentiful, though Tyee (30+lbs Chinook) had already been declining in our waters for several years. But even then we heard tales of how abundant the Tyee had been in Comox Bay, and around that area, before the Puntledge Dam and Hatchery went in.

Yes, some Tyee were still being caught around here, but if you wanted to catch one for sure, you headed to Nootka Sound. And that is what thousands of us did, travelled to Nootka for the giant salmon, the 30 to 60 pounders, and there were a lot of them. The 10 and 20 pound Chinook were usually released, since we could catch them easily off Kitty Coleman, but we took the Nootka Tyee home in our coolers.

In the early 1980s, the Conuma River Chum Hatchery went in, and a few years later it started rearing Chinook and Coho for the Nootka sport fishermen. We have known since 2004 or earlier that hatcheries diminish the genetic diversity of fish. It is also easier to take eggs from a smaller fish – short circuiting the benefits of natural selection.

So between the hatcheries diluting the genetics of Chinook and Coho, plus the sport fishermen selectively targeting Tyee, I think we know where those giant salmon have mostly gone.

Sport fishermen must take their share of responsibility for that. To quote a scientist from the 2011 PBS documentary, *Salmon: Running The Gauntlet*, “Hatchery programs are trying to replace Bach, Beethoven, and Mozart with, Yanni, Yanni, and Yanni, and it’s not going to work.”

—Fred Fern
Comox Valley, BC

The Watershed Sentinel welcomes letters

but reserves the right to edit for brevity, clarity, legality, and taste.

Anonymous letters will not be published. Send your musings and your missives to:

Watershed Sentinel Box 1270, Comox BC, V9M 7Z8

editor@watershedsentinel.ca or online at www.watershedsentinel.ca

EV networks grow

Zappy Tire

Petro Canada has announced completion of a network of over 40 EV charging stations stretching coast-to-coast from Victoria, BC to Stewiacke, NS. The stations are equipped with DC fast chargers that can charge most EVs to 80% in under a half-hour, and have universal standard CCS and CHAdeMO connectors. Meanwhile Canadian Tire announced 90 of their locations across the country are to have EV charging stations installed by the end of 2020. At completion, that network will total 240 fast chargers and 55 Level 2 chargers.

—www.insideevs.com
December 26, 2019

—Canadian Tire press release
January 15, 2020

Old books reveal salmon declines

Data Discovery

Slimy, 100-year-old notebooks exhumed from the Pacific Salmon Commission's Vancouver basement are being used to conduct a historical in-depth study of Canada's native salmon populations. The notebooks include meticulous measurements of randomly sampled salmon along the Skeena River from 1912 to 1948, as well as salmon scales and slime prized for microscope and DNA analysis. In contrast to the relative stability suggested by modern data, the treasure trove of information shows dire long-term declines, including a 56-99% reduction in the Skeena River watershed's sockeye salmon population over the past century.

—www.atlasobscura.com
August 28, 2019

Courts dismiss Taseko thrice

Tsilqhot'in Wins

On December 17, the BC Court of Appeal dismissed an application by Taseko Mines Ltd. to appeal an injunction prohibiting Taseko from conducting exploratory drilling around Teztan Biny (Fish Lake), west of Williams Lake. The day after, Taseko was further rebuffed when the Federal Court of Appeal dismissed Taseko's applications for judicial review of a 2010 Joint Review Panel report on toxic water seepage, as well as the 2014 decision by Canada's Governor-in-Council rejecting the company's New Prosperity mine proposal.

—www.ravenstrust.com
December 18, 2019

Peace Nations reject privatization

Land Sale No-Go

North Peace Tribal Council Chiefs, representing the Tall Cree First Nation, Little Red River Cree First Nation, Beaver First Nation, and Dene Tha First Nation, have rejected a land sale framework proposed by Mackenzie County to the Alberta government. One of the objectives of the framework is the sale of 350,000 acres of land. The proposal is part of a three-phase land transfer plan dating back to 2010, which has already sold off more than 120,000 acres of so-called "Crown" land in northern Treaty 8 Peace country, without the consent of area First Nations.

—North Peace Tribal Council
press release
November 27, 2019

Wetland methane multiplier

Road Block

Roads that cut through boreal peatlands can cause methane emissions from the land to multiply by up to 49 times, according to new research by a University of Waterloo scientist. Seemingly innocuous road building, especially perpendicular to water flow, was found to disrupt water cycling through wetlands, encouraging methane-emitting microbes to decompose more plant matter. Previous research suggests road-riddled peatlands take decades to return to their wild state.

—www.atlasobscura.com
December 20, 2019

Ktunaxa to create protected area

Jumbo Victory



©Danny Laroche

The 30-year battle over plans to build a \$1 billion ski resort in the Jumbo Valley has ended in resounding defeat for Jumbo Glacier Resorts, the project's proponent. The Ktunaxa Nation Council announced a deal with the Province and the federal government to receive \$16.1 million, which, along with \$5 million from private donors, will be used to buy out tenures for the resort and create the 700 km² Qat'muk Indigenous Protected and Conserved Area.

—www.vancouversun.com
January 18, 2020

Going Viral

Testing Clayoquot Sound salmon farms for PRV

by Dan Lewis

Wild salmon are on the brink of extinction in the Clayoquot Sound UNESCO Biosphere Region surrounding Tofino. Returns of Chinook in 2019 were some of the lowest ever recorded. The Megin River in Strathcona Park saw a mere eight Chinook return to spawn; the Moyeha — the adjacent valley — saw only 20. With the abundance of pristine rainforest habitat in these watersheds, we can rule out impacts from logging — something else is going on.

There could be several factors at play, but with 20 salmon farms on the migration routes of wild salmon, that seemed

like an obvious place to look for answers. That's why Clayoquot Action launched Going Viral, a project to field-test Clayoquot Sound salmon farms for the highly contagious Norwegian piscine orthoreovirus (PRV).


The method we used was developed by biologist Alexandra Morton. Because BC fish farms use open-net pens, things flow in and out. Sea lice, bits of decomposing farmed fish, and viral particles flow out freely to pollute the marine environment.

This means we can take samples from fish farms and test them for pathogens. We

approach the farm very closely, stand on the prow of the boat with aquarium nets on poles, and scoop up bits of flesh, fat, feces or fish scales. Sometimes this takes just minutes; other times we strained our eyes for an hour in order to fill a couple of vials.

The samples were placed in a virus preservative and shipped to the Atlantic Veterinary College for testing.

Here are the results as we go to press: of the farms stocked with fish during the study period, 90% of Cermaq's eleven active farms tested positive for PRV; 100%



90% of Cermaq's eleven active farms and 100% of Creative Salmon's four active farms tested positive for PRV.

of Creative Salmon's four active farms also tested positive for PRV. The lab has done further testing on our samples to confirm that the virus Clayoquot Action is finding is the Atlantic PRV1a sequence variant. (Kibenge et al 2013)

It's alarming to confirm that a virus from the Atlantic Ocean has been found coming from Atlantic salmon farms in a UNESCO Biosphere Reserve on the Pacific. It is of particular concern that Creative Salmon is rearing Pacific Chinook in their farms that tested positive for this virus. One has to ask where they got it from – could it have come from Cermaq's farmed Atlantics, or is their hatchery infected?

Pacific salmon respond to this virus differently than Atlantic salmon.¹ In Atlantic salmon, PRV causes Heart and Skeletal Muscle Inflammation (HSMI) which makes it hard for fish to feed themselves, evade predators or swim up rivers to spawn. Farm salmon – protected from predators – often recover. In Pacific chinook, PRV fills their red blood cells until they explode, overwhelming the liver, causing organ failure, and causing the fish to become jaundiced. In sockeye, PRV causes lesions to form on the heart.

Creative's salmon are processed at a plant in Tofino, made famous a couple of years ago when photographer Tavish Campbell dove and filmed the bloodwater spewing into the harbour. Although the visuals of the blood gushing out of that pipe were disturbing, what was truly alarming is that the blood was tainted with PRV.² That means that wild fish swimming through Tofino Harbour are being exposed to PRV, and currents are carrying viral particles into the Sound. Because fish breathe through gills, it is dead easy for viral particles to get into the blood of wild fish.

It's not easy to find PRV in wild salmon, because unlike salmon in captivity, they do not have the luxury of being fed and protected from predators. One study found fewer and fewer wild fish testing positive for PRV as you move away from the salmon farms and up the Fraser River.³ This suggests wild salmon exposed to salmon farms are becoming infected, and that infected salmon are having difficulty swimming up rivers.

The Liberal government promised during the 2019 election to remove open-net pen salmon farms from BC waters by 2025. This was reflected in the mandate letter to new Fisheries Minister Bernadette Jordan. Local MP Gord Johns (NDP Fisheries critic) is determined to push hard for early legislation in order to ensure an orderly transition for workers and communities.

Washington State passed similar legislation in 2018 due to the risk to wild salmon, leaving BC the only jurisdiction on the west coast of North America permitting open-net pen salmon farms. In the interim, Washington is not allowing PRV-infected fish to be put into salmon farms – in fact they've ordered that 1.8 million fish be destroyed, rather than put their wild salmon at risk (the industry has been unable to find any uninfected fish to stock their farms with).

In BC, three lawsuits have successfully challenged DFO's policy of putting PRV-infected fish in farms. However, DFO managers continue with this dangerous practice, perhaps because

the industry complained to the court that prohibiting the transfer of PRV-infected smolts from hatcheries into the farms would "severely" impact them.

There are two important reasons why we should not allow PRV-infected salmon into BC open-net pens: salmon farms amplify viruses and broadcast them to the surrounding environment, and salmon farms allow the virus to breed, mutate, and become more virulent – as happened in Norway.⁴

With the extinction trajectory that wild salmon are on, it's past time to demand that DFO immediately stop the transfer of PRV-infected fish into open-net pen salmon farms. Add your voice to the petition on salmonpeople.ca.

Dan Lewis is executive director of Clayoquot Action in Tofino.

1: Di Cicco & Miller (2018); Garver et al (2016)

2: Pers comm Alexandra Morton (work to be published)

3: *The effect of exposure to farmed salmon on piscine orthoreovirus infection and fitness in wild Pacific salmon in British Columbia, Canada*, Morton et al (2017)

4: *PRV has mutated and increased virulence in salmon farms in Norway*, Dhamotharan et al (2019) <http://dx.doi.org/10.3390/v11050465>



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Oceans of Uncertainty

Phytoplankton's response to the effects of climate change is complex, variable, and enormously important

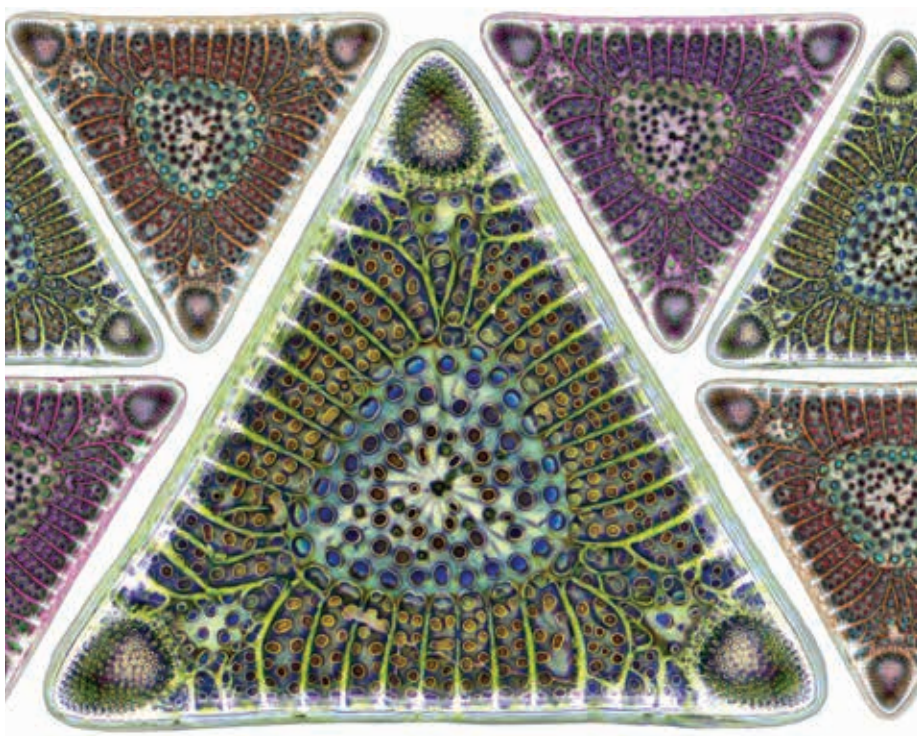
by Gavin MacRae

Ask someone on the street about the importance of the Amazon, and there's a reasonable chance the response will include an understanding that forests play an essential role in storing and cycling global carbon. Follow that question with another on the importance of ocean phytoplankton, and there are good odds on it being met with a shrug.

Yet the significance of ocean phytoplankton is nearly impossible to overstate.

Drifting in the top layer of the world's oceans, phytoplankton are a diverse group of microscopic, photosynthetic organisms. Most are single-celled algae, some are bacteria, and others are classified as protists – neither plant nor animal. Phytoplankton are estimated to produce nearly half the daily oxygen in our atmosphere, and as the basis of the ocean food web, sustain all major marine life forms. When they die, a percentage sink to the ocean floor, sequestering as much carbon as all terrestrial plants.

“If phytoplankton populations were to suffer significant decline, there would be serious consequences for marine food webs, including fisheries, and changes to the balance of nutrient cycling,” says Dr. Katherina Petrou, senior lecturer in phytoplankton ecophysiology at the University of Technology Sydney in Australia, via email.



How phytoplankton will respond to the effects of climate change is a pressing and stubborn research question. Study is made complicated by an array of interdependent variables that include warming surface sea temperatures, ocean acidification, and changes in sea ice and cloud cover.

A decade ago, Canadian researchers made headlines with an alarming study estimating ocean phytoplankton populations had dropped 40% since 1950, and were continuing to decline at a rate of around 1% per year, with ocean warming

from climate change suspected. The findings were hotly debated, and in the years since, a more nuanced yet still alarming picture of how phytoplankton will fare under climate change has begun to emerge.

In a 2015 study by two of the same Canadian researchers, projections of phytoplankton concentrations are described as “highly divergent.” Taken in aggregate, the paper maintains published research shows phytoplankton numbers increasing in near-shore waters over shorter, more recent time spans, and declining in

open oceans over longer periods. “Most published evidence suggests changes in temperature and nutrient supply rates as leading causes of these phytoplankton trends,” the study reads.

“Global modelling studies using historical data have revealed declines in phytoplankton over the last few decades, but with variability between oceans and regions, and even some patches where phytoplankton have increased,” says Petrou. “Based on these data, studies using computer models to project future conditions conclude that in many parts of the ocean, phytoplankton will decline as seas warm and water mixing patterns change.”

Warming water

Given access to sunlight and nutrients, phytoplankton can bloom in numbers of millions of cells per litre of seawater. But as the oceans warm, the water column is forming into more distinct layers, and staying that way for longer periods. The result is a layer of warmer water sitting atop cooler, nutrient-rich water beneath. When this stratification begins it can promote blooms by keeping phytoplankton cells in the upper layer, near sunlight, says Oscar Schofield, a professor at the department of marine and coastal sciences at Rutgers University. However as the bloom progresses, phytoplankton exhaust the nutrients available to them. Stratification can then prevent the resupply of nutrients into the upper layer, says Schofield, causing phytoplankton concentrations to fall, resulting in a net decline.

Climate change is shifting not only the intensity of phytoplankton blooms, but their composition. Harmful algal blooms (also known as red tides) are expected to increase as the oceans warm. Biotoxins released from the blooms can cause large-scale die-offs of fish and shellfish,

with knock-on effects to coastal economies.

“In some cases we see species growing faster, but in many instances warmer temperatures are altering ecosystems,” Petrou says. “Some species are recorded as moving towards the Polar regions, where water temperatures are lower. However, for current Polar species this poses a bit more of a problem, as they have nowhere cooler to move to.”

Schofield studies phytoplankton off the Antarctic Peninsula, the western arm of the Antarctic that reaches up toward South America. “It’s the fastest warming place on the planet in terms of winter air temperature,” he says, “so we see a lot less sea ice being made every year.” There, Schofield says, satellite observation suggests large phytoplankton declines.

But on the Antarctic Peninsula, Schofield theorizes it’s not too little mixing in the water column causing declines, but too much.

Lacking the protection of sea ice, the ocean undergoes deep mixing from strong winter winds. This disperses the free-floating phytoplankton deeper into the water column, limiting their access to sunlight. “It takes longer for that deep mixing to settle down and promote phytoplankton growth,” Schofield says. The warmer, moister climate also promotes cloud formation instead of cold, clear conditions, again limiting sunlight available to the phytoplankton.

Acidification winners and losers

In simple terms, ocean acidification is the ongoing decrease of seawater pH caused by the absorption of atmospheric carbon dioxide. When seawater reacts with CO₂ it creates carbonic acid, which breaks

down to release hydrogen and bicarbonate ions. The surplus hydrogen ions increase the acidity of the oceans.

Ocean acidification will reshape marine food webs, most notably by making it more difficult for organisms such as shellfish, starfish, snails, and corals to build their shells or exoskeletons from calcium carbonate. For phytoplankton as a whole, however, the response to ocean acidification is more nebulous.

An exception to this uncertainty is a group of phytoplankton called coccolithophores, which are vulnerable to acidification because they too build calcified exoskeletons. “They cover their cell walls with tiny chalk platelets,” says Petrou. “Increasing acidity has been shown to dissolve these plates, in the same way that a tooth will dissolve in a glass of cola.”

Another type of phytoplankton, diatoms, are single-celled algae that produce around half the organic matter in the ocean, and one-fifth of the oxygen you are breathing right now. Instead of calcium carbonate, diatoms build cell walls out of silica.

Research by Lennart Bach, a postdoctoral researcher at the Institute for Marine and Antarctic Studies at the University of Tasmania, tends to indicate diatoms will benefit from increased ocean acidity. “CO₂ is required for photosynthesis,” Bach says. “So in itself it is not the issue.”

But it’s not so simple. “There’s winners and losers within the phytoplankton community with respect to basically every environmental factor that will change,” Bach says. “Temperature, CO₂, stratification, light, environment, there are a

Continued on Page 10 ⇨

lot of factors. And when you only look at one like acidification, then they are on the winning side, but of course, you have to consider all factors because they will occur all at the same time in the future ocean. So it's really hard to say."

Declines or increases of phytoplankton types, relative to other phytoplankton, could also spell trouble. In a 2019 meta-analysis of studies on diatoms' response to acidification, Bach and a colleague write: "[Diatoms'] prevalence relative to other phytoplankton taxa could profoundly alter marine food web structures and thereby affect ecosystem

services such as fisheries or the sequestration of CO₂ in the deep ocean."

As well, a recent experiment by Petrou and other scientists discovered that in the Southern Ocean, future ocean acidification may hamper diatoms' ability to

Harmful algal blooms (also known as red tides) are expected to increase as the oceans warm ... with knock-on effects to coastal economies.

build silica cell walls. At simulated rates of acidification possible before century's end, the diatoms were smaller and lighter. With their ballast reduced, the cells would be less able to sink to the ocean floor and sequester carbon.

A study published in *Nature* in 2018, by an international team of researchers, also suggests that increased acidification could interfere with a poorly understood mechanism that allows diatoms to acquire iron – an essential nutrient for the algae.

"The decline in diatom ability to take up iron will reduce growth, while the loss in ability to form dense silica shells will alter diatom sinking rates and increase their susceptibility to grazers," Petrou says. "Combined, the two processes suggest diatoms are in for a hard time under future ocean conditions."

"We're changing the climate, and that's going to change a lot of the basic conditions we see in the ocean," says Schofield. "And the thing about the ocean is, generally, it's bottom up controls, meaning that if you change the food at the base of the web, it ripples directly up.... If and when that happens globally, it will change our planet. But we're still at a point where we can't give a quick, easy answer."

Illustration P8 compiled by Sarah James



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Wet'suwet'en

What does Horgan mean by the “rule of law”?

Commentary by Mike Morrell

“The history of the interface of Europeans and the common law with Aboriginal Peoples is a long one. As might be expected of such a long history, the principles by which the interface has been governed have not always been consistently applied. Yet running through this history, from its earliest beginnings to the present time is a golden thread – the recognition by the common law of the ancestral laws and customs of the Aboriginal Peoples who occupied the land prior to European settlement.”

—Justice Beverley McLaughlin, 1996

BC Premier John Horgan spent much of January trying to distance himself from the unfolding controversy surrounding government and RCMP response to the Wet'suwet'en hereditary chiefs' opposition to the Coastal GasLink pipeline project. On January 13, Horgan told a news conference that “This project is proceeding and the rule of law needs to prevail in BC.”

“The Law” on this issue is complex and not widely understood. Governments, corporations, and others with a colonial perspective often interpret the complex legal situation in a way that favours their particular interest.

There have been quite a few clear explanations of the ins and outs of the current legal/political conflict. I won't try to explain in detail. But here a few fundamental points:

1. The Hereditary (or Traditional) Chiefs speak for their Clans (extended families) and are entrusted with the care, management, and protection of the territories owned by their families. This is traditional Law.

2. Band Councils, which include elected Chiefs, were created by the Federal government under the *Indian Act*, which provides them with some authority to manage Indian reserves. These bodies have no jurisdiction on the traditional territories of the people of their Band. They have no legal authority to enter into agreements with industry or governments regarding projects on traditional lands off-reserve.

3. Provincial and Federal statute Law sets out the rules according to our dominant culture (aka Settler or Colonial Law). These laws have always been used as part of the dispossession and oppression of Indigenous Peoples.

4. International Law includes declarations of the United Nations and other representative international institutions regarding Human Rights and Indigenous Rights (for example, the *UN Declaration on the Rights of Indigenous Peoples (UNDRIP)*). Governments of Canada and BC have both endorsed UNDRIP, and the BC Legislature last month passed Bill 41 directing Cabinet to incorporate the UNDRIP principles into provincial Law.

5. The Unist'ot'en and the family of Smogelgem (of the Git'umden Clan) hold the authority over their territories, which are threatened by the Coastal GasLink pipeline proposals. They are supported by the Canadian Constitution, in principle by BC Bill 41, and UNDRIP and the UN Human Rights Council (UNHRC.) The UNHRC instructed the Canadian and BC governments to stand down from the current confrontation and sort out the multiple conflicts arising from contradictions among the several systems of Law that are in play here.

Horgan's statement that the “rule of law applies” is a gross oversimplification of the situation. Horgan has plenty of expert legal advice, so he must know better. I think his statement is cynical and intentionally misleading.

Mike Morrell is a fisheries biologist with special interest in Indigenous fisheries, rights, and title. He lives on Denman Island.

Clear and useful sources:

- 1) Interview with Peter Grant, counsel for Wet'suwet'en Chiefs:**
<https://www.bnnbloomberg.ca/commodities/video/duty-to-consult-is-not-just-a-checklist-item-wet-suwet-en-chiefs-lawyer~1583250>
- 2) Gavin Smith, West Coast Environmental Law:**
<https://www.wcel.org/blog/invisible-thread-coastal-gaslink-decision-and-why-we-must-do-more-recognize-application>

All Eyes on Nestlé

International water protectors share stories

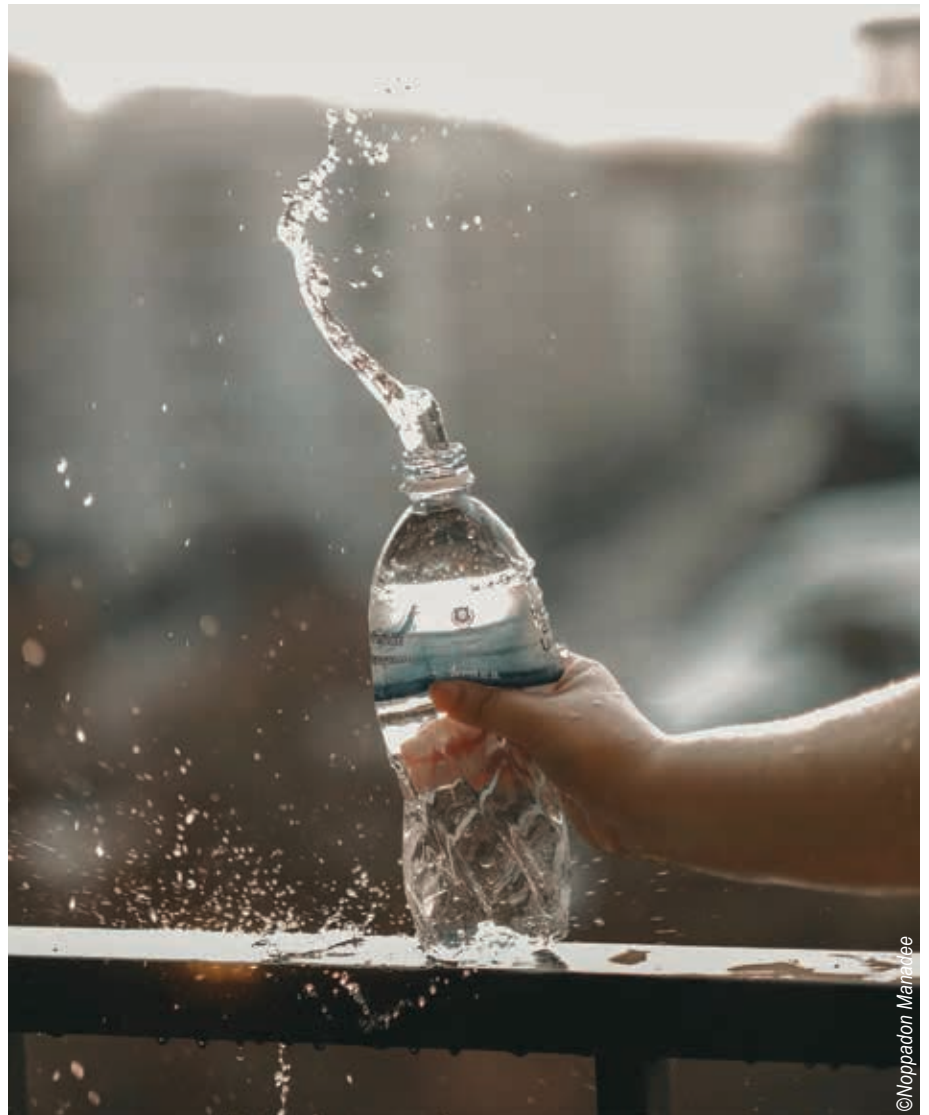
by Donna McCaw

An international gathering of water protectors shared stories of threats to water in their communities at “All Eyes on Nestlé” events in Ontario in November. Sponsored by Wellington Water Watchers, speakers travelled to Waterloo, Toronto, Hamilton, and Guelph sharing experiences about Nestlé – the Swiss multinational corporation that pumps and bottles water worldwide. Nestlé has over 50 brands of water and made a profit of ten billion dollars Canadian from water sales in 2018.

Vittel, France

Vittel was the first place to bottle water as Perrier. When Nestlé purchased Perrier, they became the first company to bottle water in plastic. Two members of Collectif Eau 88 explained there are three levels of aquifers in Vittel. Nestlé pumps exclusively from two of them and shares the third with local citizens, businesses and farmers. There’s no data on the first two but the third suffers a water deficit. Nestlé’s 30 year permit expires in 2020. The speakers would like it not to be renewed or, at least, renegotiated to save the aquifers.

The water bottled in Vittel is exported to Germany so Nestlé avoids paying taxes in France. After media attention to the situation in Vittel, sales of Nestlé water in Germany fell by 40%. Nestlé bottles water in Belgium to sell in the French market again to avoid paying taxes. Nestlé takes the water for free.



©Noppadon Manatee

Switzerland/Brazil

Franklin Frederick from Brazil, now living in Switzerland, spoke on mineral

When bottling, Nestlé removes the minerals and adds back the ones that the Pure Life brand uses worldwide.

Frederick explained that the goals of the company include the privatization of both water systems and of water itself. With a marketing budget bigger than the entire budget of the World Health Organization, Nestlé sells water as a “Healthy Hydration” company.

Flint rising

Gina Luster, from the citizens’ group Flint Rising, described the daily struggles of living with contaminated water and being forced to buy bottled water. The local GM plant gets clean water pumped in but the people cannot use municipal water, which has extremely high levels of lead contamination due to an aging and corroding system of pipes. Luster said the infrastructure has not been replaced and no plan appears to be forthcoming.

Luster also visited Nigeria, where Nestlé takes water from a village well. Nestlé built the local people fountains, which are dry. Solar panels to power a local well were installed but never hooked up. Meanwhile, women and children walk several hours a day to bring water from a river.

Sante Fe River, Florida

Merillee Jipson from the citizens’ group Our Sante Fe River talked about the Nestlé threat to the Ginnie Springs and the river. Nestlé wants 1.1 million gallons per day from the fragile springs near the

river. The river is deemed “in recovery,” after dropping three feet in twenty years from over-pumping. The springs are flowing at 50% capacity largely due to water withdrawals. Pumping over another 400 million gallons a year is not sustainable.

The water supports wetlands, vegetation, resident species of turtles, and the springs themselves. Saltwater intrusion threatens much fresh water in Florida already, making fresh water too precious to go into plastic bottles to be transported out of the area.

Maine and stolen springs

Nestlé has three bottling plants including the second-largest in the world in Maine, and sells the water under the brand Poland Springs. Nickie Sekera of Community Water Justice described the ten Maine communities where Nestlé takes water – one with a 45 year permit. Sekera said Nestlé keeps looking for more, creating havoc in small rural communities.

Michigan Citizens For Water

In 2017 in Michigan, Nestlé extracted nearly three hundred million gallons of water, at a cost of only \$600. They also pull water from two municipal wells. Meanwhile, Michigan State bought bottled water from Nestlé for the people of Flint and, in Detroit, 100,000 people are without drinking water. The poorest cannot pay the high water bills.

Lakes and streams in the state have become mudflats, ponds have dried up and soft water wells have gone hard. Nestlé has seven wells in Michigan, wants more, and is willing to sue communities to get it, said a spokesperson from the group opposing these permits.

Six Nations says stop

Members of Six Nations of the Grand River, near Brantford, Ontario, spoke against water taking and have delivered a cease and desist letter to Nestlé at their bottling plant in Aberfoyle, Ontario. According to the United Nations Declaration on the Rights of Indigenous People, Indigenous Peoples have the right to give or withhold consent to projects that may affect them or their territories. Six Nations wants to deal with the Crown on these matters, but Ontario has attempted to download consultation to the applicant, in this case, Nestlé.

Part of the Cease and Desist Statement from June of 2019 states, “These are Haudenosaunee territories that you are operating on, and as the holders of ancestral title over this territory, we declare your activities to remove aquifer waters under our territories unpermitted and demand that you cease your activity immediately.”

Wellington Water Watchers and Save Our Water are asking the Ontario government to stop issuing new permits to take water for commercial water-bottling purposes. Please join us. Water is a public trust threatened by pollution, overuse, climate change, and lack of respect.

Donna McCaw is a member of *saveourwater.ca* that has been working to protect water in Centre Wellington, Ontario since 2015.

No, Nestlé, bottled water is not an “essential public service.”

Michigan’s second-highest court has ruled that Nestlé’s commercial water-bottling operation is “not an essential public service” or a public water supply. The ruling is a victory for Osceola township, a small Michigan town that blocked Nestlé from building a pumping station that doesn’t comply with its zoning laws. But the case could also throw a wrench in Nestlé’s attempts to privatize water around the country.

—*The Guardian*, December 5, 2019

Carbon Footprint

The world's military, an emissions nightmare, gets a free pass



©Robert Sullivan

by Joyce Nelson

There is no question that, across the planet, the biggest user of fossil fuels is the military. All those fighter jets, tanks, naval vessels, air transport vehicles, Jeeps, helicopters, Humvees, and drones burn massive amounts of diesel and gas daily, creating vast carbon emissions. So you'd think that discussions about the climate emergency would focus on the military's carbon footprint, or at least place it at the top of concerns.

But aside from a few lonely voices, the military is seemingly exempt from the climate discussion.

That was vividly apparent in December 2019, when the NATO summit coincided with the opening of COP25 in Spain. The NATO summit focused almost entirely on the Trump administration's harangue that NATO members aren't spending nearly enough on military weapons. Meanwhile, COP25 focused on "carbon markets" and nations falling behind in their commitments to the 2015 Paris Accord.

Those two "silos" should have been combined to reveal the absurd premise operating behind both: that somehow the climate emergency can be met without de-escalating the military. But as we shall see, that discussion is forbidden at the highest levels.

Canada's military spending

That same disconnect was apparent during the 2019 Canadian federal election, which we were told was all about the climate. But throughout the campaign, as far as I could determine, not a single mention was made of the Trudeau Liberal government's promise of a whopping \$62 billion in "new funding" for the military, raising Canada's military spending to more than \$553 billion over the next 20 years. That new funding includes \$30 billion for 88 new fighter jets and 15 new warships by 2027.

Bids to build those 88 new jet fighters must be submitted by Spring 2020, with Boeing, Lockheed Martin, and Saab in fierce competition for the Canadian contracts.

Interestingly, the *National Post* (Nov. 12, 2019) has reported that of the top two contenders, Boeing's Super Hornet fighter jet "costs about \$18,000 [USD] an hour to operate compared to the [Lockheed Martin] F-35 which costs \$44,000" per hour.

Lest readers assume that military pilots are paid CEO-level salaries, it's important to state that all military hardware is horrifyingly fuel-inefficient, contributing to those high operating costs. Boston University's Neta Crawford, co-author of a 2019 report entitled *Pentagon Fuel Use, Climate Change, and the Costs of War*, has noted that fighter jets are so fuel-inefficient that fuel use is measured in "gallons per mile" not miles per gallon, so "one plane can get five gallons per mile." Similarly, according to Forbes, a tank like the M1 Abrams gets about 0.6 miles per gallon.

The Pentagon's fuel use

According to the Costs of War report from the Watson Institute at Brown University, the US Department of Defence is "the single largest user" of fossil fuels in the world, and "the single largest producer of greenhouse gases (GHG) in the world." That statement was echoed in a similar 2019 study issued by Oliver Belcher, Benjamin Neimark, and Patrick Bigger from Durham and Lancaster Universities, called Hidden Carbon Costs of the "Everywhere War." Both reports noted that "existing military aircraft and warships [are] locking the US military into hydrocarbons for years to come." The same could be said of other countries (like Canada) that are buying the military hardware.

Both reports state that in 2017 alone, the US military bought 269,230 barrels of oil per day and spent more than \$8.6 billion on fuel for the air force, army, navy, and marines. But that 269,230 bpd figure is only for "operational" fuel use – training, using, and sustaining the weapons hardware – which is 70% of the military's total fuel use.

The figure does not include "institutional" fuel use – the fossil fuels used to maintain the US military's domestic and foreign bases, which number more than 1,000 around the world and account for 30% of total US military fuel use.

As Gar Smith, editor emeritus of *Earth Island Journal*, reported in 2015, "The Pentagon has admitted to burning 350,000 barrels of oil a day (only 35 countries in the world consume more)."

The elephant in the room

In a remarkable piece, "The Pentagon: The Climate Elephant," originally published by the International Action Center and Global Research, Sara Flounders wrote in 2014: "There is an elephant in the climate debate that by U.S. demand cannot be discussed or even seen." That elephant is the fact that "the Pentagon has a blanket exemption in all international climate agreements. Ever since the [COP4] Kyoto Protocol negotiations in 1997, in an effort to gain US compliance, all US military operations worldwide and within the US are exempt from measurement or agreements on [GHG] reduction."

At these 1997-1998 COP4 negotiations, the Pentagon insisted on this "national security provision," giving it an exemption from reducing – or even reporting – its greenhouse gas emissions. Moreover, the US military insisted in 1998 that at all future formal discussions on climate, delegates are actually prevented from discussing the military's carbon footprint.

According to Flounders, that national security exemption includes "all multilateral operations such as the giant US-commanded NATO military alliance and AFRICOM [United States Africa Command], the US military alliance now blanketing Africa."

Ironically, the US under George W. Bush then refused to sign the Kyoto Protocol. Canada followed suit, withdrawing from Kyoto in 2011.

So in 1998, the US obtained an exemption for all countries' militaries from having to report, or cut, their carbon emissions. This privileging of war and the military (indeed, the entire military-industrial complex) has largely escaped notice for the past twenty years, even by climate activists.

As far as I can determine, no climate negotiator or politician or Big Green organization has ever blown the whistle or even mentioned these military exemptions to the press – a "cone of silence" that is baffling.

Even more baffling, in an op-ed for the *New York Review of*

No climate negotiator or politician or Big Green organization has ever blown the whistle or even mentioned these military exemptions to the press – a "cone of silence" that is baffling.

Continued on Page 16 ⇨

↳ *Footprint continued*

Books (June 27, 2019), climate activist Bill McKibben defended the military's carbon footprint, stating that the Pentagon's "use of energy pales next to that of the civilian population," and that "the military has actually been doing a not-too-shabby job of driving down its emissions."

At the COP21 meetings that led to the 2015 Paris Climate Agreement, each nation-state was allowed to determine which national sectors should make emissions cuts before 2030. Apparently, most nations have decided that the military exemption (especially for "operational" fuel use) should be maintained.

In Canada, for example, shortly after the recent federal election, the *Globe & Mail* reported (Nov. 4) that the re-elected Liberal minority government has listed seven departments that will play "major" roles in cutting carbon emissions: Finance, Global Affairs, Innovation, Science and Economic Development, Environment, Natural Resources, Intergovernmental Affairs, and Justice. Conspicuously absent is the Department of National Defence (DND). On its website, the DND touts its "efforts to meet or exceed" the federal emissions target, but notes that those efforts are "excluding military fleets" – i.e., the very military hardware that burns so much fuel.

In November 2019, the Green Budget Coalition – comprised of some 22 leading Canadian NGOs – released its 2020 carbon-cutting recommendations for federal departments, but made no mention at all of military GHG emissions or the DND itself. As a result, the military/climate change "cone of silence" continues.

Section 526

In 2010, military analyst Nick Turse reported that the US Department of Defense (DOD) awards many billions of dollars in energy contracts each year, with most of the money going to purchase bulk fuel. Those DOD contracts (worth more than \$16 billion in 2009) go primarily to top petroleum suppliers like Shell, ExxonMobil, Valero, and BP (the companies named by Turse).

All four of these companies were and are involved in tar sands extraction and refining.

In 2007, US legislators were debating the new *US Energy Security and Independence Act*. Some policymakers concerned about climate change, led by Democratic congressman Henry Waxman, managed to insert into the Act a provision called Section

526, which made it illegal for US government departments or agencies to buy fossil fuels which have a large carbon extraction footprint.

Given that the DOD is by far the largest government department purchasing fossil fuels, Section 526 was clearly directed at the DOD. And given that the production, refining, and burning of Alberta tar sands crude releases at least 23% more GHG emissions than conventional oil, Section 526 was also clearly directed at tar sands crude (and other heavy oils).

Somehow, Section 526 was overlooked by the powerful oil lobby in Washington and it became law in the US in 2007, prompting the Canadian embassy to fly into action.

The intense lobbying worked. The DOD's bulk fuels procurement agency, the Defence Logistics Agency – Energy, refused to allow Section 526 to apply to, or change, its procurement practices, and later withstood a similar Section 526 challenge mounted by US environmental groups.

In 2013, lobbyist Tom Corcoran, executive director for the Washington-based Center for North American Energy Security, told the *Globe & Mail* (March 26, 2013), "I would say it's a major victory for the Canadian oil sands producers because they supply a significant amount of the crude oil that is refined and converted to product for the Department of Defence."

"Thinking bigger"

In November 2019, former US president Jimmy Carter wrote an impassioned op-ed for *Time Magazine* (Nov. 26, 2019), arguing that "empowering women and girls" can help solve the climate crisis. He stated that the climate emergency is potentially so dire, and the time-frame for action so short, that we must stop "tinkering at the edges of our global energy industry" and instead "think bigger, act quicker, and include everyone."

But Carter never once mentions the military.

Unless we actually do start to "think bigger" and work to dismantle the war machine (and NATO), there is little hope. While the rest of us attempt to transition to a low-carbon future, the military has carte blanche to burn all the fossil fuels it wants for never-ending war.

Award-winning author Joyce Nelson's latest book, *Bypassing Dystopia*, is published by Watershed Sentinel books.

Letters

Beware the Techno-Tweak Temptation

All the best in 2020 to you, Delores, staff, volunteers & board, for continuing to publish a pertinent and relevant magazine. Keep it challenging though – as Bill Rees, Andrew Nikiforuk and others have pointedly described, technological tweaks like green energy are no solution to an addicted-to-growth society. Our solution? Minimize our carbon footprint and build soil carbon, by making and using biochar, and protecting & restoring ecosystems.

—Rick and Juliette Laing
Salt Spring Island, BC

Clarification: Fuzzy Little Clouds

Last issue's editorial, "Walk with the Stars," implies that many stars we see are actually distant galaxies. In fact, the furthest stars that are visible are 16,000 light years away, in our third of the Milky Way galaxy. Only a very few "nearby" galaxies are visible with the naked eye, and they do not look like stars but rather like fuzzy little clouds.

—Eli Pivnick, Vernon, BC

A Remedy for Politicking?

Have you ever heard of Sortition, where randomly selected citizens form governments?

Imagine a city council of 10 people is needed. A list of, say, 200 candidates is randomly generated and those candidates are asked if they want one of 10 council jobs – same pay, same benefits, same rules as currently apply. As the replies come in, applicants are screened by gender (one woman, then one man), age (under 30, over 30, etc), maybe location (like a ward system), maybe income (low, middle and high). You get the idea. We could select people based on real practicalities, not just riches and promises. Candidates would have to be on the voters list, be literate, and want the job. They would be trained in governance, just like current politicians.

Think of the savings in signage, campaign travel, and the reduction in empty campaign promises and attack ads – my biggest complaints with voting and political parties.

But could random citizens make better decisions than elected politicians? As I see it, they couldn't do any worse! Check out the UK-based Sortition Foundation: "We campaign for a world free from partisan politicking, where representative random samples of everyday people make decisions in informed and deliberative citizens' assemblies."

—Susan Holvenstot, Courtenay, BC

The Watershed Sentinel welcomes letters

but reserves the right to edit for brevity, clarity, legality, and taste.

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With the grand showcase failure of the world's politicians to get their collective act together on climate action, most recently at the Paris Accord meetings, which pretty much ended in discord, it is easy to overlook the real global action.

All around the world concrete steps are being taken at a more local level. Cities are banding together to share ideas and programmes. Corporations are putting their shoulders to the wheel. And local co-operatives, neighbourhood groups, schools, and clubs are showing us the path forward, one determined step at a time.

In this section, we try to highlight just a smattering of these local actions. They are usually bioregional in nature, they are generated from within communities, and frequently they are spearheaded by just a few motivated people, who take the lead.

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The Path Forward

The Party's Over

What can and should be preserved?

by N.J. Hagens

A bunch of mildly clever, highly social apes broke into a cookie jar of fossil energy and have been throwing a party for the past 150 years. The conditions at the party are incompatible with the biophysical realities of the planet. The party is about over and when morning comes, radical changes to our way of living will be imposed.

Some of the apes must sober up (before morning) and create a plan that the rest of the party-goers will agree to. But mildly clever, highly social apes neither easily nor voluntarily make radical changes to their ways of living. And so coffee and stimulants (credit, etc.) will be consumed during another lavish breakfast, but with the shades drawn. It's morning already.

It is likely that, in the not-too-distant future, the size, complexity, and (literal) "burn rate" of our civilization will be much reduced by forces other than human volition. We will not plan for this outcome – but we could react to it with airbags, social cohesion, an ethos and prepared blueprints based on intelligent (and wise) foresight.

What aspects of our current world can and should be preserved? What can we do to make the path ahead less painful? How can we nurture ecosystems and species, as well as the great body of human culture and knowledge, so that they can, as far as possible, survive the bottlenecks of the 21st century?

What really, could we aspire to become as a species? Can we use science to guide us from mildly clever to moderately wise? Can we tap into our wiring for group cooperation to align ourselves with a purpose beyond turning trillions of barrels of fossils into microliters of dopamine?

What sort of economics will help us ask, research, and inform these questions?

Can we tap into our wiring for group cooperation to align ourselves with a purpose beyond turning trillions of barrels of fossils into microliters of dopamine?

Thirty years ago, ecological economics pioneered a systems approach to economics, but unfortunately became dominated by a narrow micro-focus on ecosystem services, monetary valuation, and conventional economics (Plumecocq, 2014).

Whatever we'll call it, we are desperately in need of a set of guideposts and principles that include not only ecology but also biology, psychology, physics, and emergent behaviors. This discipline will focus at least as much on "what we'll

have to do" as on "what we should do." And it will apply the evolving knowledge of experts with a view to the maps and charts made by generalists.

Ecological economics was shaped as a next step from earlier classical ideologies so as to consider the inclusion of sources and sinks.

Over the next 30 years, ecological economics must be both torchbearer for a systems economics and midwife to a smaller flame.

The above is the conclusion of "Economics for the future – Beyond the superorganism," N.J. Hagens, Institute for the Study of Energy and Our Future, (<http://energyandourfuture.org/>) United States. Published in *Ecological Economics* 169 (2020), <https://doi.org/10.1016/j.ecolecon.2019.106520>

Appropriate Tech

Or, how to save money and the world in under 1000 words

by Hal Hewett

A steady stream of headlines showcasing the rapid advancement of solar power and electric vehicles suggests our drive away from fossil fuels is assured and we have all the technology we need.

Going Green makes economic sense. EVs save big on fuel and maintenance; get solar panels for returns up to 10 times a savings account; ditch the oil furnace for a heat pump and save 40 percent! All good stuff for those who can afford to make these leaps, but a billion Teslas is not what the world needs, even if we do have the lithium.

Must we be rich to be green or is it better to be poor? What if we're stuck between?

High tech/high cost approaches are rarely an option for the world's poor majority, and instead we would do well to assess what technology works in their real world.

Merriam-Webster defines appropriate technology as "technology that is suitable to the social and economic conditions of the geographic area in which it is to be applied, is environmentally sound, and promotes self-sufficiency on the part of those using it."

Appropriate tech seems to be exactly what we need – something for everyone, from bicycles to Teslas. Compared with bicycles, Teslas are complex, energy intensive, cost prohibitive, and require ad-



©Teddy Kwok

vanced repair networks, charge stations, and roads. Yet EVs are appropriate in some settings, and Canada could meet its Paris targets by switching to electric vehicles. Still, in many regions, it's hard to beat the simplicity, cost-effectiveness, easy maintenance, and terrain-suitability of the humble bicycle.

Electric power is simple, clean, and beneficial when sourced sustainably, yet worldwide more than a billion people live

without electricity. Biofuels have served us since we first mastered fire, and we've grown accustomed to the comforts and products they've provided through the millennia. Though they're not fashionable, biofuels can sometimes be greener than high tech. They are always derived from biomass, which is simply any plant or animal matter.

Roughly 2.5 billion people around the world still rely on wood as fuel for cook-

ing, heating, and small industries like tile making. Those in urban areas that can't afford propane prefer charcoal for its higher energy density and nearly smokeless combustion. It's big business – the charcoal industry provides energy security for entire countries and employment for an estimated 40 million worldwide; charcoal provided revenue of US \$1.6 billion in Kenya alone, in 2014.

Fuelwood use is not limited to the “developing” world; many in rural North America rely on wood heat. The picturesque off-grid cabin shares realities with isolated villages in Africa: solar power keeps getting cheaper as lighting and electronics get ever more efficient, but there's no easy way around making heat. It takes a lot of power. While every stick and lump of dung is valued in some regions, North Americans are so awash in easy power that “wastewood” is a problem to be piled up and burned. The charcoal makers of Haiti would not understand.

Fuelwood can be used to drive steam and internal combustion engines – more than a million gasoline and diesel vehicles were powered by wood gas due to extreme fuel shortages in WWII. Certainly woodfuel has drawbacks, chiefly air pollution and deforestation. Yet these fuels have been used forever, are renewable and can be carbon neutral. Careful processing and use can nearly eliminate smoke, the UN has been actively working to “green the charcoal chain,” and recent studies show fuelwood harvesting has not been the main cause of deforestation.

Got gas guilt but can't afford electric? Most people would save money getting a used diesel car and running biodiesel.

Biodiesel traces its roots to the very first compression ignition engine, which ran on peanut oil, unveiled by Rudolph Die-

sel in 1900 at the Paris World Exposition. Biodiesel is the only viable non-fossil fuel that can be used directly in existing equipment like firetrucks, Smart cars, long haul trucks, ships and even jet engines. Biodiesel has many advantages over dinodiesel: it can be produced carbon-neutrally from a wide range of feedstocks, is more lubricative and better for engines, less volatile, and produces significantly less fine particulate matter and other harmful emissions.

Though they're not fashionable, biofuels can sometimes be greener than high tech.

While there are valid concerns about biofuels displacing food crops and forests, Canada sits on a record glut of canola. Thousands of hectares of public land tended for no return like road medians and powerline rights of way could be harnessed. Marginal lands could be used to produce vast quantities of oil using algae – by far the highest yielding oil crop.

Flight guilt? Excellent! We need to fly less. While zero-emission aircraft technology develops, Norway leads the world in bio-jetfuel production from agricultural and forestry “wastes.”

As we speed away from coal, natural gas increasingly fills the gap. Fracked fossil gas has many downsides but it's really just methane, which we can make at the home or community level and use in existing equipment at a localized scale. The first methane-producing anaerobic digesters appeared in the late 1800s, with India leading in development and im-

plementation over the next century – by 1975, about 17,000 biogas plants were installed across the country, providing fuel for cooking, reducing pressure on forests, and improving sanitation in rural villages. Not only is a supply of convenient clean-burning natural gas created but the resulting compost has three times the nitrogen of conventional compost. It's not all about dung: by weight, leaves produce three times the volume of gas as dung. It's easy to imagine municipal yard waste providing substantial energy while contributing to local employment and energy security.

There's a new class of fuels: non fossil hydrocarbons. Making fuel out of seawater sounds unlikely, but the US Navy developed this technology as a way to fill its fighter jets aboard carriers in far-flung oceans. They claim this technology is currently near par with retail costs for gasoline, and it has the advantages of sucking CO₂ out of the acidifying oceans while being much more benign than the oilfield-pipeline-refinery chain. This is simply an evolution of 1920s technology.

Using means tailored to each region, an appropriate technological approach will encourage energy decentralization and democratization, resilient communities, and localized economies – crucial objectives for both climate change mitigation and adaptation. We can win this battle when we stop subsidizing the problem and support the many viable alternatives. We have all technology we need to rapidly complete the transition away from a fossil future towards what can be a healthier, happier, more egalitarian way.

Hal Hewett is a heavy duty mechanic with extensive experience in biofuels.

The Great Simplification

The end of cheap fossil fuels will force us to re-localize

by Tara Lohan

Despite the warning signs – climate change, biodiversity loss, depleted soils and a shrinking supply of cheap energy – we continue to push along with an economy fuelled by perpetual growth on a finite planet. We'll need to reckon with this discrepancy.

Much has been written about when and how that should be done. The Post Carbon Institute's latest effort is a report by board president Jason Bradford called *The Future Is Rural: Food System Adaptations to the Great Simplification*.

The report finds that new technologies and renewable energy will not be able to fully replace fossil fuels – or not as quickly as we will need them to. While some kinds of energy are more easily substituted by renewables, like solar and wind standing in for fossil-fuelled electricity, others are not. Running things like tractors and cargo ships that have relied on liquid fuels is a much more challenging task. Thus, the reasoning goes, we'll need to use less energy, and use it differently.

If true, this would have major impacts on every facet of our lives, including our food system – which today, in the West, relies on fossil fuels and long trade networks.

“We must face the prospect that many of us will need to be more responsible for food security,” Bradford writes in the report. “People in highly urbanized and globally integrated countries like the US will need to re-ruralize and re-localize ...

over the coming decades to adapt to both the end of cheaply available fossil fuels and climate change.”

We talked to Bradford, who has worked for years in sustainable agriculture, about what changes he thinks are ahead and what we can do to prepare for them.

We must face the prospect that many of us will need to be more responsible for food security.

You refer to the age you see coming up when there's less cheap energy available as the “Great Simplification.” What does that term mean?

Societies that have less energy available organize themselves differently, and so the Great Simplification is this idea that as energy becomes more dear we'll need to use less of it. And our highly complex and globally integrated societies will begin to take on forms that are simpler over time. That means less complex trade networks, less specialization in jobs, less bureaucratic hierarchies.

When I try to envision what this Great Simplification would look like, I think of either pre-industrial society or at least pre-World War II. What does it look like to you?

I remember traveling through Europe and seeing the contrast between a modern European city and someplace like a World Heritage site that is still a living city, but it was built centuries ago and there never was a suburban expansion around it. And so you basically see this countryside that you can walk to from the city centre.

That's how people lived prior to the industrial revolution in most parts of the world. If you go to somewhere such as rural Bolivia, that's what it still looks like. I think that's maybe what the long-term consequences of fossil fuel depletion will look like. But what happens in the messy middle is much harder to figure out.

To think about that, the report looks at places that are already being abandoned in the upper Midwest because they lost the industrial clout they used to have from the steel industry and the auto industry. So you can sort of see this process unfolding already. You may have a partial abandonment of some areas and then maybe also reclaiming of them partly for food production. Big suburban houses may instead have more people living together to share expenses and share work.

It seems like today in the US very few people know much about farming – how do we start to close that knowledge gap?

I feel like we have two kinds of threads going right now. On the one hand, there are a lot of school gardens taking off and



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there's more being done for horticulture, shop programs, and home economics. There's a bit of a skills revival happening. But on the other hand, there's also a big focus on teaching every kid how to code, or kids being on their devices all the time instead of getting outside in nature.

Part of what I hope the report does is to make people aware of this skills gap and try to prioritize learning not just about self-sufficiency, but how communities can work together.

I don't expect the people reading the report will suddenly perform voluntary simplicity and try to find a commune to live on somewhere. But what I do hope is to inspire people to become change agents – to be ready for when the energy system forces a transition and start setting up systems that are pre-adapted to an energy-scarce world.

How can people support this kind of re-localization without being an actual farmer or food producer?

If you're a rural landowner there's a big opportunity [to lease land to] a farmer who's oriented towards more regenerative, organic, local and regional systems. If you have money, there are also lending clubs that can help support local food systems and entrepreneurs. [Those] who are politically connected [can] push for changes in codes or policies, like for instance, if there's a local law that doesn't allow you to capture rainwater or have a front yard garden.

Maybe you can support the local soil and water conservation district or the local conservation group that's trying put biodiversity back on farmlands. Farms ... can be great places to rebuild ecosystem services, protect watersheds, get insect, bat and bird populations back up – that will serve food production in the long run.

The kinds of changes you're talking about could seem scary to a lot of people. What inspires you the most and what do you think will be most exciting about re-localization?

I think that these coming times of great challenge and stress will force people to work together in ways where they have a shared sense of purpose, [like the veterans] at the American Legion Hall who had some experience together 40 years ago when they were in their 20s that bonded them and they know deep down that this person sitting next to them is someone they can trust.

Even though it's going to be difficult, we will find tremendous meaning in our shared experience that could be wonderful. And that's something people are missing right now.

Tara Lohan is deputy editor of *The Revelator* and has worked for more than a decade as an environmental journalist focused on energy, water and climate.

This story was originally published by *The Revelator*.

Urban Renewables

Cities **lead the fight** against climate change



©Dušan Smetana

by Ren21, Paris, November 26, 2019

“It might come as a surprise to some, but it is a pattern that we now find everywhere in the world: Cities are driving the transition towards renewable energy. They understand that renewables mean less lung and heart diseases, more local jobs, and relief for the municipal budget,” says Rana Adib, REN21’s Executive Secretary, at the presentation of their first Renewables in Cities 2019 Global Status Report (REC-GSR) in Paris. “If cities alone were to decide, today’s climate and energy politics would look totally different.”

“Fossil fuel centered economies make it difficult for national governments to put climate concerns front and center, with the result that globally we are not on track to meet the Paris Agreement. This truth is hard to face,” says Adib. “The [UN Environmental Programme’s *Emissions Gap Report 2019*] shows the harsh reality: countries collectively fail to stop growth in global greenhouse gas emissions. The gap between targets and reality is only growing. Deeper and faster cuts are required now, and cities can take climate action into their own hands.”

By November 2019, almost 1,200 jurisdictions and local governments in 23 countries had declared a state of climate emergency. Almost 10,000 have already adopted carbon emission reduction targets, many of which are linked to renewable energy, notes the newly released report.

Cities move to renewables

Many countries still expect that the implementation of 100% renewable energy systems will take several decades. Yet, there are plenty of cities in the world that already today source 100% of their electricity from renewables. Now they are taking steps to expand their ambitions to get rid of fossil fuels in heating, cooling, transport, and industry.

The report shows that more and more cities in Europe are taking the energy supply back into their own hands by re-municipalizing energy companies or forming new ones. Barcelona Energía, recently formed to supply locally-produced renewable energy to the city's inhabitants and municipal facilities, is just one example. In 2000, Barcelona was also one of the first European cities to require all new and renovated buildings to use solar energy to supply a minimum of 60% of a building's running hot water needs. The next project in line, a solar cooling network, is about to get up and running.

New high air quality standards

"An important message from the report is that many cities understand that they are directly suffering from the burning of fossil fuels. Shifting to efficient and renewable energy systems is the only way out," notes Adib.

One of the most powerful motivations is air pollution. Particles and other air pollutants from fossil fuels literally asphyxiate cities. They barely measure a fraction of the diameter of a human hair, but according to studies by the World Health Organisation, their presence above urban skies is responsible for millions of premature deaths and costs billions. Health damages by road traffic alone cost the EU around 62 billion euros a year.

There are plenty of cities in the world that already today source 100% of their electricity from renewables.

Mr. Ban Ki-Moon, former UN Secretary General and Chair of Korea's National Council on Climate and Air Quality underlines the link between burning of fossil fuel and citizens' health. "Unsustainable and reckless consumption of energy has led to concerning levels of air pollution, making it the fourth-largest threat to human health and the single biggest environmental health risk that we face today. Against this background, transition to a cleaner and more sustainable energy model is no longer a choice but a must. Cities can spearhead progress in combating air pollution, by implementing creative policies and incubating innovative ideas, like what the Seoul Metropolitan Government is doing. We have the necessary means to pursue energy transition. All we need is the political and institutional will to make the transition into reality."

Like Seoul, Barcelona, Berlin, Copenhagen, Heidelberg, Lisbon, London, Madrid, Paris, Rotterdam, Stockholm, and Warsaw have all pledged to set new air quality standards that meet or exceed existing national targets within two years.

When signing the declaration in October, Copenhagen's Mayor Frank Jensen commented: "Air pollution is a global problem, but it has a local solution. Copenhagen wants to be the world's first climate-neutral capital by 2025. This year, we have put 400 electric buses on the streets and by next year ferries should go electric, too. We want that our citizens can take a deep breath at any time of the year without fearing for their health."

Cities in developing countries

For cities in the developing world, renewable energy is the only way to expand energy access to all inhabitants, particularly those living in urban slums and informal settlements and in suburban and peri-urban areas.

Cape Town has the highest electrification rate in South Africa but thousands of households are in areas which are un-electrifiable because the land is illegally occupied or situated in flood-prone or restricted areas. Poverty often causes households to not use electricity for part of the month. "While efforts to deliver housing are ongoing there is significant informality. Open flame technologies like candles and paraffin stoves are used. Devastating shack fires occur periodically, causing deaths, injuries, and displacement. Solar home systems are a safe and affordable alternative," explains Dan Plato, Mayor of Cape Town.

Executive Director of the United Nations Environment Programme Inger Andersen believes that "by avoiding resource depletion and pollution, and creating jobs, renewable energy is a common-sense engine of social and economic development. As our cities expand, those built on a strong renewable energy base will thrive."

Renewables make cities resilient

Data in the report reveals that increased prosperity and living standards in cities

Continued on Page 26 ⇨

cause a sheer insatiable hunger for energy.

REN21's report shows that 70% of all cities are already affected by the impact of climate change today. Says Adib: "If cities don't do something about the way they produce and use energy, they are going to wreak their own destruction. It's that simple and they know it. And with more than one billion people worldwide living in urban slums and informal settlements, the poorest will be the hardest hit. Even in Europe, tropical storms will become more frequent. We got a taste of it when storm Leslie hit northern and central Portugal with wind speeds of over 100 km/h and brought heavy rainfall in Spain and France last year."

Keeping the energy infrastructure working, once the flood or storm arrives, is essential to secure continued operation of rescue services, hospitals, and information systems. Businesses and industry invest in renewable energy to avoid disruptions. Cities adopt energy systems based on distributed renewable generation because they are more flexible and resilient to those central shocks which are becoming more frequent with climate change, underlines the report.

Participation at the local level

"An advantage of renewable energy is that it gives citizens a role in shaping the infrastructure," says Adib.

"Our report shows that in recent years, the number of community energy projects using renewable sources has surged, confirming that democracy is just as important as a driver for the energy transition as climate change." Denmark, Germany and the UK are at the forefront of this development. Yet, such projects are beginning to emerge also in other parts of the world including Thailand, Japan, and Canada, the report notes.

"Cities can actively drive the fight against climate change at national and global levels. They are able to tap into opportunities that other levels of government do not have, including a more direct relationship with local citizens and businesses," notes Germany's Minister for Environment, Nature Conservation, and Nuclear Safety, Svenja Schulze. "Citizen engagement and public pressure have raised cities' level of ambition on renewables in many places around the world, reaping economic, social and environmental benefits."

"Yet, even the world's largest cities with the most decision-making structure cannot replace national governments and their responsibility in fulfilling their commitments under the Paris Agreement," Adib concludes.

The Renewables in Cities 2019 Global Status Report is the first in an annual stock-taking of the world's cities transition to renewable energy. It aims to make data available, more standardised, easier to evaluate and compare. "We expect that it will be an important tool to document the transition to renewable energy worldwide," says Adib.

REN21 is a global community of renewable energy actors from science, academia, governments, intergovernmental organizations, NGOs and industry. It provides up-to-date facts, figures and peer-reviewed analysis of global developments in technology, policies and markets to decision-makers.

The full report, regional fact sheets, infographics and press releases in several languages can be downloaded here: <https://rebrand.ly/ren21cities>



You Click, We Pick

Have you heard of the “Cow-op”?

by Derrick Pawlowski

An initiative of the Cowichan Valley Co-operative Marketplace, *cow-op.ca* is an online farmers’ market aimed at providing fresh, healthy, and sustainably produced food, while at the same time increasing the economic viability of the Cowichan region’s local agriculture. The Cowichan Valley Cooperative Marketplace is a not-for-profit community services co-operative of over 80 local farmers and food processors with the goal of supporting local farmers, and increasing food security and resiliency in the Cowichan Region.

Behind the scenes, Vancouver Island boasts a robust community of local farmers and food processors. From Sooke to Saanich, the Cowichan Valley, the Comox Valley and beyond: these diehard, passionate, and motivated individuals are doing the important work of growing and procuring healthy, delicious food for families, restaurants, grocery stores, and more. People need fresh local food – it is healthy, delicious, and exists outside of the unsustainable global industrial agriculture system. In addition, local farmers and food processors protect farmland from shortsighted development, regenerate soils, protect ecological biodiversity, and reduce carbon emissions and the use of plastics and pesticides. Local farmers even produce bio-regionally adapted and drought resistant seeds.

However, the reality behind such ecologically responsible agriculture is that it is

difficult and demanding work. Managing diverse, continuously overlapping crop cycles is hectic. Added to the burden are busy days setting up and taking down market stalls, and selling wares for hours on end (sometimes in the rain!), all in hopes of returning to the farm with fewer vegetables and fair remuneration. Now imagine doing this multiple times a week. The work of growing and providing fresh products with an extremely short shelf life is taxing.

Local farmers need more than the feel-good buzz of the weekend farmers’ market to build long-term, viable businesses – they need sustained demand for their products. Farmers need to make a decent living to stay inspired, feel fulfilled, and maintain the desire to keep doing the dirty work of growing local food for us.

The Cow-op allows producers to come together and post their products on an online farmers market, directly connecting to local consumers. By taking on the work of marketing, aggregating and distributing products for local producers, the Cow-op lets farmers and food processors have more time to do what they do best – produce good food!

All the food available from the Cow-op is produced in the Cowichan region.

Here’s how it works:

- Customers can place orders online every Friday at noon, to Tuesday at midnight. Producers receive orders Wednesday morning and prepare for delivery.
- Fresh orders are delivered Thursday mornings to the Cowichan Green Community in Duncan (360 Duncan St.) for customer pickup from 3-6pm, and to Zero Waste Emporium in Victoria (1728 Douglas St.) for pickup from noon-6pm.

The cow-op is working to open additional pickup spots in Cowichan Bay and off Hwy 18 on Drinkwater Rd.

To sign up or learn more, visit www.cow-op.ca or email info@cow-op.ca.

Derrick Pawlowski is the general manager of the Cowichan Valley Co-operative Marketplace, co-owner of Coastal Rainforest Farm, and an advocate for community food resiliency.



Cool Beans

A superstar of food security, climate resiliency, and community

by Dan Jason

The humble bean has never been much appreciated as a food crop in British Columbia.

When I say beans, I mean the pulses that have edible seeds in pods, most notably chickpeas, favas, and lentils, as well as dry peas and beans.

There are good reasons for British Columbians to get serious about them.

We can no longer rely on our oceans and rivers as sources of quality protein. As readers of the *Watershed Sentinel* well know, fisheries management is a disaster, waters are polluted, and stocks are depleting to the point of extinction. Based on over three decades experience in bean growing, I can say that they are our best alternative.

Beans have been a key food in temperate climates around the world for over 8000 years. They are rich in protein, fibre, and complex carbohydrates, and contain an impressive variety of vitamins and minerals. Beans are recommended for heart health, diabetes, and weight control and are an excellent mainstay for vegetarian, vegan, and gluten-free diets.

Countries around the world enjoy the diverse variety of pulses prepared in myriad ways. Surprisingly, it's Canadian beans that

are often eaten in areas such as the Middle East, Southeast Asia, and India. In fact, our country is the world's largest exporter of pulses.

Domestically, Canadians consume less than five per cent of the dried peas, beans, chickpeas, favas, and lentils that are grown on the Prairies. The beans found in our own supermarkets are almost always imported. These are usually old and dried out.

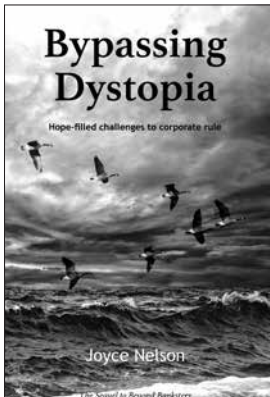
We tend to think of them as inferior foods that are hard to digest, but the truth is that if you cook dry beans within a year of their harvest, they absorb water better, cook up quickly, and are much easier on the digestive tract than the ones you are used to.

As legumes, they increase soil fertility by taking nitrogen out of the air and putting it in the ground. They do this in association with soil organisms on their roots. Pull a plant out of the ground, and you can easily observe the root nodules where nitrogen fixing takes place. I have often grown pulses in the same place for two and three years, with increased yields the second year and even more so the third year.

Beans are drought resistant, and can be grown without herbicides and pesticides, as millions of small-scale farmers do worldwide. I have been doing so myself for over 30 years.

If planted in May, when there is still moisture in the soil, beans can be mulched to keep moisture from evaporating and to prevent weed competition. Then, no care is required until harvest. Last May, I planted at Ruckle Park on Salt Spring Island, with the intention of bulking up bean varieties for larger plantings. It took six of us only a few hours to plant the beans. They grew quickly, soon shaded out the rows and the weeds, and didn't need further work until harvesting in September. We obtained over 150 pounds of dry beans from eighteen 70-foot rows.

Bean yields are easily stored as-is in covered containers in a cool dark place.



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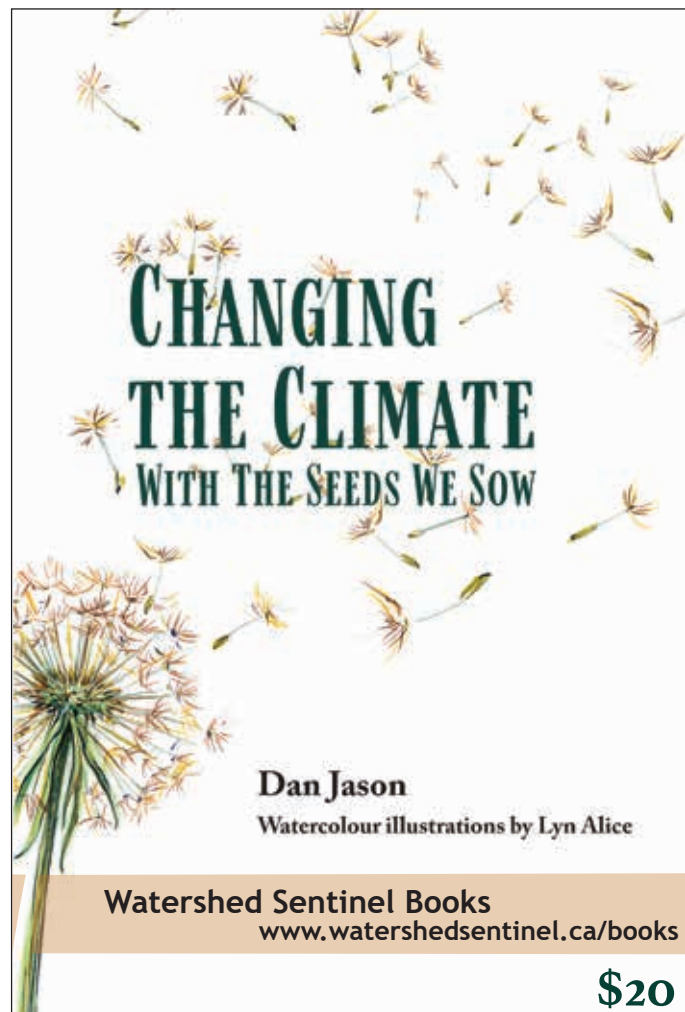
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Beyond industrial agriculture

In my recent book, *Changing the Climate with the Seeds We Sow*, I cover how food is rarely mentioned in climate change discussions – and especially not by politicians. Yet a strong case can be made that the unsustainable way we grow, transport, process, and consume food in North America is contributing to climate disaster.

We work most of our lives so we can have “food on the table.” If we are ever to break the hold the banksters have on us, we need to move beyond a monetary measure for the value for food. In truth, we need to bust out of the current arrangement that is destroying the earth very quickly. It is crazy that people whose hands never touch the earth profit from industrial agriculture,



If we are ever to **break the hold the banksters have on us**, we need to move beyond a monetary measure for the value for food.

and equally crazy that we ship crops thousands of miles across the globe, while those same crops are transported thousands of miles to us.

Indigenous Peoples thrived without buying and selling food. If we are to take better care of ourselves and the planet, there's no better or easier starting place than growing our own food communally instead of buying it as individuals. Well, maybe not easy considering the mindset that makes money the reason for everything. But certainly, it shouldn't be hard to turn over some soil and plant food with friends and neighbours.

There is so much suitable land around that is just growing grass.

School gardens are sprouting everywhere these days, so why not make them large enough to grow significant amounts of food, to become, in essence, community mini-farms? Perennial fruits, berries, nuts, and annuals could all be planted and become free food sources for years to come. Kids could bring home snacks for their parents!

What is the most likely scenario in the years to come? For sure there will be more climate-related floods, fires, windstorms, and temperature extremes. It will become increasingly difficult and expensive to maintain roads, bridges, ferry docks, and power grids. All these things will erode food security.

If we make food production a community endeavour and learn how to take care of ourselves where we are, we will increase our ability to weather the impacts of a changing climate, as well as our prospects for still having a good life.

Dan Jason is the author of *Changing the Climate with the Seeds we Sow*. He has owned and operated the mail order seed company Salt Spring Seeds for 34 years. It specializes in heritage beans.

Herring and UNDRIP

Narrowing choices in an ecological collapse



by Loys Maingon

Increasingly, there is a yawning gap between the apparent growing prosperity and abundance that we experience daily, and the ecological collapse around us that is hardly noticed, and only discussed in arcane circles of environmental scientists and First Nations. In BC, a provincial fisheries collapse and the consequent news that fishermen will need to be economically bailed out are reported by news outlets only to fall on deaf ears. Letters in *Science* (November 2019) with what might once have been considered “alarmist” titles, such as: “Salmon in clear and present danger” note laconically that: “Habitat destruction has driven the collapse of wild salmon fisheries from California to Washington, where 93% of wild salmon abundance has been lost.” Assuming that somehow the reality of the ongoing salmon collapse is different in BC, those now-banal data only draw a yawn.

It is, however, a global cultural problem as we see science increasingly marginalized in public planning and decision making. There appears to be a large dissonance between what is actually happening to the state of the environment around us, our material expectations, and the assumptions we make about the stability of the “resource environment.” We treat a rapidly changing and deteriorating environment as though it remains the cornucopia of infinite resources it was at the time of contact, and as if the drivers of change have had no significant long-term or cumulative impacts.

Even local increases in species richness, which give the misleading illusion of increasing biodiversity, can set the stage for a decline in local resilience. Therefore, what we appear to be witnessing, particularly in ocean ecosystems, is a human-driven instability in biodiversity which is a prelude to ecosystem collapse.

The point that most people seem to miss is that it is not just the species composition that is changing. It is the matrix or envelope of that composition that we are rapidly changing, with foreseeable consequences.

Pacific Herring

Coastal BC's ecosystem food chains are already under severe stresses. It is not just the southern resident orcas, and their main prey, the Chinook salmon, that are threatened with extinction. The very foundation of the entire chain, the Chinook's main prey the Pacific herring which officially collapsed from over-fishing in 1965 and again in 1993, has never rebounded to historic highs.

There is considerable controversy as to whether current numbers warrant re-opening a fishery in the Salish Sea. Of particular note, the DFO numbers used in modelling are based on the total biomass of an assumed annual return of an offshore population, using the total catch for 1953 onwards as the benchmark. (1953 happens to have been the year of a massive population collapse.) The stock has consequently been routinely grossly overestimated based on a flawed short-term database, and for the last 40 years the allowable catch has been set at an unsustainable 20%, resulting in the successive collapse of herring spawning sites.

How this failed management approach translates in practical terms can be illustrated by the DFO's own numbers for last year's fishery in Lambert Channel, which was opposed by conservationists and most First Nations.

In simple terms, the return was overestimated by 30% and the take was exceeded by 20%, a regular practice that explains the collapse of all other previous herring spawns.¹

Against the DFO's broad assumption that the biomass is equivalent to "historic highs," it can be difficult for the uninitiated and the public to understand that current returns in no way approximate the abundance of herring at contact and at the turn of the century. Stephen Hume puts this into perspective from a historical anecdote that was frequently corroborated by early settlers: "In June of 1893, a small steam tug thumped past Nanaimo. Abruptly, the sea began to seethe. It was a herring school so vast it took three hours to traverse. The school was 70 kilometres across."²

The actual magnitude of the decline of herring in the Salish Sea before contact has been reconstructed archaeologically by McKechnie et al. Herring consumption was prevalent from Puget Sound to Alaska, but it was highest around the Salish Sea. It amounted to between 80 to 100% of the fish consumed by the native population, and therefore had to correspond to fishing from extremely abundant year-round herring populations.³

The herring return was overestimated by 30% and the take was exceeded by 20%, a regular practice.

By this measure, the now-unique Lambert Channel fishery between Hornby and Denman islands constitutes an anomalous vestige of a pre-contact ecosystem, which flourished for millennia until about 1953. And even as a vestige it now has its own problem with local kelp reproduction, which is essential for herring reproduction. It should therefore come as no surprise that the Salish Sea is increasingly considered by many to be a broken ecosystem on the verge of collapse.

Not included in the DFO estimates are the losses of some 21 resident populations unique to the Salish Sea, which are known by local First Nations and commercial fishermen to have been fished year-round. Many of these resident herring populations have been extirpated, as is to be expected from a fishery which intercepts a species by removing both reproductive adults and eggs from its life-cycle.

Co-management - a way forward

There is growing concern over the collapse of the herring fishery throughout the BC coast. It is felt that it is a product of the DFO's over-estimation and questionable mismanagement of the stock.

After decades of opposition to the DFO's management of herring, in 2016 the Supreme Court enabled the Heiltsuk Nation to enter in a joint-management agreement with the DFO. Notwithstanding teething disagreements, the Heiltsuk management protocols have now returned to traditional management practices which do not target adult fish and which limit the roe fishery.

The success of this agreement has motivated First Nations around the Salish Sea to advocate for a similar arrangement to control the fishery at Lambert Channel and throughout the Salish Sea. In November, Saanich Nation WSÁNEĆ Leadership Council (WLC) of Tsartlip, Tseycum, and Tsawout First Nations invited 25 local First Nations and 50 community organiza-

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↳ *Herring continued*

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tions to an event called HELIT TTE SLON,ET (Let the Herring Live), to develop the groundwork for a traditional management agreement based on science, similar to the Heiltsuk joint management agreement.

Fundamental to this effort is the question of “social licence.” The DFO’s decades of mismanagement, and the interests that have benefited from this, have largely lost the support of both fishing communities and the public. Unlike fisheries from previous decades, the BC commercial fleet is no longer a quilt work of small boat owners. The commercial fleet is now concentrated in the ownership of BC’s richest billionaire, and therefore the benefits of a destructive fishery are mostly accrued by one billionaire.⁴

The discussion raised by the WSÁNEĆ Leadership Council comes at a very opportune moment in BC’s history. BC has become the first province in Canada to move to endorse as part of its laws the United Nations Declaration on the Rights of Indigenous People (UNDRIP). This is a matter of momentous importance for environmental biologists working around BC. Most of BC is still on unceded territory, and therefore, in principle, the environment is to be managed at the very least through joint management agreements with the rightful owners. There is now an obligation to act in good faith and to work jointly.

The open question remains that of “good faith” in an environment and history that has done little to build trust, since all gains have had to be acquired in court.

UNDRIP may be presented as a “game changer,” however one notices that around the world, it is disregarded when powerful interests are at play, as in Australia’s Adani mine expansion which saw Queensland extinguish Indigenous title in 2019. In Canada things are not radically different from Queensland. There still seems to be an inequality in the law for First Nations. Although we claim to respect and recognize the rights inherent in Section 35 of the *Charter of Rights and Freedoms*, and now in UNDRIP, a recent study showed that in practice there is still one law for First Nations, and another very different one that grants far more authority and rights to the interests of corporations and government.⁵

So, while UNDRIP may be a move in the right direction for First Nations’ rights, as well as for sustainable environmental management practices that affect all of us, there is a long way to go, and very little time to get there.

Loys Maingon MA, PhD, MSc (RPBio) is the BC Director of the Canadian Society of Environmental Biologists

Extracted from the complete article with full references in the winter issue of *The Bulletin of the Canadian Society of Environmental Biologists* (<https://cseb-scbe.org>)

Notes:

- 1: <https://seashepherd.org/2019/10/29/strait-of-georgia-herring-in-steep-decline/>
- 2: Focus Magazine, March 6, 2019
- 3: Archaeological data provide alternative hypotheses on Pacific herring (*Clupea pallasii*) distribution, abundance, and variability, PNAS, February 2014
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Wild Times

Cloud Watching



©Joe Foy

by Joe Foy

I have lived in the lower Fraser Valley my entire life. When I was a kid roaming local forests and fields near Langley, my footwear alternated between gumboots and running shoes depending on the weather and time of year. We spent a lot of time looking up at the clouds to try to figure out what the weather might throw at us next.

On days when the wind is from the west, big clouds roll in from the Pacific, their bellies all dark with foreboding of a storm to come. They bump up against the Coast Mountains and stand shoulder to shoulder from West Vancouver to Port Moody and beyond to Pitt Meadows, obliterating the view of the northern sky and promising a proper soaker of a day. Meanwhile to the south, the sky can still be as bright and blue as a robin's egg. The question always is – which will prevail, blue sky or rainstorm? Will it be runners or gumboots?

Predicting what's going to happen with the weather in the lower Fraser Valley can be tricky – but not as tricky as predicting our provincial government's environmental intentions.

In May of 2017 John Horgan became the premier of BC, the first NDP premier since Ujjal Dosanjh in 2001. What followed was a swirl of hit and miss actions on key environmental issues.

In December 2017 Premier Horgan announced that his government would proceed with the Site C dam – a mega-boondoggle destined to unleash horrifying devastation to the beautiful Peace River Valley in an ill-advised scheme to power up BC's fracked-gas fields.

But that very same month the BC government announced a permanent ban on the sport hunting of grizzly bears – a tremendous move that prevents the thrill killing of about 300 bears a year.

In October 2018 the premier was cheering on yet another devastating project – LNG Canada's plans to construct a massive Liquefied Fracked Gas plant at Kitimat which would make BC's climate commitments just so much hot air.

But ever since being elected, the government of Premier Horgan has been an outspoken advocate against the Trans Mountain pipeline – speaking out and going to court to defend our coast and climate from the impacts of a supersized tanker fleet.

Premier Horgan's government has defended Tetrahedron Provincial Park on the Sunshine Coast from an ill-conceived

plan to downsize it for a municipal water diversion scheme; they have banned logging in the so-called Donut Hole, an unprotected wild area sandwiched between Manning and Skagit provincial parks; and they have steadfastly opposed the Jumbo Pass ski resort proposal allowing the wildlands there to move toward becoming a Ktunaxa First Nation Indigenous Protected Area.

So what decisions are coming up? BC endangered species legislation was promised – but so far no action from Victoria. The same legislative foot-dragging is occurring on mountain caribou and spotted owl, two creatures that are being logged to death by an out of control timber industry. This year BC will decide what to do about old-growth logging – a ban on the terrible practice is long overdue.

Some may still remember that the 1990s were often referred to as the "Turnaround Decade." Here in BC there are now so many species at risk of disappearing, I wonder if the 2020s will be known as the Extinction Decade. It may all depend on decisions our governments make in the coming year.

Though storm clouds never listen to us, elected leaders sometimes do. Good reason to write yet another letter encouraging our representatives in Victoria to be the environmental heroes we know they can be.

Joe Foy is the protected areas campaigner for the Wilderness Committee.

Electric Vehicles

The good, the bad, the context



by Gavin MacRae

There are some strange ideas out there about electric vehicles. A percentage of would-be owners are nervous about driving an EV in a lightning storm, taking an EV through a car wash, or even worried that charging an electric vehicle will electrocute them.

But the granddaddy of EV myths is that after accounting for the embodied emissions from battery production, EVs actually produce more greenhouse gases over their lifespans than internal combustion engine vehicles (ICEs). Like a lot of myths, it started with some truth, back when battery production was less efficient and electricity grids were on average dirtier.

“There was a time when you could make a serious argument against electric vehicles because of the battery manufacturing,” says Daniel Posen, assistant professor of civil & mineral engineering at the University of Toronto. “That time has passed.”

But the myth lives on, periodically resuscitated by dubious analyses, and despite expert refutations.

In a paper published in *Joule* this June, Dutch researcher Auke Hoekstra details the “common flaws in assumptions and methodology” he says are needed to number-crunch in favour of ICE vehicles: overestimating emissions from battery manufacture, underestimating battery lifespan, excluding emissions from fuel

production, and assuming that over the lifetime of the EV, the electricity grid will not green. By Hoekstra's calculations, such assumptions can more than double on-paper lifecycle emissions of EVs.

Exaggerations also stem from comparing small, fuel-efficient ICE cars to larger, performance EVs, and assuming batteries are made with 100% virgin materials, says Neil MacEachern, sustainable transportation program manager at the Fraser Basin Council. "It's an apples to oranges comparison, or worse," he says.

In a 2018 study by researchers from Simon Fraser University and the Fraser Basin Council, MacEachern says results showed that even on Alberta's coal-heavy grid, "you still end up with a 50% life-cycle reduction for a comparable battery electric vehicle compared to a similar combustion engine vehicle."

Lifecycle emissions aside, EVs beat ICEs on air quality, hands down. A study co-authored by Posen, still under peer review, found that replacing all the cars in the Greater Toronto and Hamilton Area with EVs would have "enormous health benefits" even if none of the charging electricity was generated by renewables. "With an all natural gas [power grid], we've still found huge health benefits overall, even including areas near some of the gas plants," says Posen. "Because of the benefits of stopping the tailpipe emissions from cars that are at street level, right near people."

Dead battery

But batteries aren't made of fairy dust, and a second gripe with electric vehicles holds more truth. Cobalt, lithium and other metals used in lithium-ion EV batteries (as well as in cell phones, laptops and other devices) represent an impending waste

"The question of whether something **can be recycled** is distinct from the question of whether something **will be recycled**."

management dilemma, while mining the materials is associated with human rights and health impacts, and heavy metal contamination of water and agricultural soils.

At the same time, failure to maintain a steady supply of the metals could bottleneck EV adoption and energy storage technologies. And demand for the metals is set to boom.

Accelerating battery manufacture for EVs and energy storage is expected to outstrip the supply of lithium by 2022, and cobalt and nickel by 2030, according to a commissioned report by the University of Technology in Sydney, Australia. Known reserves of all three metals are projected to be exhausted by 2050.

To avoid a parallel escalation in environmental damage and human exploitation, the report calls for battery manufacturers to reduce demand through efficiency increases, substitute materials where possible, and make sustainable sourcing a priority.

But the single largest way to reduce demand for battery materials is by recycling them. Currently, industry is "very aware of the looming volumes," the report says, and working to advance recycling infrastructure that is right now inadequate.

"Of course, the question of whether something can be recycled is distinct from the question of whether something will be recycled," says Jeremy Michalek, professor of engineering and public policy at Carnegie Mellon University, by

email. "Recycling practice will depend on the cost of collecting, sorting, and processing used batteries as well as the value of the materials the process produces."

For cobalt, which is not required for all EV battery technologies, the same factors that make it scarce could see it phased out, says MacEachern. "Given the rarity of cobalt, the fact that it is throttled by a limited number of suppliers, and the instability in a lot of the places it comes from, it's not necessarily something you want to have in your supply chain," he says. "And so a number of producers, Tesla being the largest, have stated they intend to take cobalt entirely out of their batteries, and they've been consistently reducing the amount of cobalt for those reasons, as well as making dedications to ethical sourcing."

Used EV batteries can also be repurposed for other applications at the end of their in-car life, most notably as stationary energy storage. "It's something our current regulatory structure in Canada doesn't allow for," says MacEachern. "But in other countries they are using batteries that may only have like, 60% of their state of health, which is maybe not great for people who are doing road trips, but they work very well as backups for solar panels, and so we're seeing more and more of that occurring on a global scale."

However, Michalek cautions that in future, plans to repurpose EV batteries will be competing against new, low-cost stationary battery designs.

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All told, without iron-clad commitments to sustainable and ethical supply chains, and an efficient global recycling regime, spiraling lithium-ion battery production could exact a toll in environmental damage and human misery. Yet as the University of Technology Sydney report notes, EV manufacturers are consumer-facing brands, and rising EV adoption could offer the opportunity to clean up not only the supply chain for EV batteries specifically, but for the metals more broadly.

In weighing the issue, it must also be noted that the materials used in lithium-ion batteries are key to eliminating the environmental, health, and social costs of fossil fuel extraction and burning.

Mode shift

Other emissions-reducing measures for transportation are essential, too, such as increased public transit, protected bike lanes, and increasing the walkability and density of cities.

In British Columbia, these “mode shifts” – from driving to other means of trans-

portation – are being overshadowed by auto-centric policies, says Victoria-based transportation planning consultant Eric Doherty.

“The dominant media narrative is that the electric vehicle is *the* thing to do about greenhouse gas pollution from transportation,” Doherty says. “There’s been a little lip service toward better transit, but it’s been a pretty dismal public dialogue.”

That focus has led to highway expansions in the midst of a climate crisis, which does nothing to decrease the number of cars on the road, or the average distances travelled, Doherty says. “On Vancouver Island, for example, right now they’re spending huge amounts of money to build a four lane section of Sooke Road, Highway 14, instead of improving public transit to suit.”

In contrast, Doherty points to Paris, France, as an example of bold transportation policy. The French capital has steadily restricted car access to the city centre, while building hundreds of kilometres of dedicated bike lanes. Because of the

changes, bicycle use has jumped 54% in one year, according to a survey by the mayor’s office.

In BC, Doherty says such systemic changes are prevented by entrenched car-loving culture, Big Oil’s political clout, and developers who lobby to build sprawling, car-dependent housing developments.

“We need to get into a new paradigm,” Doherty says. “Before, the idea was ‘we’ll maybe make a bus lane where it’s not going to get in the way of cars.’ We need to shift that to say every every bit of lane space that you can shift to transit or bicycles or walking has a big benefit.”

MacEachern agrees that mode shifts have benefits above and beyond swapping ICE cars for Electric Vehicles, but says the advantage of EVs is that they offer fast emissions reductions, now.

“In the long term, a movement away from the single occupancy vehicle model – public transportation, bicycles, people’s feet – all these things provide a lot of other social benefits that single passenger vehicles don’t,” he says. “But those are a longer battle to fight. We need to make investments in those, but I think in the here and now, given the way our society is structured, moving to electric, personal vehicles is an incredibly important step in that direction.”

Posen says: “Most would agree electric vehicles are part of the solution, and many would agree that they are a large part of the solution. And almost everyone would agree that they are not the only thing we need to do. They won’t be enough alone.”

Tram trolling

Swedish public transit service pranks EV show

Sweden’s biggest electric car show this year included a model that was cutting edge...



in 1902. Public transit company Västtrafik snuck in an antique electric tram to the event in a stunt designed to highlight mass transit as the most sustainable travel option, and also to promote the company’s commitment to electrification. “The solution to many of our urban challenges have been standing right in front of us for a very long time – we simply have to travel more together. Electric cars are part of the transition towards sustainable transport, but they won’t solve the traffic situation. An electric car on the road is still a car on the road,” said Lars Backström, CEO of Västtrafik.

– Västtrafik press release, December 4, 2019

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