

## **BC Report: “Sudan” in a Year of Canadian Cholera**

*Now we are borrowing from nature at a rate that is many times higher than the world can sustain. The day of reckoning will come,”*

- Christian Steel (Norway)

These days the French existential philosopher and 1957 Nobel prize-winner, Albert Camus (1917- 1960) would find British Columbia to be fertile grounds for his brand of realism. Camus was made famous for his work on the myth of Sisyphus, and his 1947 novel *The Plague*, which describes an ethical and physical outbreak of the plague in a North African city. BC’s not quite made it to the “black plague” (*Yersinia pestis*), but we have made it to the “blue plague” (*Vibrio cholerae*). The symptoms are similar.

Nothing really quite speaks to the state of BC’s mythical “pristine” environment, as a recent outbreak of cholera in the retirement haven of Parksville and Qualicum Beach.<sup>i</sup> As noted by the provincial health officer: it is the kind of disease one normally associates with the worst of the third world, or that one currently reads about in the context of Yemen, where local infrastructure has collapsed in the wake of a protracted civil war.<sup>ii</sup> (Incidentally, Yemen’s misery is in part made possible by the sale of Canadian armaments to Saudi Arabia,<sup>iii</sup> perhaps demonstrating once again hubris: we never quite escape the consequences of living in a global village.) Of course, we can always pretend that the usual laws of nature do not apply to Canada. However, if it quacks like a duck, chances are it is a duck.

BC’s unique cholera outbreak has its own special significant cultural and environmental dimensions in the global village that are well-worth noting for what they tell us about the real state of BC’s environment. In particular it should raise red flags about the state of our coastal waters. As the BC Centre for Disease Control notes: “The main sources of contamination are humans and coastal waters.”<sup>iv</sup> A cholera outbreak is therefore not without known antecedents. Even if we cannot determine the exact point-source, we can ascertain the general processes leading up to it.

First, as befits a third-world disease outbreak, the victims are from the most vulnerable and exploited cultural group in Canada, which an endless succession of provincial and federal governments claim to respect, First Nations. And the sanctimonious talk of respect has to be notwithstanding Premier John Horgan’s recent very quotable justification for dismissing First Nations’ cultural concerns in the Site C decision, in a memorable betrayal of public expectations:

*“When it comes to reconciliation and working with Indigenous leadership there has been over 150 years of disappointment in British Columbia,” said Horgan. “I’m not the first person to stand before you and disappoint Indigenous people.”<sup>v</sup>*

Premier Horgan’s defense is the most mendacious argument in law. It is known as: “*everybody was at it.*” There is a legal test for this defense. It is known as the “*Ghosh* test for honesty.” It

depends on demonstrating that the perceived common practice is socially acceptable, and that if it is not, the defendant did not know that it is unacceptable. Given that failure to respect cultural rights and treaties is not deemed socially acceptable in Canada, even if it has a long history, and by his own admission he knows it is not, Horgan fails both limbs of the test.<sup>vi</sup> It is therefore not surprising that with less than a year in government, the Horgan administration has already reached an all-time low in its relations with First Nations.<sup>vii</sup>

In BC much of the land mass is “unceded First Nations territory.” No treaties were ever agreed upon, beyond Treaty 8 in the north-east of the province. The government must consult meaningfully with the original residents, as determined by *Tsilqot’in vs. British Columbia*. It is impossible to embark on long-term management of the environment without first establishing a working relationship with First Nations’ governments. As was the case with the previous government, like Sisyphus, this new government now faces a host of uphill legal challenges, as a result of the Site C decision, its reversal of its previous position on LNG development, and its tacit refusal to accept First Nations’ requests to terminate Atlantic salmon fish farm licenses, as the State of Washington has done. These apparent reversals from the pre-electoral positions that the NDP advocated, are likely to have critical ramifications for the long-term environmental management of this province.

The recent outbreak of cholera is without any precedent in BC. Over the thousands of years of cultural celebration of the herring spawn, there has never been any record of poisoning. This is not “red tide.” It is not a “natural” event. It is a signal of contamination of a “healthy environment.” This event is a contamination of a traditional food source, herring eggs, that corresponds to the early March herring run. The annual herring spawn is a cyclical culturally and environmentally important event rooted in the cultural fabric of local First Nations. It heralds the abundance that comes with the return of early salmon and spring freshets. The outbreak of cholera is therefore not just a simple incident. It is a cultural affront resulting from decades of provincial environmental mismanagement, and disregard for First Nations traditional management of the environment.

In keeping with the classic 1854 discovery by John Simon that cholera is not an air-borne “miasma”, but a clear contamination of water infrastructure.<sup>viii</sup> As in Yemen, the usual source of cholera likely is a contamination of surface waters. While it occurs in nature, and can contaminate shellfish, it is not a “natural” occurrence unless “natural” is synonymous with “uncontrolled.” The winter/spring surface waters of the “Salish Sea” (Strait of Georgia) receive rain and snow run-off and have a relatively low salinity. As Richard and Sydney Cannings eloquently put it:

*“The fresh water pouring out of these mountains is an important part of the coastal marine environment. The flow of large rivers is especially important: at maximal flow in early June, the Fraser can turn the surface layer of the entire Strait of Georgia into one large, brackish lake.”<sup>ix</sup>*

That suggests that our coastal waters, and the seafoods we harvest from them, are directly affected by the quality of the freshwater water plumes that dilute sea water. Contamination of surface freshwaters is a growing problem across North America, as population density increases.<sup>x</sup> Recent reports show that rivers are contaminated worldwide with agricultural pharmaceutical effluents.<sup>xi</sup>

In BC, and particularly on the east coast of Vancouver Island, development has been proceeding at an unbridled pace. We are “world-class”. We treat our rivers as drainage ditches, and connect Ministry of transport ditches, which are themselves connected to agricultural drainage, to them. So, the findings of the just released 2018 United Nations World Water Development Report: Nature-based Solutions for Water<sup>xii</sup> on the global state of water and the limits of “grey infrastructure” are appropriate:

*For too long, the world has turned first to human-built, or “grey”, infrastructure to improve water management. In so doing, it has often brushed aside traditional and Indigenous knowledge that embraces greener approaches. Three years into the 2030 Agenda for Sustainable Development, it is time for us to re-examine nature-based solutions (NBS) to help achieve water management objectives.*<sup>xiii</sup>

Grey infrastructure is akin to our blue-box approach to recycling, which is currently running into trouble all across Canada.<sup>xiv</sup> By building multi-million water treatment plants, we defer having to deal with the problem of a generalized degradation of our surface water resources. Just as the blue box programmes merely enable consumers to consume more and dispose of waste “out of sight and out of mind”, without having to deal with the source problems, multi-million dollar water treatment plants create the illusion of an endless supply of potable water that will never challenge our economic assumptions.

In this context, it is somewhat bewildering that British Columbians, and nominally so the current government, who oppose, and face daily arrest in their opposition to the Kinder-Morgan pipeline out of genuine concern for the potential oil contamination, seemingly remain silent about the less contamination of the Salish Sea by surface drainage practices.<sup>xv</sup> The levels of contamination are well-documented through the study of contaminant levels in resident orcas.<sup>xvi</sup> Sources of contamination of the strait, which include the state of our freshwaters are known, and are well-established as indicated by recent work such as that by Patrick Shaw et al.<sup>xvii</sup>

On Vancouver Island and in the Lower Mainland, the demand for housing is such that it often exceeds sustainable potable water supplies. Over the past two decades all municipalities along Vancouver Island’s east coast have faced increasing problems with water quality, which they are now moving to address in order to conform with the requirements of Vancouver Island’s Health Authority, by building multi-million dollar water treatment plants. However, addressing the problem of drinking water quality is not the same thing as addressing the quantity and quality of the environmental surface water supply that flows into the Salish Sea.

The two questions: the quality of the drinking water supply and the quality and potential contamination of surface waters are often confused in the public mind. It is noteworthy to consider that until very recently rural surface waters were considered potable. Untreated surface water was the only source of potable water in much of rural Canada. Public expectation with regards to surface water quality over the last fifty years has shifted from concerns over eutrophication of public waters in the late 1950's and 1960's to a broad political acceptance after 2000 that all surface waters were deemed unpotable. Concern for eutrophication in the 1950's led to research on the impacts of environmental non-point source disturbances on the water supply, and the ecological processes that maintained water quality. This guided much of the now classic Hubbard Brook experiments largely led by Gene Likens and Herbert Borman who studied the relationships between soil and vegetation and water fluxes and quality. This is what we today refer to as "green infrastructure. Failure to heed the findings and applications of this work has resulted in a number of "accidents" and in Canada, to a broad acceptance after the successive Walkerton and North Battleford e-coli outbreaks in 2000 and 2001 that surface waters are no longer expected to be potable. In keeping with the 2018 United Nations report referred to above, the main reason why surface waters which were previously potable are now no longer potable is because we have effectively destroyed much of the green infrastructure that previously filtered and treated water microbially. We have directly contaminated water tables and exceeded carrying capacity of the land.

This is a result of increased population density and increased direct and indirect contamination of the water supply through poor land use and management. In other words, the effective general mismanagement of the environment, of which surface water quality is perhaps our best and most direct indicator, has not been addressed at source, but has been circumvented by an increasingly costly "grey infrastructure," which is highly vulnerable in a region subject to cycles of 9.5 earthquakes. The increased contamination is a result of managing the problem ad hoc, while claiming that the continued practices that generate contamination are "sustainable", rather than address them at source and acknowledging unsustainability of an over-built infrastructure.

The narrow zone of rich agricultural land on the east coast of Vancouver Island which forms an essential part of BC's ALR (agricultural land reserve, **Figure 1**) is also home to a relatively densely populated and highly developed retirement real estate market. BC's ALR makes up only 1.1% of the total provincial landmass. This means that BC only has 1.1% of arable land that can be used for agriculture. Vancouver Island's agricultural reserve is a mere fraction of that 1.1%, but it is increasingly intensely managed. The current government proposes to intensify the agricultural footprint. This poses a number of important conservation challenges.

Agricultural land is "valley bottom" land rich in organic soils. As such, in its natural state it is made up of some of the most microbially active and complex soils which support some of the province's highest biodiversity, with milder microclimates and more complex environments. On Vancouver Island the ALR area is therefore contiguous and synonymous with some of Canada's most endangered ecosystems: the Coastal Douglas Fir and Garry Oak ecosystems. These thin

strips of dry Mediterranean climate ecosystems are also in high demand for housing development.



**Figure 1:** Map of BC's Agricultural Land Reserve, showing the narrow coastal strip along east Coast Vancouver Island. Vancouver Island ALR shown as a red line underlining the green patches.

On Vancouver Island, the twin problems of water quality and quantity are compounded by climate change which is already observable in the climate data. Climate data based on ClimateBC data indicates that mean annual temperature warmed across Vancouver Island from 1962 to 2005 from 4.86 to 5.11 °C and annual precipitation decreased from 3768-3359 mm.<sup>xviii</sup> These trends have only increased over the past 13 years, over which Vancouver Island has experienced a succession of summer droughts. Water deficits are increasingly no longer compensated for by diminishing glaciers and snowpacks which are now vanishing and receding early.

These adverse surface water quality and quantity conditions are further exacerbated by a drive towards agricultural intensification in a largely unregulated environment, created by abuses in *The Right to Farm Act*. It is therefore to be noted that within the east Vancouver Island ALR,

both the previous Liberal and current NDP government, as would the Green Party were it in power, promote an intensification of agricultural activities.<sup>xix</sup> Ironically, the Horgan government, which has elected to continue the Site C project and, therefore, to destroy some 5,550 hectares of prime agricultural land within the traditional territory of Treaty 8 First Nations, has embarked on a ministerial review “to protect the ALR.” The main concern of the review stems from the previous government’s re-classification of the ALR into two different regulatory zones in order to enable landowners to sell and subdivide agricultural land for other purposes in Zone 2 (See **Figure 1**). Beyond this focus, the current government is interested in augmenting agricultural production on agricultural land by penalizing through increased taxation what they interpret to be the non-productive or non-agricultural uses of ALR properties, and rewarding agricultural intensification, presumably through subsidies.

This has huge conservation implications for BC’s biodiversity. Of particular concern is the fact that this involves the conversion of forest and wetlands to agriculture. To date the east coast of Vancouver Island has already lost about 75% of its wetlands and intermittent streams. Unlike, most other Canadian provinces, such as Alberta, Saskatchewan and Ontario, BC has no clear regulation or enforcement controlling the landfilling and drainage of agricultural and development land. While there are some references in a plethora of acts and “frameworks” guidance is unclear, and generally unenforced. In BC, farmers and developers regularly deforest land, fill wetlands and intermittent streams, and connect drainage directly into the Ministry of Transport ditching system, with impunity and minimal, if any, oversight. Even the Minister of Agriculture’s Advisory Committee’s “Discussion Paper for Stakeholder Consultation and Public Engagement”<sup>xx</sup>, only tacitly acknowledges this problem, if insufficiently so:

*“Government ministries and agencies can have considerable impact on agricultural land through such things as transportation planning, wildlife habitat management and conservation, forest and water management and energy planning. Accordingly, the ALC is both proactive and collaborative in working with ministries...”*

The ALC cannot be proactive if it does not address the question of on-site water management, deforestation and drainage. The disturbing anomaly is that in BC there is no drainage regulation comparable to other provinces. The fact is that highway ditches are not common property for landowners to drain into, but property of Ministry of Transportation and Highways, and therefore should not be connected to without explicit permission. Failure to exercise its responsibilities to downstream landowners carries liabilities for the MoT. It is a common law offense to flood a “downstream” neighbour,<sup>xxi</sup> an inconvenient fact ignored by developers, would-be farmers and Ministry of Transportation staff alike.

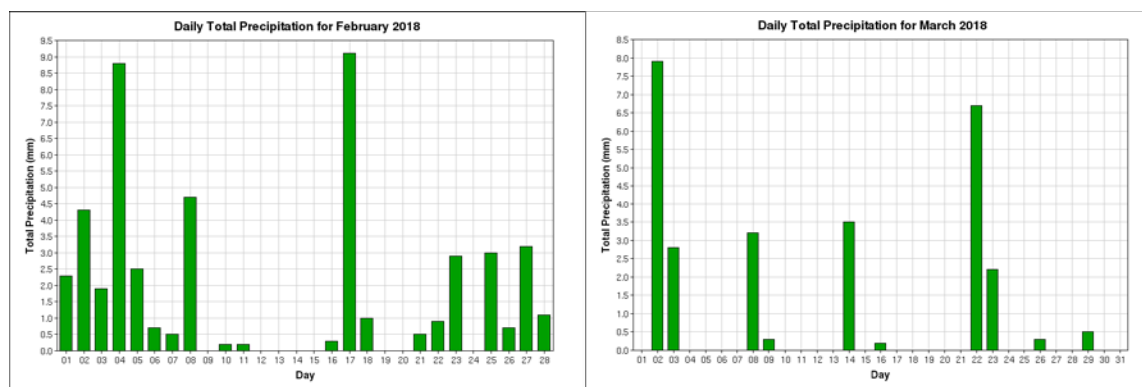
Given Coastal BC’s high winter precipitation, winter water saturation is a growing major concern, as climate change proceeds. Here, as elsewhere on the planet, flooding due to anthropogenic climate disruption is a major recurrent event. Addressing flooding problems by

restoring estuarial wetlands as Campbell River has done, and now as Courtenay is proposing to do with Kus-kus-sum project on multi-million dollar grants, is doubtless meritorious and deserves to be supported.<sup>xxii</sup> However, while such projects principally address the management of water quantity, they do not address the source problems, and they only secondarily address the problems of water quality, which can be addressed cheaply at source.

The continued destruction of upland ephemeral and permanent wetlands, and the unrestricted drainage of agricultural lands results in poor water retention throughout the region during the summer water deficit period, with consequent over-pumping of the water table and aquifers. Moreover as our rain events are increasingly stochastic and come as large storms. This results in river surges and flood events. Such events are forecast to increase globally as climate change develops.<sup>xxiii</sup> The outcome is that BC, and most of east Vancouver Island experiences flash floods during these events. That means that all contaminants from road waste, industrial and agricultural activity effectively flush into Georgia Strait, without any or little processing from a green infrastructure that has been extirpated. The expectation is that these contaminants will be diluted in the water.

That BC continues to rely on “the dilution model”, warrants recalling Newman’s comment in his 1998 ecotoxicology primer: “As *World War II* ended, the *dilution paradigm* (the solution to pollution is pollution), was replaced by the *boomerang paradigm* ( what you throw away can come back and hurt you).”<sup>xxiv</sup> Since the writing of this primer, BC’s approach to pollution has not substantially evolved. BC has not really progressed “beyond 1945 practices.” Our recycling and waste problems show that we continue to be a throw-away society, and we continue to rely on dilution to absorb our waste. Victoria’s lengthy debate over sewage treatment, and the continued acceptance of fish farm practices speak volumes about the collective mindset determining what is environmentally acceptable in BC. The dilution model is known to be limited by carrying capacity, but we seem to ignore those limits, until we hit a major crisis, such as the looming one that this small anomalous cholera outbreak signals.

Even a cursory review of our precipitation pattern over the past years can show that rain has not been constant, but rather comes in large rain events. This means that contaminants are accumulated on land over protracted periods and flushed in large pulses. This is exactly what Environment Canada’s data for precipitation at Parksville BC, shows for the period around the herring spawn (**Figure 2**).



**Figure 2:** Environment Canada Data for precipitation at Parksville BC, during the herring spawn (February 20- March 15).<sup>xxv</sup>

Monitoring broad environmental contamination pulses at a regional scale poses numerous sampling challenges, and contaminants from a variety of small streams and ditches can easily escape detection.

While agriculture is certainly to be promoted to minimize the carbon footprint and ensure our food security, it should be noted that this cannot be done at the expense of a healthy and sustainable environment. As other provinces, BC needs to pass laws mandating that landowners protect and restore green infrastructure. We have access to aerial photographs of the ALR dating back to about 1920 which can enable us to evaluate the losses that we have incurred, and to develop restoration strategies.

Agricultural intensification has serious environmental costs which politicians by and large do not understand. The loss of species is not the loss of landscape ornaments. It is the loss of ecosystem functioning. Argentina provides a textbook example of the consequences of deforestation and agricultural intensification in the Morro basin. The recent conversion of forests and savannah that absorbed rainfall and maintained a stable landscape, to soy bean field agriculture has resulted in the massive erosion of the landscape and the appearance of previously unknown rivers.<sup>xxvi</sup> This is a repetition of all the lessons that were learnt in 1935 when Paul B. Sears published *Deserts on the March*, which was mandatory high school reading in 1965, (as I recall from personal experience.)

More recently, the European Union's policy of intensifying agricultural production, with minimal conservation incentives has resulted in the collapse of insects throughout Europe,<sup>xxvii</sup> and the resulting documented collapse of bird populations in France<sup>xxviii</sup> and in Britain<sup>xxix</sup>. In all cases biodiversity collapse is driven in part by pesticide and herbicide use, and perhaps to a larger extent by habitat destruction. It is therefore surprising to note that Brexit may have at least one positive result for conservation, although recent reports indicate that the overall impact will be adverse.<sup>xxx</sup> In its rejection of European rules and subsidies promoting intensive agriculture, Britain proposes to reward landowners and farmers who enhance conservation values on their



land. In other words, having lost 56% of its farmland birds and experienced an unprecedented biodiversity collapse between 1970 and 2015, the current conservative government is moving to reward farmers, not for the amount of food they produce, nor for the amount of arable farmland they own, but for the amount of conservation measures that they implement:

*“They will be paid according to the amount of environmentally friendly measures they can put in place on their land. The new philosophy is “public money for public goods”, and the environment is explicitly recognised as the principal public good”.*<sup>xxxix</sup>

This reversal of policy comes at a most critical time in which the entire planet is experiencing a collapse in biodiversity without any precedent since the Cretaceous-Paleogene extinction event that ended the Mesozoic era 65 million years ago. Just as President Trump has revoked the United States’ first International Convention on Migratory Birds, signed exactly 100 years ago, for its inconvenience to agriculture and oil field development, the National Wildlife Federation has released a major report detailing the collapse of fully 1/3<sup>rd</sup> of America’s wildlife:

*“Habitat loss and degradation, invasive species, disease, and pollution all pose threats to our wildlife—threats that are being amplified by a rapidly changing climate.”*<sup>xxxix</sup>

As Canada did when we signed the International Migratory Birds Convention in 1917, we should understand that while politicians may reckon by borders, wildlife knows no borders. The American problem is fully our problem. And this problem is also that which has been widely documented in Europe, and concerns the entire planet.

The conservation incentives to farmland owners proposed by the British government need to be also implemented and enhanced in BC, and particularly so on east-coast Vancouver Island. They are in keeping with the eloquent proposal made by E.O. Wilson in his latest book, *Half – Earth: Our Planet’s Fight for Life*,<sup>xxxix</sup> the contents of which are summarized in a New York Times editorial “*The Eight Million Species We Don’t Know*.”<sup>xxxix</sup> Wilson’s proposal is quite simple. We have to take steps to curtail our consumption, shift our economy and set aside 50% of the planet for the preservation of the other species who make our well-being possible. After decades of mumbling about “sustainability,” nothing that we have proposed or done so far has delivered actual sustainability. The very real and measurable biodiversity crisis and the collapse of the ecosystem services that it sustains are the very palpable measure of the unsustainability of our economic system and demands.

And Wilson was proven right in what is probably the best and most significant research article produced in January 2018 by O’Neil et al. “*A good life for all in planetary boundaries*” in the journal *Nature Sustainability*. The article is a resounding condemnation the sustainability mantra that has dominated political thinking since the mid-1980’s. The authors’ conclusions roundly reject the sustainability of our current practices and the economic system that they entail:

*“We find that no country meets basic needs for its citizens at a globally sustainable level of resource use. Physical needs such as nutrition, sanitation, access to electricity and the elimination of extreme poverty*

*could likely be met for all people without transgressing planetary boundaries. However, the universal achievement of more qualitative goals (for example, high life satisfaction) would require a level of resource use that is 2–6 times the sustainable level, based on current relationships.”<sup>xxxv</sup>*

The data for this research are available on a website managed at Leeds University which compares the performance of 150 countries. Canada is among the worst delinquents, and performs only mildly better than the USA. What is notable is that for all the talk of sustainability and good intentions to meet climate change objectives, after 3 years of talk no country is anywhere near meeting the objectives set in the Paris Agreement of 2015.<sup>xxxvi</sup>

Any proposal “to save the ALR” should be based on a workable proposal to save the biodiversity of the ALR and the ecosystem services it provides to the citizens of BC. Farmers and landowners should be rewarded for preserving at least 50% of their ALR land, and conversely landowners who destroy 50% of natural ecosystems should be penalized for poor stewardship. And within that framework, drainage must adhere to basic common law principles which make landowners responsible for the conservation of water resources and water treatment on their land.

In March BC experienced floods in the Okanagan,<sup>xxxvii</sup> and its first major forest fire<sup>xxxviii</sup>, on the same day. Fire predictions for this summer indicate that are once again headed to break previous records of drought and fire.<sup>xxxix</sup> One might think that an outbreak of cholera might raise red flags in public consciousness... it would have in the Middle Ages. In spite of any public talk to the contrary, in BC, as elsewhere in Canada, the environment remains a subsidiary concern, and at best a subject of much talk. For politicians it is something to be addressed once we attain a nirvana of “economic prosperity.” Regrettably, life is fragile, and becoming more fragile as the consumer economy and the energy sources that drive it continue to reach out towards a nirvana that daily recedes infinitely.

On March 20, 2018 the world lost one more iconic species, among many. “Sudan,” the 45-year old last surviving male Northern White rhinoceros (*Ceratotherium simum cottoni*) had to be euthanized. Although much is made in the popular press about *in vitro* fertilization efforts that will continue to be made to save the species with his two surviving daughters, given the success rate of many efforts over the past decade, the probability of success is extremely low. The promises of technology are much overrated. As E.O. Wilson so eloquently put it, as he touched one of the last equally endangered Sumatran rhinoceros (*Dicerorhinus sumatrensis*): “...I did so, once each, quickly and softly, with the tips of my fingers. My feeling at that moment was spiritual and lasting, one I can’t explain to you or even to myself.”<sup>xl</sup> That feeling is known at the very least to most biologists versed in evolution as the moral obligation that comes with our evolutionary connection to the rest of the species that are quickly disappearing.

Unfortunately, most politicians do not seem to understand the connection. Although reports of the clearly deteriorating state of the planet continue to mount in spite of continuous promises of change, the only change that seems to matter is the weight of economic change that skews the future of this planet.

It therefore comes as no wonder that as we slide to the end of the NDP's first year in power, both David Suzuki and Andrew Weaver have recently assessed the achievements of the Horgan government as "very little change."<sup>xli</sup> And in so doing, they confirm the findings of the latest depressing UN report on the continued land degradation that is undermining biodiversity and human well-being.<sup>xlii</sup>

In BC as in the rest of the planet, only climate changes and even cholera becomes almost acceptable.

It is Easter, maybe there will be a resurrection? I doubt it. The deathly economy must prevail, no matter what government.

*Loys Maingon,  
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<sup>i</sup> <http://vancouver.sun.com/news/local-news/unheard-of-cholera-cases-on-vancouver-island-linked-to-b-c-herring-eggs> ; [http://www.timescolonist.com/news/local/vancouver-island-cholera-outbreak-a-unique-situation-health-officials-say-1.23213384?utm\\_campaign=magnet&utm\\_source=article\\_page&utm\\_medium=related\\_articles](http://www.timescolonist.com/news/local/vancouver-island-cholera-outbreak-a-unique-situation-health-officials-say-1.23213384?utm_campaign=magnet&utm_source=article_page&utm_medium=related_articles) ;

<sup>ii</sup> <https://www.reuters.com/article/us-yemen-security-cholera/yemens-cholera-epidemic-likely-to-intensify-in-coming-months-who-idUSKCN1GA225> .

<sup>iii</sup> <http://www.cbc.ca/radio/thecurrent/the-current-for-january-29-2018-1.4508290/should-canada-scrap-military-deals-with-saudi-arabia-over-war-in-yemen-1.4508327>

<sup>iv</sup> <http://www.bccdc.ca/health-info/diseases-conditions/cholera#overview>

<sup>v</sup> <http://vancouver.sun.com/news/politics/ndp-government-decides-to-continue-construction-on-site-c-dam>

<sup>vi</sup> <https://www.lexology.com/library/detail.aspx?g=04ddb348-4ed4-454c-9d06-aeb0be56e97e>

<http://www.4kbw.co.uk/wp-content/uploads/So-Longmore-PDF-1.pdf>

<sup>vii</sup> <https://www.theglobeandmail.com/news/british-columbia/bcs-john-horgan-faces-ire-of-first-nations-after-site-c-approval/article37310963/>

<sup>viii</sup> [https://en.wikipedia.org/wiki/1854\\_Broad\\_Street\\_cholera\\_outbreak](https://en.wikipedia.org/wiki/1854_Broad_Street_cholera_outbreak) ;

<https://www.cdc.gov/cholera/usa/index.html>

<sup>ix</sup> Richard Cannings and Sydney Cannings. (2015). *British Columbia: A Natural History*. Greystone, 62.

<sup>x</sup> <https://www.workingwatersgeos.org/>

- <sup>xi</sup> <https://phys.org/news/2018-04-rivers-worldwide-threatened-pharma.html> ;  
<https://www.theguardian.com/environment/2018/apr/11/drug-waste-clogs-rivers-around-the-world-scientists-say>
- <sup>xii</sup> <http://www.unwater.org/publications/world-water-development-report-2018/>
- <sup>xiii</sup> [www.unwater.org/publications/world-water-development-report-2018](http://www.unwater.org/publications/world-water-development-report-2018)
- <sup>xiv</sup> In Calgary as everywhere in Canada: <http://www.cbc.ca/news/canada/calgary/calgary-recycling-material-backlog-china-1.4479075> ; <https://www.theglobeandmail.com/news/national/chinese-ban-on-foreign-recyclables-leaving-some-canadian-cities-in-the-lurch/article37536117/>
- <sup>xv</sup> <https://www.theglobeandmail.com/canada/british-columbia/article-more-than-150-protesters-arrested-so-far-at-kinder-morgan-terminals-in/>
- <sup>xvi</sup> <https://georgiastrait.org/work/species-at-risk/orca-protection/killer-whales-pacific-northwest/orca-facts/> ;
- <sup>xvii</sup> <http://www.waterquality.ec.gc.ca/web/Environment~Canada/Water~Quality~Web/assets/PDFs/Acrobat%20Document.pdf>
- <sup>xviii</sup> Michelle M. Jackson, Emmeline Topp, Sarah E. Gergel, Kathy Martin, Francesco Pirotti and Tommaso Sizia. (2016) "Expansion of subalpine woody vegetation over 40 years on Vancouver Island, British Columbia, Canada," *Canadian Journal of Forestry Research* 46: 437-443.
- <sup>xix</sup> <https://news.gov.bc.ca/releases/2017agri0016-000185>
- <sup>xx</sup> <https://engage.gov.bc.ca/app/uploads/sites/327/2018/02/Discussion-Paper-ALR-and-ALC-Revitalization-February-2018-Final.pdf>
- <sup>xxi</sup> Common Law on drainage is ably summarized in: <http://www.omafra.gov.on.ca/english/engineer/facts/98-015.htm>
- <sup>xxii</sup> <https://projectwatershed.ca/>
- <sup>xxiii</sup> Willner et al., Adaptation required to preserve future high-end river flood risk at present levels *Sci. Adv.* 2018;4: eaao1914 10 January 2018 .
- <sup>xxiv</sup> Michael C. Newman (1998). *Fundamentals of Ecotoxicology*. Ann Arbor Press, p.1.
- <sup>xxv</sup> [http://climate.weather.gc.ca/climate\\_data/daily\\_data\\_e.html?StationID=46987&timeframe=2&StartYear=1840&EndYear=2018&Day=31&Year=2018&Month=3#](http://climate.weather.gc.ca/climate_data/daily_data_e.html?StationID=46987&timeframe=2&StartYear=1840&EndYear=2018&Day=31&Year=2018&Month=3#)
- <sup>xxvi</sup> <https://www.theguardian.com/world/2018/apr/01/argentina-new-river-soya-beans>
- <sup>xxvii</sup> <http://www.sciencemag.org/news/2017/10/germany-s-insects-are-disappearing>
- <sup>xxviii</sup> <https://www.theguardian.com/world/2018/mar/21/catastrophe-as-frances-bird-population-collapses-due-to-pesticides> ; <https://www.birdguides.com/news/catastrophic-collapse-in-farmland-bird-populations-across-france/>
- <sup>xxix</sup> <https://www.independent.co.uk/environment/uk-bird-numbers-species-declines-british-wildlife-turtle-dove-corn-bunting-willow-tits-farmland-a7744666.html>
- <sup>xxx</sup> <https://www.theguardian.com/environment/2018/apr/12/green-brexite-unlikely-despite-government-claims-report-concludes>
- <sup>xxxi</sup> <https://www.theguardian.com/commentisfree/2018/mar/26/wildlife-modern-farming-insects-birds>
- <sup>xxxii</sup> <https://www.nwf.org/ReversingWildlifeCrisis>
- <sup>xxxiii</sup> E.O. Wilson. (2016). *Half-Earth: Our Planet's Fight for Life*. New York: Liveright. 33.
- <sup>xxxiv</sup> <https://www.nytimes.com/2018/03/03/opinion/sunday/species-conservation-extinction.html>
- <sup>xxxv</sup> <http://www.nature.com/articles/s41893-018-0021-4>
- <sup>xxxvi</sup> <https://goodlife.leeds.ac.uk/>
- <sup>xxxvii</sup> <http://www.cbc.ca/news/canada/british-columbia/flooding-armstrong-state-emergency-1.4590653>
- <sup>xxxviii</sup> <http://www.cbc.ca/news/canada/british-columbia/lytton-wildfire-march-1.4590902>
- <sup>xxxix</sup> <http://www.cbc.ca/news/canada/british-columbia/wildfire-forecasts-predict-hot-dry-conditions-in-b-c-this-year-1.4607198>
- <sup>xl</sup> E.O. Wilson. (2016). *Half-Earth: Our Planet's Fight for Life*. New York: Liveright. 33.
- <sup>xli</sup> <https://www.nationalobserver.com/2018/03/05/news/david-suzuki-fires-death-zone-trudeau-weaver-and-broken-system>;
- <sup>xlii</sup> <https://www.theguardian.com/commentisfree/2018/mar/26/wildlife-modern-farming-insects-birds> ;

<https://www.theguardian.com/environment/2018/mar/23/destruction-of-nature-as-dangerous-as-climate-change-scientists-warn> ; <https://www.theguardian.com/environment/2018/mar/26/land-degradation-is-undermining-human-wellbeing-un-report-warns>