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THE CANADIAN SOCIETY OF ENVIRONMENTAL BIOLOGISTS Newsletter / Bulletin



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Front Cover: Clark's Nutcracker (*Nucifraga columbiana*). This species hides thousands of seeds each year. Laboratory studies have shown that the bird has a tremendous memory and can remember where to find most of the seeds it hides. Photo taken by Peter Wells, CSEB Atlantic Member, at Lake Louise, Alberta.

Back Cover: Scenic view of Maligne Lake, Jasper National Park. Leah Peak (2901 m) on left and Samson Peak (3081 m) on right are in the distance. Photo by Peter Wells.

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CSEB NEWSLETTER 2016

Vol. 73, Number 4, Winter 2016

The Canadian Society of Environmental Biologists Newsletter is a quarterly publication. The Newsletter keeps members informed of the Society's activities and updates members on the current affairs and advances in the field of environmental biology. This publication draws together the widely diverse group of Canadian environmental biologists through a national exchange of ideas. Members are invited to contribute papers, photos or announcements that are of a national biological and environmental interest. Letters to the editor are welcome. This is a volunteer nonprofit organization and we rely on your participation to make the newsletter a productive forum for ideas and discussion.

All business correspondence, changes of address, undeliverable copies and membership applications should be sent to: CSEB National Office, P.O. Box 962, Station F, Toronto, ON., M4Y 2N9. **Editorial correspondence:** Gary Ash, Editor, e-mail: garyash@shaw.ca

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LE BULLETIN de la SCBE 2016

Vol. 73, Numéro 4, Hiver 2016

Le Bulletin de la SCBE est une publication trimestrielle de la Société Canadienne des Biologistes de l'Environnement. Le Bulletin informe les membres des activités de la Société sur événements courants ainsi que les progrès qui font en sciences de l'environnement. Par un échange d'idées au niveau national, cette publication intéresse un groupe très diversifié d'environnementalistes Canadien. Les membres sont invités à contribuer des articles, photos (noir et blanc) ou des messages qui sont d'intérêt nationale en sciences biologiques et environnementales. Les lettres à l'éditeur sont bienvenues.

Tout la correspondance d'affaires, y compris les abonnements, les changements d'adresse, les exemplaires retournés et les formulaires: CSEB National Office, P.O.Box 962, Station F, Toronto, ON, M4Y 2N9. **Les lettres à l'éditeur:** Gary Ash, Editor, courriel: garyash@shaw.ca

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The Canadian Society of Environmental Biologists



CSEB OBJECTIVES

The Canadian Society of Environmental Biologists (CSEB) is a national nonprofit organization. Its primary objectives are:

- to further the conservation of Canadian natural resources.
- to ensure the prudent management of these resources so as to minimize environmental effects.
- to maintain high professional standards in education, research and management related to natural resources and the environment.

OBJECTIFS de la SOCIÉTÉ

La Société Canadienne des Biologistes de l'Environnement (SCBE) est une organisation nationale sans but lucratif. Ses objectifs premiers sont:

- de conserver les ressources naturelles canadiennes.
- d'assurer l'aménagement rationnel de ces ressources tout en minimisant les effets sur l'environnement.
- de maintenir des normes professionnelles élevées en enseignement, recherche, et aménagement en relation avec la notion de durabilité des ressources naturelles et de l'environnement, et cela pour le bénéfice de la communauté.

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NATIONAL News

PRESIDENT'S Report

By Acting President Anne Wilson

I stepped into this position with the passing of our President Bill Paton on June 13, 2016, and would like to acknowledge what big shoes he left to fill. Dr. William Paton, Bill to his friends in the CSEB, was a tireless supporter of the Society both as a member over many years, and in his role of the President. The tribute from the University of Brandon acknowledged Bill's passion for service, and all the time and energy he devoted to important issues and causes. This was very evident in the work he did with and for the CSEB, and Bill is much missed.



Dr. Bill Paton was honoured at the Brandon University Long Service Recognition ceremony in 2015.

With the cancellation of the planned CSEB conference in fall 2016, the CSEB had to acknowledge the difficulty of organizing such gatherings, given our wide geographic distribution and modest numbers. The idea was brought up of moving to an electronic format, and I would like to sincerely thank Loys Maingon for his leadership and hard work in initiating the CSEB webinars. These are being run approximately monthly, on current environmental issues, and have drawn good audiences.

Some of these issues may lead to further involvement by the CSEB, whether it is ongoing information through future webinars, or using our voice as a national organization to be heard on environmental problems. One that comes immediately to mind is that of microplastics — something that wasn't even on my radar until I heard the webinar by Dr. Sarah Dudas (available on the CSEB (a link to this webinar can be found at <https://cseb-sceb.org/cseb-research-webinar-microplastics-coastal-ecosystem/>). I encourage you to check this out - this is an issue that will be further researched and hopefully can lead to changes in what we release to the environment!

The CSEB Annual General Meeting has been postponed until the new year, as a result of my long-awaited shoulder surgery occurring last month. Many of the executive positions are up

for election, and I strongly encourage members to think about stepping forward and getting involved! There are some great folks who are doing a lot of work, and it would be so good to have some more active biologists bring their time and energy to the executive! Please watch the web site for notification of the dates (TBD) and plan to participate.

2016 has been a year with some difficult events, and with some exciting developments. I am looking forward to seeing what 2017 brings! I wish each of you a very Merry Christmas, and all the best for the New Year.

WEBINAR Series

CSEB launched a scientific webinar series in October to replace our annual conference/workshop, at least in the near-term, due to the logistical difficulties in organizing a conference/workshop in different localities across Canada, as well as the difficulties for biologists being able to travel as part of their jobs.

Since October, we have hosted three webinars using the Citrix GoTo webinar platform. Below is a short abstract of each, and a link to a recording of the webinar in case you were unable to attend.

CSEB Webinar #1

Microplastics in Coastal Foodchains

By Dr. Sarah Dudas, Vancouver Island University

Held 17 October 2016

Abstract: The impact of micro-plastics ingested by marine organisms is a growing recent concern. Relatively little is known about the fate of micro-plastics and their ultimate potential impacts on marine food chains. The ability of micro-plastics to sorb a large variety of chemicals makes them a potential danger for natural ecosystems and human health.



Dr. Sarah Dudas is Canada research chair at the Shellfish Research Centre at Vancouver Island University in Nanaimo, BC. Her research of micro-plastic impacts on marine food chains recently drew national attention. She is currently supervising a project tagging some 3,000 shellfish Vancouver Island to study the impacts of micro-plastics on marine food-chains.

The recording available at <https://attendee.gotowebinar.com/recording/173052513137825793>

Check out the CSEB Video at

<http://youtu.be/J7cOuDbBf9c> or

<https://www.youtube.com/watch?v=J7cOuDbBf9c>

CSEB Webinar #2**Canadian Water Quality Guidelines for the Protection of Aquatic Life**

*Presented by Uwe Schneider, Environmental Consultant
Held 9 November 2016*



Abstract: Uwe Schneider, a long-time developer and educator on the Canadian Water Quality Guidelines, presented the technical rationale for current guidelines. The Canadian Environmental Quality Guidelines are nationally approved, science-based indicators of environmental quality, nationally mandated by the Canadian Environmental Protection Act (CEPA, 1999). They are recommended numerical or narrative limits for a variety of substances and environmental quality parameters, which, if exceeded, may impair the health of Canadian ecosystems.

The recording is available at <https://attendee.gotowebinar.com/recording/5746594602586416641>

CSEB Webinar #3**Styrofoam Degradation by Mealworm Beetles and Other Good News**

*Presented by Peter Heule, Royal Alberta Museum, Edmonton, AB
Held 6 December 2016*



Abstract: Styrofoam and plastic biodegradation: Good News! Two materials formerly believed to be non-biodegradable and ubiquitous in consumer and construction waste can be broken down by the common mealworm beetle and naturally occurring bacteria, respectively. Plastic water bottles and Styrofoam are not as permanent as we thought, some bacteria are able to reduce them into less persistent constituents, giving hope for reducing the amount of plastic pollution in the environment and our landfills. The implications for further research and development of biodegradation techniques for problematic pollutants using insects and bacteria are discussed.

Peter Heule works as Life Science's Live Culture and Natural History Outreach Technician. His duties include the care and maintenance of the museum's displays of live creatures along with public education and media presentations about a wide range of natural history topics. In addition to outreach activities throughout the province both in person and through the museum's distance learning programs, Peter is often a guest speaker on CBC Radio One's "Radio Active" as the show's "Official Bug Guy".



The recording is available at <https://attendee.gotowebinar.com/register/622797849388385540>

CHECK THE CSEB WEBSITE FOR UPCOMING WEBINARS

NOTICE OF CSEB ANNUAL GENERAL MEETING

To be held January 26, 2017

By Webinar and Teleconference

Please check CSEB website for the time and login details

CALL FOR NOMINATIONS:

Positions Available Include the Following:

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Vice President

Secretary-Treasurer

Regional Directors:

Atlantic

Quebec

Ontario

Manitoba

Saskatchewan

Alberta

BC

Territories

Please submit nominations or interest to

anne.wilson2@canada.ca

by

January 9th, 2017

Born to the Wild (Grey Wolf Books)

by Rob Kaye

Peter Wells sent a note about the above book, for which he provided a book review of last year in the CSEB Newsletter/Bulletin. The book is selling very well out west, and in the most recent reprinted edition, 2015-2016, which has much improved maps, the publishers have included an excerpt from the book review, with credit to CSEB, at the front of the book, together with excerpted reviews from groups such as BC Bookworld, Nature Alberta, BC Nature, and CPAWS. Good publicity for the CSEB organization! Many CSEB members would, I think, enjoy this book, as it puts the reader right into the saddle of a back country, mountain park warden. Makes a nice gift!!

REGIONAL News

BRITISH COLUMBIA News

By Loys Maingon, CSEB BC Director

BC's Post-truth Universe: Do Empirical Facts Matter Anymore?

"In God we trust; all others require data" – Bernard Fisher

BC made national news this fall mainly around issues related to the fate of large resource projects that needed federal approval, such as Site C, the Northern Gateway, and the Kinder Morgan pipelines. Beyond the general public dissatisfaction with the structure and processes of the NEB, both projects that have been approved by the federal government in BC have provoked the outrage of people who believe primarily in numbers, facts, and data. Add to that, that in this province, political parties are in full provincial election mode until May 2017, and as everywhere, we have entered the new reality of the "post-truth" universe.¹

While these politically-charged issues drew attention, as did the sinking of the *Nathan B. Stewart* and the resulting diesel spill on BC's mid-coast, at a much more fundamental level to how we do and communicate science, the most significant event in BC's scientific world went hardly noticed by the public press. It did, however, find its way in the international pages of *Science*, and is most relevant to concerns that are currently uppermost in the minds of most scientists in North America and Europe: how is science to be conducted in an environment that is likely to become adverse to the very basic principles of science: fact-checking and the scientific method? It is a telling story of the changing priorities in our leading institutions.

Is this question overblown, trivial or out of place? It seems not. While this article was first awkwardly drafted in late November, this concern is now the editorial topic of key representative publications such as *Science* (16 December 2016).

After a year since the fall of the Harper government, Canadian federal scientists appear to have just negotiated the right to speak freely about their research.² Question is, will there be any point in speaking out in a world where science is now deemed irrelevant, or has "no rightful place"? The Canadian gain contrasts with greater concerns currently developing in the United States, where restrictions and political interference in public science and information that dominated the Bush administration would appear trivial compared to what is now to be expected after January 20. As I write, the situation is sufficiently dire for scientists across the world to be moving swiftly to duplicate and secure environmental research data, before it is ordered to be destroyed by the new administration.³ What appears to be in store would make Stephen Harper's destruction of DFO libraries appear trivial. And that appears to be a growing consensus among American scientists.⁴

The term "post-truth" has now emerged to describe the new reality within which we are expected to carry on as scientists.

The "post-truth" universe is one in which the normally-accepted standards of evidence are arbitrarily dismissed. Expert testimony, facts, history, and data have no standing in the post-truth universe — personal opinion and whim are just as credible. As is pointed out increasingly: *"The late US senator Daniel Patrick Moynihan used to say: "You're entitled to your own opinion, but you're not entitled to your own facts." But that distinction seems to have broken down. Now people regard facts as very much like opinions: you can discard the ones you don't like."*⁵

What is increasingly at stake is how we individually deal with facts, and how they are accepted as touchstones in public discourse in an environment dominated by overriding commercial interests. In BC, this is nothing new. How deeply this problem is ingrained can be illustrated by a little-publicized recent research scandal at the cancer research unit of the University of British Columbia. In 2014, researchers discovered that results of a senior researcher's experiments were irreproducible. In an unreleased report, UBC discovered: *"...29 instances of scholarly misconduct, 16 of them "serious," including falsification and fabrication of data.... Investigators found that the tainted work had been included in six journals between 2005 and 2012 and had drawn financial support from more than a dozen government and private funders."*⁶

UBC, which like most universities today is dominated by the overriding presence of a "Business School," and governors largely drawn from "business," dealt with this by invoking privacy regulations, suppressing public knowledge of this report, and letting the responsible parties voluntarily terminate their direct employment at UBC, as they "transitioned into business." None of the bogus publications were withdrawn, thereby allowing unreliable information to continue to circulate as valid peer-reviewed research, and the guilty parties to continue to solicit funding on the basis of their publication record. In fact, one of the parties is currently the CEO of a successful private research firm, heavily funded by donors nominally blissfully unaware of the unreliability of the research funded and successfully marketed. In other words, fraudulent data are successfully meeting market demands, and, therefore, are a form of "truth."

The fictitious reality of commercial and marketing interests appears to override any standards of obligations to facts and accountability. Lest we think that UBC is the only institution tainted by this example of professional misconduct, a professional assessment indicates that the problem is endemic throughout Canadian institutions: *"Current practices in Canada are "nothing but a cover-up with the excuse of privacy laid on top of it," argues Amit Attan, a law professor and biologist at the University of Ottawa."*⁷ This is not just a casual casting into doubt of the validity of science, such as we saw throughout the Bush presidency. This is the practical endorsement of science and facts as an arbitrary conduit for market commodities. It is the legitimization of the fabrication of data for marketing purposes as equal to "reality," or reduced to the fiction known as "market reality."

There is a growing dissonance between the observed reality of facts and governments', industry's, and even NGO's accounts of that reality. The only method we know to account for that reality is the scientific method, which is rapidly being marginalized by political interests. When facts themselves, and the rigorous pursuit of facts, no longer matter to governments, science is in trouble, and ultimately the public is not well served by the discredit of science.

Facts and reality have been the most endangered species in BC for many years. The most frequent buzz-words in BC are "leadership," "world-class," "pristine," and of course, our not very scientific tourism mantra "super-natural." It is still a little bit disconcerting when the political and commercial hype are found to be at odds with the empirical reality of numbers. As a recent report revealed, BC's environmental leadership amounts to the most super natural urges of mankind floating increasingly into the pristine waters of our world-class fisheries:

*"In B.C., the province that dumps the most untreated waste water into rivers and oceans, the amount rose to 82.3 billion litres in 2015, a 32.7 per cent increase from 2013. From November to December 2015 alone, an estimated 24.8 billion litres of raw sewage were flushed into the Juan de Fuca Strait near Victoria, which recently voted to build a sewage treatment plant."*⁸

While there is really nothing new to the exponential growth of oil, microplastic, and fecal pollution in Canadian waters, and waters around the world, the nature of the emerging dissonance between claims of environmental stewardship and the observed testable reality is itself developing novel considerations that have to be of concern to environmental scientists.

The problems that biologists wrestle with are first and foremost problems of scale. As is often pointed out, what happens locally is either a product of, or a reverberation of, a globally-generated disturbance. We all know that while anthropogenically-generated environmental impacts, such as logging of old growth, a mining disaster, or an oil spill are observed locally, they originate somewhere in a boardroom conversation or on an Excel® sheet projected on a computer screen. The emerging novelty is that a local anthropogenic disturbance is a product of a completely unshared and arbitrary reality, an alternate economic truth, that would resist measurement or impact analysis, or be impervious to any factual analysis.

In this "post-truth" context, although anthropogenic environmental impacts begin with human communication, the communication itself is considered to be entirely arbitrary. Such communications claim not to share the same constructs of reality as the rest of humankind. An unshared reality would by definition not be testable or empirically-based, making science and facts completely irrelevant. It is a magical world without consequences, in which every man or woman is an island. This is a relatively novel condition that scientists until now have rarely needed to stop to consider in the decisions we make. Until now, we have by and large operated on the assumption that we shared in a common testable reality towards which we owe some ethical responsibility. This old time-tested assumption is currently undergoing tectonic shifts, with huge implications for scientific environmental work.

The central assumption of science is that scientists deal with facts inherent in rigorous data, which is collectively an accurate description of the reality about us. Key to that central assumption has been the belief that all human beings share in a common experience that forms the framework of reality. The central assumption is that we share in the facts, otherwise facts are just personal fictions. Truthfulness is essential to science in ways that it is not to other endeavours such as commerce or politics. However, until now, even commerce and politics were assumed to be anchored in a common sense of values and reality. Science is the business of checking facts. Politics and commerce now overtly reject facts that stand in the way of their interests, and remain unchallenged. If we are to trust recent reports, in a world that is increasingly licensing or marketing an explicit disregard for facts, science may be becoming irrelevant, and particularly so if it is subservient to political ends.

Over the last couple of decades, a counter-current has emerged that has until now unsuccessfully challenged some of the basic premises of science, such as evolution. The years of the Bush presidency (2001-2009) were dominated by the creationist debate, which claimed to present an account factually equivalent to Darwin's account of evolution.⁹ Throughout those years, there was an emerging sense in some quarters that facts and reality could be manipulated at will, around a common shared reality. It is important for scientists to understand that our concept of a shared reality is no longer universally accepted. The Bush presidency operated from a nihilist perspective that rejected empirical reality and replaced it with arbitrary constructs that suited the actors. In 2002, a presidential aide explained to a reporter:

*".....that guys like me were "in what we call the reality-based community," which he defined as people who "believe that solutions emerge from your judicious study of discernible reality." I nodded and murmured something about enlightenment principles and empiricism. He cut me off. "That's not the way the world really works anymore," he continued. "We're an empire now, and when we act, we create our own reality. And while you're studying that reality — judiciously, as you will — we'll act again, creating other new realities, which you can study too, and that's how things will sort out. We're history's actors . . . and you, all of you, will be left to just study what we do."*¹⁰

Possibly not insignificantly, this current emerged at about the same time that science has been harnessed to work closely with politics and commerce to an unprecedented degree as the world about us became increasingly technological, and science was professionalized and harnessed to work in concert with industry. That was an acceptable marriage only as long as commerce and science shared in a common empirical reality.

Science is, by definition, empirical. What is not based on objective data is not science. Scientists are now being asked to do science in a society that is increasingly rejecting empirical facts and reality. As the UBC scandal indicates, an acceptable sense of arbitrariness is also corrupting the primary research environment. Increasingly factual testable science information has to compete with web-based science dis-information. The rise of "populist" politicians poses a singular renewed challenge for science, and the work and credibility of scientists, because science is "a reality-based

community,” and populist politics reject the “facts” that anchor this community relationship to the environment.

The emerging new social order does not feel encumbered by concepts of truthfulness or facts, or shared reality. As pointed out by the editorial board of the *New York Times*, we are entering an unprecedented period of crisis: “*The institutions that once generated and reaffirmed that shared reality — including the church, the government, the news media, the universities and labour unions — are in various stages of turmoil or even collapse.*” The incoming leader of the free world is, “*...not just indifferent to facts; he can be hostile to any effort to assert them.*”¹¹

This situation has prompted 800 top scientists in the United States to direct a short six-point letter to the President-elect to, literally, reconnect with the reality that the world is experiencing.¹² The letter is a clear factual statement of the threats that climate change poses to the economy, national security, and public health and safety, and the need to shift the economy as quickly as possible away from fossil fuels. In what will probably become a characteristic response, the President-elect has ordered that a list of civil servants involved in climate change planning and research be drawn up, in what appears to be a planned McCarthyist witch-hunt.¹³ Even fundamentally conservative organizations, such as the American Association for the Advancement of Science and the American Geophysical Union, have voiced their deep concern for the future of North-American scientific leadership.¹⁴

It would be erroneous to think that this problem, which has been emerging for the last two decades, is limited to the United States, or that Canada will be somehow immune to the problems our American colleagues are facing. There is a growing pervasive global unwillingness to deal with objective data and the resulting facts if these collide with economic objectives or aspirations. In this, Canada is no exception. This is, in point of fact, a large part of the British Columbian concern with Prime Minister Justin Trudeau’s recent pipeline decisions and announcements to fund emergency response on the West Coast at the cost of \$1.5B, partially reverse a 40 year-old tanker ban, and authorize the expansion of the Kinder Morgan and Enbridge pipelines.¹⁵ To analysts, it seems that to accept these decisions is also to tacitly accept the logic of climate change denial.

Most environmental concerns have their origin in the gap between so-called “market realities” that sustain an unsustainable economic system that believes in “endless growth”, and environmental realities that limit the resilience of ecosystems. This was correctly pointed out back in 1972 with the publication of *Limits to Growth*. As the impacts of climate change and industrial growth continue to become increasingly obvious to the generations that are experiencing them – and will continue to experience them in ever-increasing magnitude – this message is becoming increasingly clear to a growing number of British Columbians. This is particularly true in the Lower Mainland where problems of population density, air and water quality, and sustainability are areas of growing concern, that are compelling municipal governments to initiate “deep decarbonization” shifts.

British Columbians have long expressed concerns with the sustainability of our fossil fuel economy and its impacts on our natural environment. Land and water pollution is a concern in BC’s collective psyche that runs from Hamilton Mack Laing’s

first article about this in 1927 through the later writings of Roderick Haig Brown, and their successors. These deep-rooted concerns are consistent with a timeline of legislative opposition to oil and gas impacts that runs from 1959 onwards, as illustrated in **Figure 1**. While BC has continued to develop its economy, like the rest of the planet, largely by developing hydro-electric power and relying on fossil fuels, a growing concern for the long-term implications of climate change had enabled BC to initiate the beginnings of a shift away from reliance on oil and gas and towards deep decarbonisation under the Gordon Campbell government between 2007 and 2012. Unfortunately, this work has largely been undone and undermined by the contradictory policies of the Christy Clark government since 2012.¹⁶

The Christy Clark government was able to move away from its environmental obligations to climate change largely because the Campbell government had downloaded many of its environmental responsibilities onto municipal governments. Thus, while the Christy Clark government has not followed in the progressive steps of Gordon Campbell’s Minister of the Environment, Joyce Murray, most large municipal governments have felt compelled to further pursue sustainability policy options that can only lead to a shift to deep decarbonization. Hence, the concern of Lower Mainland municipal politicians, who reflect their constituents’ passion for a carbon-free future and have made it clear that they feel strongly enough about this issue to vow to join protests and be arrested.¹⁷

Contrary to frequently repeated claims of climate leadership, the Christy Clark government has been a post-truth trend-setter, and total laggard. In 2014 when this government repealed the Cap and Trade Act (2006), contrary to what the data showed to scientists, the Minister of Environment, Mary Polak, maintained that her government still expected to meet its GHG reduction targets by 2020 even with intense LNG development. “*The one won’t have an impact on the other,*” she said. “*We in British Columbia are going to measure the actual amount of emissions and whether or not we have met our targets. The fact that the benchmark for LNG is measured in intensity, the two don’t conflict with each other.*”¹⁸ Contrary to this statement, reality does conflict with economic priorities, and BC has become a major polluter in Canada.

Only months later, the extremely lightweight report of the “Climate Change Leadership Team” went on to confirm that BC was not in position to meet its 2020 targets, and was unlikely to meet them until 2030 unless it took stringent steps.¹⁹ As if this report did not set not sufficiently low expectations, the report was not sent to specialists for comment, but to the general public, under the chairmanship of a known climate change denier, Fazil Mihlar, former director of the right-wing Fraser Institute.²⁰ Therefore, Premier Christy Clark’s political performance at the Federal government’s round table was correctly interpreted by *Globe and Mail* reporters as cynical grand-standing.²¹ When the data are analysed, by experts at either the Pembina Institute or Navius Research at SFU, BC’s carbon footprint is expected not to decrease, but to increase by 39% by 2030 and exceed all 2050 targets. Therefore, this government’s claims, which Prime Minister Justin Trudeau has all too willingly endorsed and set as an example for Canada, fit the post-truth mould of our southern neighbours. BC’s precedents and the extreme willingness of the

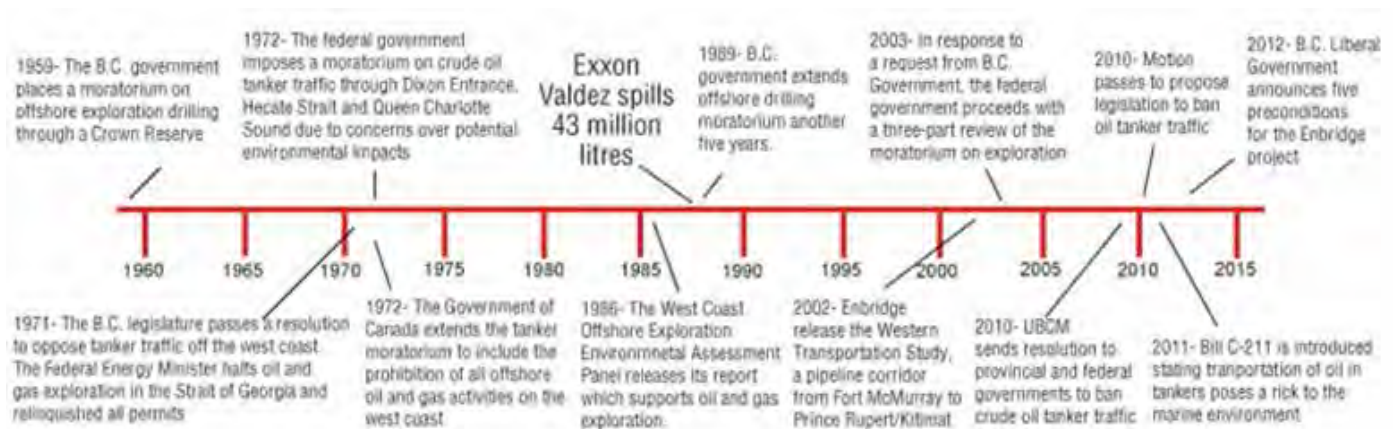


Figure 1: Timeline of legislative opposition to oil and gas development and tanker traffic in BC

Prime Minister to endorse them can only cast doubt on the veracity of his own climate change action plans.

There is no doubt that renewed oil development will stimulate Canada's stagnant economy, because over the past two to three decades, the current economy has been built around Alberta's booming oil revenues. That aspect of the economic argument is not in any doubt. However, the climate impact of continued gas and oil development in the oil sands is also not in doubt. The honest questions should be to what extent do we wish to continue contributing to climate change, and when do we propose to make a shift to a carbon-free economy? These are the real questions that few politicians either understand and accept, or are willing to answer honestly.

The claim that the development of oil pipelines is compatible with a transition towards a carbon neutral economy is itself tautological. If this were true, Canada would have transitioned rapidly 20 years ago after signing the Kyoto Protocol (1997). Taxing carbon and phasing out coal, which is already an increasingly unpopular fuel, are just baby-steps aiming at soft targets. The scientific consensus is that building oil pipelines will continue to commit us to the long-term (50 years) maintenance of a fossil fuel driven economy — and the results should be expected to be a fourfold increase in carbon outputs by 2050. This simply contravenes the commitments and public grand-standing made in Paris.

There are two basic and intricately-related topics that surround BC's concerns with Justin Trudeau's approval of the Kinder Morgan pipeline. The first is the contribution of Canada's heavy oil production to global climate change and to Canada's ability to meet climate change obligations under COP21, The Paris Agreement. That has been tacitly answered above.

The second is the environmental risk that both overland transportation and tanker traffic pose. On that score, it is customary for scientists to turn to data available from reference sites. Although it is out of sight and out of mind, since official monitoring funding ceased in 2000, 27 years after the 1989 *Exxon Valdez*, the promised restoration is far from a full recovery, even if it is the best we can hope for. While the site has visually returned to aesthetic normality, any sense that the 1800 km of shoreline has fully recovered to pre-1989 conditions is illusory. Neither the ecosystem nor the fisheries it formerly sustained have really

recovered. Economic and ecological impacts continue to this day. In practical terms, if we want to consider only human costs, that means that an entire generation of human beings have been adversely affected. The conservative assessment of the NOAA, whose funding for long-term monitoring ceased in 2000, is worth quoting, even if it is not "elevated" contamination that continues to pervade the food chain to this day:

"Chemical contamination by polycyclic aromatic hydrocarbons (potentially toxic chemical components of oil) in tissues of mussels and clams were significantly elevated over background levels through 1992 for mussels and 1996 for clams. When we re-surveyed clams in 2007, we did not find any elevated tissue concentrations at our monitoring sites.

Environmental exposure, sediment size, and initial oil concentrations all affected oil weathering processes and rates. By 1997, residual oil found in patches in sediments at a few of our sites ranged from moderately to extremely weathered, with oil from deep subsurface reservoirs under gravel beaches the least weathered. Other researchers have located surprising pockets of oil remaining on some beaches, and these are being studied to determine why they have persisted for over two decades....

However, there is still residual oil to be found. The remaining oil generally lies below the surface of the beaches in those places that are very sheltered from the actions of wind and wave (which help to break down and remove stranded oil), and those beaches where oil initially penetrated very deeply and was not removed. The fact that oil remains at all, over two decades after the initial spill, is of interest and is the subject of current studies funded by the Exxon Valdez Oil Spill Trustee Council."²²

After nearly three decades, the *Exxon Valdez* experience is a tragedy from which neither the ecosystem, nor the economy, of Prince William Sound have ever fully recovered. British Columbians should continue to learn from this and guide decisions made concerning the coastal ecosystems on which our economy is founded. How many *Exxon Valdez* could or should British Columbians be expected to sustain?

Anybody familiar with Ian McAllister's work at *Pacific Wild* quickly understands that BC's coastline, however highly productive and biologically diverse, is a fragile environment, which has sustained First Nations fisheries for over 15,000 years. As the *Exxon Valdez* data show, the risk of an oil spill on BC's Coast is not a one or two year disruption, but a long-term generational or multi-generational threat to ecosystems, cultures, and economies.

After many claims in BC of having "world class" emergency response capabilities, the sinking of the tug *Nathan B. Stewart* illustrated the post-truth reality of the provincial government's numerous claims. The *Nathan B. Stewart* sank October 13, 2016, spilling 100,000 litres of diesel. Due to poor communication, it took the response crew 20 hours to arrive on scene and actual intervention never started for another 16 hours. Removal of the wreck took another two weeks. Skimmers that were deployed to contain the diesel were ineffective, collecting at most no more than 15% of the surface fuel. The entire shellfish fishery on which the local economy depends was closed due to contamination. It is unclear when it will re-open. Ironically, the timely sinking of the *Nathan B. Stewart* should have made the following point amply clear: in the event of an oil spill, no amount of money to fund "emergency preparedness" will be sufficient either to contain surface oil in stormy seas, or to clean up and restore the sensitive and productive habitats of BC's coast. Justin Trudeau's November announcement of \$1.5 billion to "create a marine safety system, restoring marine ecosystems and research into oil spill cleanup methods,"²³ is cold comfort. It was correctly interpreted by many as a set-up for the foregone conclusion that the Kinder-Morgan pipeline was already approved, contrary to electoral promises and representations.

Once again, the logic of claiming to "protect the coast" by ultimately endangering it, by creating conditions that will reverse the 1972 tanker traffic ban, simply failed to convince many British Columbians. It is as convincing as the claim that building oil and gas pipelines will help us transition away from fossil fuels and help us meet COP21 commitments. As David Suzuki put it "none of this makes sense."²⁴

Certainly, none of this makes sense to anybody who has looked at the data and understands that climate change is very real, and that after 50 years of "mucking", we need to get very realistic as the data — which are about to be erased by President-elect Trump's appointments to the EPA and NOAA — currently tell us. Simply put, it may not make sense to David Suzuki, and other environmental scientists, who persist in relying on the archaic and tested methods of fact-finding and data analysis in this dawning of the complex age of "post-truth," where Harry Potter wizardry and alchemy are put on equal footing with science by some economists and business leaders who do not believe that climate change is a real and imminent threat to both civilization and natural ecosystems.

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ALBERTA News

By Brian Free, CSEB Member

The urgency around pipelines seems to have waned a bit as decisions are made: federal approval of the Trans-Mountain and the Enbridge Line 3 pipelines and rejection of the Northern Gateway proposal. As we move into 2017, climate change is perhaps the highest profile environmental issue in Alberta, largely because the Alberta government is taking action that has direct economic implications. For example, starting January 1, a carbon levy will be included in the price of all fuels that create greenhouse gases when burned: \$20/tonne in 2017 rising to \$30/tonne in 2018. Also part of the Climate Leadership Plan are a limit on the allowable emissions from oil sands operations and a schedule for the phase-out of coal-fired electricity.

The carbon levy will apply to transportation and heating fuels such as diesel, gasoline, natural gas, and propane. Certain fuels, such as marked gas and diesel used on farms, will be exempt from the levy.

All of the revenue generated from the levy will be reinvested to fund the following:

- efforts to reduce greenhouse gas emissions;
- development of renewable energy projects and green infrastructure;
- research and innovation; and
- rebates for low and middle class Albertans to offset cost increases.

This is a real test of the public's willingness to take serious action to address climate change. I, for one, applaud these bold steps, but like everyone else, I'll be watching the price of gas at the pump, the cost of groceries, and I'll be on the lookout for rebates towards a new energy-efficient furnace and hot water tank.

SASKATCHEWAN News

By Robert Stedwill, CSEB Past President & Sask. Chapter Chair

This past summer and fall have been anything but busy. With the downturn in the economy, the low price for oil and potash, it seems from my perspective that things have certainly quieted down since this time last year. There have been numerous layoffs at mines in both northern and southern Saskatchewan as well as the oil patch. Indications of the downturn can readily be seen in vacancy rates, which before the downturn sat at very low levels, in the tenths of a percentage point, versus what appears now in some communities at 26%.

Current happenings find that Husky Energy delivered its long-awaited technical report on the failure of one of its pipelines in proximity to the North Saskatchewan River, releasing many tens of thousands of litres of oil into the river, necessitating the shutting down of two major potable water systems.

"Ground movement, described as geotechnical activity, was the reason a section of Husky Energy pipeline ruptured," spewing

oil into the North Saskatchewan River. A previous assessment of the river bank at that point indicated that the soil was quite stable. The report noted that the leak took place about 160 m from the river, and that of the 225,000 litres of oil that was released, about 40% entered the river.

The spring no doubt will see additional work being done with respect to this discharge, continuing assessment of the impact on the river, and further development by the government with respect to assessing river crossings, both for future and existing pipelines.

The province continues to run counter to the national movement of downsizing and eliminating its coal burning facilities; however, it appears that some agreement has been reached with the federal government when the carbon dioxide capture technology is taken into account. Time will tell how successful this will be. It is likely that no new coal burning facilities will be built in the future, as an announcement has just been made with respect to a new gas fired generating station in the Swift Current area, which happens to be in or close to the premier's riding.

On another positive note, Saskatchewan Polytechnic has developed an "award winning climate change adaptation tool [which] brings big data to the local level." The project was funded by the coal burning facilities Office of Applied Research and Innovation and was shepherded through to completion by Natural Resources Technology instructor Ryan Galbraith at Saskatchewan Polytechnic and Dr. Nirmil Subedi, a Forest Economist from Natural Resources Canada. The goal was simple: help make large-scale environmental data more useful at the local level. The result is the Climate Change Adaption Tool, which provides farmers and local communities with the environmental data they need to make planting and development decisions.

"There's a disconnect between global climate change data and the local farmer," says Galbraith. "The data that is available is provincial or national, but there isn't much data for local communities. This tool makes big data more local, and can lead to effective environmental and economically sustainable solutions."

Galbraith says this tool can influence environmental stewardship and can prove to be useful in a number of contexts, including helping farmers plan better for changing climates. The two researchers won an Education for Sustainable Development Recognition Award from the Regional Centre of Expertise on Education for Sustainable Development (RCE).

Money from the Sustainable Initiative Fund (SIF) provided by the Office of Applied Research and Innovation, goes towards selected projects that contribute to finding practical and innovative solutions to sustainable development challenges. Other SIF projects include the following:

- Plant Phenology and archival records project at Wanuskewin Heritage park just outside of Saskatoon;
- Colonization potential of broken concrete versus natural cobble substrates by benthic macroinvertebrate communities;
- Assessment of Dragonfly [Odonata] Populations of Conservation Concern in the Saskatchewan River system; and
- Proving Aerial Survey Methods for Assessing Forest Regeneration.

MANITOBA News

Submitted by Gary Ash, CSEB Newsletter Editor

Lake Winnipegosis Islands Temporary Park Reserve Status Expired

A network of islands at the north end of Lake Winnipegosis could be vulnerable to mining and other developments now that the islands' temporary park reserve status has recently expired.

In 2001, the Manitoba government created the Goose Islands, Grand Island, and Pemmican Island park reserves, restricting logging, mining, oil, gas and hydroelectric development and any other activity that may significantly or adversely affect habitat on nine islands in the area. The Canadian Parks and Wilderness Society (CPAWS) wants the government to designate the islands into three provincial parks to protect important wildlife habitat or to at least renew the park reserve status for another five years. CPAWS is concerned that mining may affect the water of Lake Winnipegosis, which would affect the downstream Lake Winnipeg, thereby exacerbating the issues facing that lake.

Klyne Exploration holds the mining rights on and surrounding Pemmican Island, and recent exploration suggests that the company may be considering a mine for nickel and/or zinc ore deposits on the island and surrounding lake bed.

There are First Nations communities along the shores of Lake Winnipegosis near the islands, which also could be affected by any mine developments in the area.

For further information about the previous park reserve, see http://www.gov.mb.ca/sd/parks/pdf/public/goose_island_park_reserves.pdf

ONTARIO News

Submitted by Eloise Boileau, CSEB Ontario Member

Ontario Moving Forward To Protect Water Resource

Ontario is protecting groundwater sources in the province by moving forward with a two-year moratorium on new and expanded water takings by bottling companies. Effective on December 16, 2016, the moratorium bans new water bottling facilities from taking groundwater, and prohibits existing facilities from increasing their groundwater taking or testing for future groundwater sources. It will ensure groundwater resources are better conserved for future generations, and help to protect against future water insecurity due to climate change, population growth, increasing consumption and drought. Currently, water bottling facilities must apply for permits to take water from groundwater sources if the facility takes more than 50,000 litres of water in a day. The minister of the environment and climate change, Glen Murray: "Water is a vital resource – one that is essential to the health and integrity of our ecosystems and communities. We need to ensure water is protected for future generations, and this moratorium is an important step to ensure its sustainability."

Source: Ontario Ministry of the Environment and Climate Change

ATLANTIC News

Submitted by Pat Stewart, CSEB Atlantic Director

Research Associated with Tidal Energy Development Good News for Biologists

Early in November, the first tidal electrical turbine connected to the power grid was deployed in Minas Passage, Nova Scotia, a narrow strait with the world's highest tidal currents, and which connects the outer Bay of Fundy with the inland sea, Minas Basin.

The 2-megawatt turbine sits on the seabed at a depth of about 30 m and relatively silently generates enough power to service 500 homes, 24 hours a day.

While many Nova Scotians are celebrating installation of the turbine and delivery of electricity to the power grid—a truly amazing technical feat—biologists have been riding on a crest of exciting advances in knowledge and understanding of the area's marine biology, in a large part connected with the area's tidal development activities.

Some of the new insights have come from the application of advanced, high-tech acoustic technologies, for tagging and tracking fish and for listening to and detecting marine mammals, in particular the harbour porpoise, which occur in the area and which are one of the important species for which avoidance of impacts of tidal energy devices is a major concern.

Biology concerns have been addressed throughout the project—known as the Fundy Ocean Research Centre for Energy, or FORCE—through the operation of an environmental effects monitoring program, which includes the following:

- baseline and operational background noise measurements;
- marine mammal monitoring by passive underwater acoustic techniques;
- visual surveys for seabirds and waterfowl; acoustic surveys for fish; and
- monitoring of lobster catch in the vicinity of the turbine and in control areas.

A bonus for the chosen site is that the project is located in a narrow strait (Minas Passage) in which underwater acoustic receivers and transponders were beginning to be deployed at the time as the tidal project was being developed, in concurrent studies to use acoustic tagging technology to detect and log acoustic tags on fish, and determine their movements.

Tracking marine fish is a big deal on the east coast, in particular with the international Ocean Tracking Network (OTN) now based at Dalhousie University in Halifax. Acoustic tagging has been increasingly used by government and university researchers to reveal fish movements and other secrets of the ocean's marine life.

The two acoustic monitoring techniques have provided some amazing insights into the biology of the waters in which the turbine has been placed. Passive Acoustic Monitoring (PAM) for marine mammals—using hydrophones that detect and analyze sounds of whales and other cetaceans to determine their presence

and abundance—has provided an annual picture of movements of harbour porpoise, *Phocoena phocoena*, the main cetacean occupying the waters in Minas Passage.

A small population of Harbour Porpoise are found in the inner Bay of Fundy, where they move through Minas Passage following schools of fish, and at times occupying much wider areas of the nearby productive marine bay, Minas Basin. Little is known about their behaviour, population size, movements, etc. Hydrophones on the PAM systems, known as C-Pods, detect the clicks—high frequency bursts of sound—the porpoises use to locate fish and communicate.

The devices are anchored or placed on the bottom in an array near the turbine deployment site. Biologists working on the project have determined annual patterns of abundance, diurnal timing, and movements relative to the tidal cycle, based on the long digital datasets obtained from the acoustic devices. Moored hydrophones in other locations have provided evidence for the presence of harbour porpoise in the absence of visual sightings, and have shown the species can occur widely in the bay.



Figure 1. Tidal turbine sits in a barge in preparation for deployment, November 7, 2016, in Minas Passage, Nova Scotia.

The array of acoustic transponders in Minas Passage at the site has also given remarkable insight into movements of migratory species including Striped Bass, which is endangered because it is the last healthy population out of three, in the Inner Bay of Fundy. Acoustic tags on the fish were detected in the vicinity of the tidal site, and in addition, for the first time showed that Striped Bass can occupy the area in winter.

Acoustic tags have also been useful in tracking movements of Atlantic Sturgeon, which migrate from other parts of the northeast Atlantic coast to Minas Basin to feed in summer in the productive and relatively warm waters there. The tagging showed the sturgeon typically use a different part of the Minas Passage than is occupied by the turbine, in their movements into Minas Basin.

While some of the research into fish migration biology was ongoing, the overall effort has been enhanced by the interest in tidal energy development, and the additional associated research funding that has become available. Although there are research outcomes on all fronts, some of the most interesting are in biological fields. I guess sometimes it takes an industrial initiative, to ‘power up’ research into the biological world.

You can view short videos of the deployment of the turbine at <http://fundyforce.ca/power-on-cstv-generates-first-in-stream-tidal-energy-at-force/>

Do Marine Protected Areas Work - Lessons Learned?

Letter to the Editor, published in the Halifax Chronicle Herald Oct.15, 2016

by Peter Wells, CSEB Atlantic Member

Canadian marine ecosystems require more protection and conservation efforts, from governments, the resource sector, i.e., fishing industry, the environmental NGOs, and the interested public. Jim Meek’s recent thoughtful article (TCH, Sat. Sept. 24th, F2) points to some of the shortcomings of the policy in the federal Fisheries and Oceans (DFO) department of establishing MPAs (marine protected areas) under the *Oceans Act*. Setting aside such areas for marine conservation, small or large, is an admirable goal. Unfortunately, it does not guarantee successful protection of sensitive habitats or endangered species. The first lesson – MPAs are simply one tool in the conservation tool box. Despite some successes (e.g., Musquash Estuary, Bay of Fundy), they are unproven in many places and countries, and frequently of great concern to local coastal fishermen striving for a livelihood.

What is remarkable in the various discussions about MPAs, Meek’s being no exception, is the lack of comparison to similar efforts on land, also aiming to protect unique and often threatened terrestrial habitats, species and ecosystems. Witness the successes and failures over the past 100 years of the national parks (NP) system in Canada, which represent some of our best protected terrestrial areas. The parks system is much heralded globally for its breadth, visibility, goals, and uses for recreation and tourism. But it is often over-rated as to the success of its long-term goal – safeguarding the ecological integrity and health and the wildlife of these special places. The evidence often shows worrisome shortcomings. For example, in Nova Scotia, Kejimikujik NP is not protected from side by side forest clear cutting and new roads, pointing to the great need for buffer zones, a big issue with MPAs. In New Brunswick, Fundy NP remains a green oasis in a landscape of massive, relentless and totally destructive clear cutting, again pointing to the need for buffer zones. In western Canada, Jasper and Banff NPs are rarely patrolled along their extensive boundaries, hence iconic larger species such as bighorn sheep and grizzlies that roam large distances and have no respect for park boundaries, are not protected from nearby big game hunters.

Thus, a second lesson learned - a mere park or area designation does not guarantee protection, but on land, the major pros and cons of designation are visible. Size matters to both habitats and species and larger areas may be more resilient. In recent news - the future is much brighter now for the enormous, unique Great Bear Rainforest on BC’s coast, officially recognized this week during the visit of a famed royal couple!

For the oceans, MPAs generally suffer the same limitations as land parks. However, being on or under water, their habitats and species are much less visible, are harder to monitor and measure, and are often seldom visited by the interested public. MPAs, as Meek points out, give the impression of protection and conservation, and people feel good about such efforts and initiatives. But to date, there is too little proof of their positive effects, besides upholding a commitment to the United Nations

Convention on Biological Diversity. MPAs may work for selected bottom-dwelling habitats and species, such as corals and sea grasses, but not for water-dwelling species such as whales and sea turtles. Hence, one hopes for the best for the newly announced, undersea canyons MPA off the SW coast of Nova Scotia, an area of remarkable, cold water hard corals. However, great concern remains for largely unprotected areas of the outer Bay of Fundy and Gulf of Maine frequented by endangered migratory whales.

Hence, the third lesson – to prove their effectiveness, what is needed for each new and established MPA is dedicated “at sea” activity of ecological science, surveillance, monitoring and enforcement. The DFO is deeply committed to the promise and goals of the *Oceans Act* and deserves much credit for its overall efforts and latest success in the Nova Scotia offshore. Having renewed funding for science and monitoring, the department should pursue such “at sea” activity with all energy and haste. This would reinforce the value, albeit with limitations, of the MPA approach in the public and political mind. It would also allay the concerns of the Maritime fishing industry while priority areas for other regional MPAs are being considered.

Peter Wells

Dalhousie University, Halifax, NS.

The Royal Canadian Geographical Society

Dr. Peter Wells, Atlantic CSEB member was recently inducted into the College of Fellows of the RCGS. Peter notes that the RCGS is a very good organization to be allied with, as it stresses the importance of geographical knowledge, has some very good educational programs, sponsors expeditions, etc. It goes without saying that geography and geographical knowledge are one of the underpinnings of environmental biology.

CONGRATULATIONS Peter, an honour well deserved!!!

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TERRITORIES News

Submitted by Anne Wilson, CSEB Territories Director

NWT and NU Regional Update:

Greetings to all, as I look out on a cool winter's day with a stiff wind blowing snow sideways. My winter philosophy will have to be brought into action – ignore it and it will eventually go away! Seriously, I am happy to see some snow, and hopeful to recuperate from recent shoulder surgery in time to do some cross country skiing, skijoring, and snowshoeing in the area.

As I have been away from work, this contribution to the newsletter will not include the usual updates (back next issue!) but will focus on two recent events that I felt worth mentioning. These are the Canadian Ecotoxicity Workshop (CEW) held in Edmonton in late September, and the Northern Territories Water and Wastewater Association (NTWWA) conference held in Yellowknife in November. Both were very well received, and provided relevant information and networking opportunities. Ken Johnson, one of the presenters at the NTWWA conference, provides the synopsis at the end of this submission. I have attended past NTWWA conferences and found them a great source of information on the state of wastewater treatment research in the North (and I got a really nice ball cap!).

This year I did attend the CEW in Edmonton, which brought together scientists from a wide range of disciplines, and included work that was specific to the North. I would like to give credit to the resource sector in the NWT, who shared information and sent presenters even in this time of constraints. The topics of greatest interest to me included the Mining and Environment session, the General Toxicological Effects of Contaminants in Aquatic Species, Assessing Natural Variability, and the Advances in Water Quality Guidelines and Benchmarks. If you detect my water bias, you are not mistaken – but there were also sessions of interest to terrestrial biologists, air quality scientists, and microbiologists to name a few. There were some interesting supporting topics pertaining to community driven research in the North, and effective communication of science – a varied and well-presented agenda! The plenary speakers were excellent, and I would like to provide the abstract for the opening speaker, who has worked extensively in the North. Given the ongoing research and monitoring work in the NWT and Nunavut, I wanted to highlight this venue as good value for leading edge information as well as great networking opportunities. The next Canadian Ecotoxicity Workshop is in Guelph October 1-4, 2017. Details can be found at <https://ecotoxcan.ca>.

Planning for Uncertainty Using the Past: Paleo-ecotoxicological Perspectives on Aquatic Ecosystems

John P. Smol¹ and Jules Blais²

¹Queen's University ²University of Ottawa

One of the greatest challenges faced by ecologists, water quality managers, and other environmental scientists is using appropriate time scales to assess environmental change.

Due to the lack of systematic long-term monitoring data, it is often difficult to determine the nature and timing of ecosystem changes. This presentation summarizes recent developments in assessing the effects of multiple stressors from primarily resource development on lake ecosystems using sediments as archives. Here, we focus on integrating the principles of ecotoxicology with lake sediment analyses in our work to develop the field of “paleo-ecotoxicology”. We argue that this framework is useful to test predictions from laboratory bioassays in natural ecosystems, to disentangle the effects of multiple interacting stressors, as well as to assess the importance of direct and indirect effects for mediating biotic responses to contaminant exposure. Specific examples include ongoing work assessing the long-term limnological impacts of gold mining in the Yellowknife region to the effects of industrial oil sands activities in northern Alberta. The problems of contaminant transport and the over-riding effects of recent climatic change will be highlighted, including the challenges faced when dealing with multiple stressors.

Northern Territories Water and Waste Association (NTWWA) 2016

Submitted by Ken Johnson, M.A.Sc., RPP, P.Eng.

Engineer and Planner, Cryofront

cryofront@shaw.ca

The annual conference of the Northern Territories Water and Waste Association was held on November 19 and 20 in Yellowknife. A varied technical program was presented to the 105 attendees by scientists, engineers, operators and regulators. The program included several presentations on guidelines associated with northern water and sanitation, in particular the guidelines on solid waste that are being developed by Environment and Climate Change Canada, and the update to the Good Engineering Practices for municipal infrastructure from the Department of Municipal and Community Affairs, of the Government of the NWT. There were a number of special guests at the conference including a contingent representing the community of Nuuk, Greenland and a contingent representing the National Research Council (NRC) of Canada. The NRC representatives have attended the conference twice before, as part of the rollout of the Government of Canada's “Arctic Program”, and they provided several interesting presentations to update the NRC northern wastewater infrastructure research work that is underway. Of particular interest is the pilot testing underway on an electrically assisted anaerobic wastewater treatment technology, which is affectionately referred to by the acronym “BEAST”. The two Greenlanders were visiting the Canadian north for their first time, and were a very welcome addition to the program with presentations on solid waste management in Greenland and sanitation strategies for small Greenlandic communities. The link to Greenland was established in April of 2016 by the attendance of NRC staff at a wastewater conference hosted by the Danish Technology University in Sisimiut, Greenland, which is a community of 6,000 people just north of Nuuk. Some strong water connections have been established between northern Canada and Greenland, which will provide an opportunity for an exchange of ideas in the future. The conference presentations also included a day in the life of an Iqaluit water system operator, solid waste

management in Fort Providence, NWT, and the initiative to chart a new course for wastewater management in Nunavut. Of course the conference was not all work for the attendees, and the opening reception included the famous “pipe challenge”, where teams are given a hockey bag full of plastic pipes, and a crude schematic drawing to reference in assembling the pipes. The teams this year were the engineers and regulators versus the operators; the engineers and regulators did not fare well in the competition, however the team enjoyed the competition (see photo below). Following the 2 day conference was the annual operator workshop; the workshop provides a departure from the technical framework of the conference to present information of practical value to the community water and sanitation system operators attending the conference. The 2017 NTWWA conference will be held in Iqaluit in November, and information on this conference will be available during the summer at the NTWWA web page (www.ntwwa.com). More information on northern water and sanitation may be gleaned from the association’s annual magazine publication, which is available for downloading at the NTWWA website.



2016 NTWWA Pipe Challenge – Engineers and Regulators Team

Closing:

If you are connected to activities in the Yukon, NT or NU, there is a vacancy for a Director, and I would love to welcome someone on board. If you are doing work north of 60 that you would like to highlight in the newsletter, or running some seminars or other training opportunities, please let us know. The CSEB provides a valuable networking and communication forum, and a voice for biologists if there are any issues to be raised. There is also the option of instigating other CSEB activities – both of the fun and/or of the educational variety – with colleagues in the North. Please email your thoughts to anne.wilson2@canada.ca.

Persistent Warming Trend And Loss of Sea Ice Are Triggering Extensive Arctic Changes

Observations in 2016 showed a continuation of long-term Arctic warming trends, which reveals the interdependency of physical and biological Arctic systems, contributing to a growing recognition that the Arctic is an integral part of the globe, and increasing the need for comprehensive communication of Arctic

change to diverse user audiences. Below are some highlights from the NOAA Arctic Program 2016 Report Card. Issued annually since 2006, the Arctic Report Card is a timely and peer-reviewed source for clear, reliable and concise environmental information on the current state of different components of the Arctic environmental system relative to historical records.

The Report Card is intended for a wide audience, including scientists, teachers, students, decision-makers and the general public interested in the Arctic environment and science.

Some of the highlights are as follows:

- The average surface air temperature for the year ending September 2016 is by far the highest since 1900, and new monthly record highs were recorded for January, February, October and November 2016.
 - Sea surface temperatures (SSTs) in August 2016 were up to +5° C warmer than the 1982-2010 August mean in regions of the Barents and Chukchi seas, and off the east and west coasts of Greenland.
 - In the Arctic Basin, spatial patterns of August 2016 SST anomalies relative to the 1982-2010 August mean are linked to regional variability in sea-ice retreat, regional air temperature, and advection of waters from the Pacific and Atlantic oceans.
 - The Chukchi Sea and eastern Baffin Bay show significant ocean surface warming trends; linear trends over 1982-2016 indicate August SSTs are increasing at ~0.5° C/decade in these regions.
- After only modest changes from 2013-2015, minimum sea ice extent at the end of summer 2016 tied with 2007 for the second lowest in the satellite record, which started in 1979.
- Spring snow cover extent in the North American Arctic was the lowest in the satellite record, which started in 1967.
- In 37 years of Greenland ice sheet observations, only one year had earlier onset of spring melting than 2016.
- The Arctic Ocean is especially prone to ocean acidification, due to water temperatures that are colder than those further south. The short Arctic food chain leaves Arctic marine ecosystems vulnerable to ocean acidification events.
- Thawing permafrost releases carbon into the atmosphere, whereas greening tundra absorbs atmospheric carbon. Overall, tundra is presently releasing net carbon into the atmosphere.
- Small Arctic mammals, such as shrews, and their parasites, serve as indicators for present and historical environmental variability. Newly acquired parasites indicate northward shifts of sub-Arctic species and increases in Arctic biodiversity.

For more information about the NOAA Arctic Program and the 2016 Report Card and the scientific reports that are the basis for the Report Card, go to the following website:

<http://arctic.noaa.gov/Report-Card/Report-Card-2016>

Pronghorn and the Special Areas of Alberta: Natural History Notes

by Dr. Bob Gainer, longtime CSEB Alberta Member (Gainer.bob@gmail.com)

My two avocations in my older adult life have been flying land pronghorns (*Antilocapra americana*). My two provocations had been as a mixed animal veterinary practitioner and a naturalist/biologist. They all came together about 50 years ago when I worked for Al Oeming on his Game Farm just east of Edmonton. After several summers, he had driven me down to the Hanna area to collect pronghorn fawns and had flown me all over the northwest and Arctic as a field assistant collecting other animals. Like several biologists with an enthusiasm for the outdoors, this man, who died in 2014 age 89, had a profound influence on us. This was where our careers started. He was hard to work for; he either inspired you or you conspired against him, invariably at your expense.

After several summers, I had become an avid pilot and naturalist. This was great when I was single but getting married and having three children, my veterinary practice mixed with biology assignments paid the bills. Fifteen years after I had started with Oeming, I was back in Hanna, headquarters of the Special Areas, but now I drove the countryside as a large animal practitioner, and on days off, soaring my own small aircraft over this vast, virtually uninhabited semi-desert, for almost 30 years.



Pronghorn - Source: *Alberta Environment and Parks website*

The Special Areas is more than five million acres that was opened to settlement in the 1910s, that shouldn't have been, and was almost completely abandoned in the 1920s, from its high of 30,000 people to 10,000 (including towns and villages) by 1930 and now. The Alberta Government received it from the Federal Government in 1930, when Lands and Minerals were bestowed upon the Provinces, in a form of municipal receivership for a bankrupt region. The Province's foremost problem was to deal with the destruction to the environment, especially soil erosion, caused by cultivation that should never have been encouraged. Further cultivation was forbidden on crown land and tax recovery land that had not been cultivated. Tax recovery land that had been cultivated became tame pasture and only deeded land with taxes paid, a small fraction of the total, could be used for mixed farming.

Today the "Areas" is over half native prairie, and of the other half, much is tame pasture. Pronghorn occupy three different biomes and many different habitat types, but always it is where there are no trees and nearby at least, water and native prairie. The "Areas" fits their bill in a big way, more so in the summer than the winter as it is as far north as they will winter, and not all winters. It does seem like it is a preferred area for them, here and to the east, where there is even more cultivation, more so

than the more southern areas of Alberta and Saskatchewan where there are even less trees and more native habitat. A mix of more cultivated to native prairie seems to be most attractive. To the immediate east in Saskatchewan's dry belt south of Kindersley and Rosetown to the South Saskatchewan River, there is much more cultivation of land and less native and tame pasture, but much more peas, beans, and pulses.

The literature on pronghorn emphasizes the importance of winter survival as a determinant of their numbers in this area (Barret and Vriend 1980). Since the construction of the Canadian Pacific Railroad and its page-wire fencing, and later the opening up of southern Alberta to settlement, pronghorn were virtually eradicated from Alberta by 1923. In 1906, there was a winter so severe that 95% of the cattle in the Province died, and they had the help of humans for food and shelter. Since then, both species have recovered considerably, but every time there is a severe winter, pronghorn numbers drop considerably. Since 1950, there were bad winters in 1954, 1958, 1964, and 1974. Since 1974, there were no bad winters until 2010 (and it was not as severe as the previous noted), and since then, the winters have had higher than normal snow accumulations and pronghorn numbers have not come back to what they were pre-2010.

Pronghorn are not particularly well adapted to survive winters — this is still the same subspecies that spends the winter on the Mexican border. Even during the coldest blizzards, they will not seek shelter, they desire open habitat so much, unlike cold-adapted ungulates like caribou, which seek trees or any form of shelter. Their neck, feet, and legs are not at all designed for shovelling or pawing or travelling in snow, but then this region of the country does not normally have much snow, and when it does, it is usually at least partially removed by the wind or chinooks. If it does accumulate, the animals travel the back roads and trails at night when there is no motorized traffic, looking for fields with exposed vegetation, sometimes for many miles. It is only when the winter has an overwhelming amount of snow and the chinooks don't come that they have serious trouble.

An animal's teeth can tell you about its dietary preference. Pronghorns are hypsodont, grazer-grinder style, and being small and more delicate than most grazers their grasses would have to be early growth, more tender stages or forbs, which is what pronghorn are usually described as eating. However, Yoakum (O'Gara and Yoakum 2004:501) goes on to say that pronghorn are "selective, opportunistic foragers, feeding on grasses, forbs and shrubs, depending on palatability, availability, succulence, preference, and nutritional value. Food habits of pronghorn are not an attribute of the individual animal, rather of the population in a given location during a specific time. Comparison of diet compositions among populations or locations may be misleading if not accomplished for similar vegetative ecosystems, seasons of the year, and weather patterns." In other words, they may be

forb eaters by choice but out of necessity, they can make do with just about anything.

Most ungulate species can live in cold climates. Al Oeming's game farm probably had 10 African species that survived and multiplied. In the Northwest Territories (Gainer 1987), cattle and horses have been a feature for more than 100 years. Horses were the most durable, but cattle were always kept by the Missions, for dairy primarily, as far north as Inuvik. What was required was shelter for cattle (not so much for horses) and adequate digestible calories. Local roughage was abundant in the form of various slough hays but production was always improved with grain supplementation, usually barged in from the south along the McKenzie River. As long as stock owners appreciated extra calories were required for the cold, and the area always had unlimited local roughage for feed and bedding, they could easily survive the winters.

Thirty years of driving and flying the "Areas" and environs have probably made me somewhat knowledgeable of pronghorn distribution and movements here. Being conscious of the importance of winter habitats to their survival, I made note of what vegetation, cultivation, native and non-native, they were on and apparently utilizing. Although a relatively amateurish and hands-off study, it never-the-less gave me some appreciation of their habitat selection (Gainer et al. 2005).

In the summer, a portion of the Alberta pronghorn population ranges farther north than the "Areas", but in the fall they all start drifting south. There are several east-west barriers that discourage their southward drift. The farthest north (splitting the "Areas" approximately in half north-south) is the Calgary-Saskatoon Highway 9. Approximately 100 km south of Highway 9 is the east-flowing Red Deer River (the southern border of the "Areas"), and another 100 km south is the Trans-Canada Highway 1. To some extent, these barriers are continued for 200 km east into Saskatchewan north of the South Saskatchewan River.

Driving Highway 9 (Highway 7 in Saskatchewan) to Saskatoon and back in the fall and winters, groups of up to 50 pronghorn can be seen occasionally along the north side. If there is an especially severe and early blizzard, or if there is an oppressive hunting season, they brave the crossing of Highway 9. Otherwise they form large groups and learn where the best fields are for their purposes and settle in for the winter. If it is an easy, normal fall and winter, probably less than half of them move on south to the next barrier. When they do cross these barriers, it is usually at night when there is the least chance of motorized traffic. Crossing the highways, they use the country roads access and when crossing the rivers, they use the bridges.

In the spring, they drift north in much smaller groups or even single animals, and almost only females. Driving Highway 9 and Highway 7 to Saskatoon, I've seen this noticeable buildup on the south side of the road. In addition, my home for the last 25 years has been 0.5 km south of Highway 9, and almost every spring, I have seen females in my fields anxiously, almost desperately try to penetrate the Highway 9 barrier moving back and forth along the south edge looking for a road crossing. Andrew Jake's (pers. comm.) explanation for this seemingly destructive behaviour (working with pronghorn at the Game Farm and being acquainted with them over the years, I found their behaviour to be the most

excitable, high strung, over-reactive, almost suicidal, of any of the ungulate species), is their innate desire to return to where they were born to fawn themselves.

If pronghorn behaviour is to readily move north in the spring and less readily south in the fall, if they stay in the open rather than seek shelter during storms, if they have an innate high metabolic rate, and if they have no special adaptations for cold weather, than they will have higher caloric requirements than other native ungulates. Offsetting factors may be their reconnaissance at night on country roads during periods of snow cover for the best fields available, use of depressions in open areas when bedding down during storms (Bruns 1977), and flexibility of diets as Yoakum emphasized. My examination of winter feeding sites for 30 years showed that once the winter advanced and snow became a factor, then standing vegetation, such as second-growth alfalfa, was critical, and grain, ideally standing but at least exposed, always seemed to be in the background.

Often the literature stresses the importance of silver sage in their winter diets. The problem is that almost 95% of the "Areas" is north of the Red Deer River, virtually the northern range of this plant. Silver sage does increase in prevalence moving south but even in the native prairie, it is not that prominent, and if anything, pronghorn numbers are less. The only area where it is found in abundance is down in the Red Deer River valley, which pronghorn avoid. Depending on the type of winter, most of the Area's pronghorns stayed well north of the Red Deer River and survived just fine. If the winter forced them to accumulate on the north side of the River, a natural barrier to their movements, from the air it never seemed to result in them using the silver sage along its banks. I even flew to an area 40 km south of Brooks where silver sage had proliferated (O'Leary et al. 1990) and it was speculated that it would be a good overwintering site. Pronghorn showed no attraction to this area or this plant.

During particularly bad winters in places like Montana and Wyoming, pronghorn seem to migrate to where silver sage is available and postmortems reveal their rumens to be full of the plant. This does not mean it was an ideal choice for the animals, but that animals that died were eating it. Silver sage is not a forb, it is a coarse, poorly digested, browse. In the "Areas", if they use it, this species would be a "make do" diet component of last resort because it is all that protrudes through deep snow. Alfalfa leaves, and lately the increased production of peas, beans, and pulses, are much more like the forbs that pronghorn are adapted to, and various types of alfalfa are grown throughout the "Areas". The alkali lakes and wetlands throughout the region often use the tap-root varieties to help desalinate the banks and neighbouring soils, favoured areas of the pronghorn. The plant is the most widespread non-native perennial in the "Areas".

Another component of their diet they seemed to be attracted to in the dead of winter was grain. Normally wild ruminants show little interest in mature grain, unlike their domestic relatives. Cattle and sheep need to be fenced out, otherwise they will overeat it causing their digestive systems severe damage and usually their loss of life (Merck 2005:181). Wild ruminants could easily overcome the fences anytime they wanted to but rarely do, and if they do, it is not to eat mature grain. They do not seem to be attracted to it like domestication causes in other ungulates. My feeling is

that pronghorn eat only the minimum of grain their body needs to overcome their natural disinterest in the food, although their teeth are adapted for grinding, and that is why I didn't see the usual problems associated with its ingestion.

I suggest, with 25 years of general veterinary practise and knowledge of pronghorn winter feeding sites, that during the depths of the winter, the situation with pronghorns is similar to a condition in beef cattle colloquially referred to as "Saskatchewan Disease," or abomasal impaction (Merck 2005:198). In general, beef cattle will survive the cold of winter if provided enough shelter and calories. Some winters, the source of calories may be poorer, coarser, and more indigestible than other years. To consume enough of the roughage to provide adequate calories to offset the loss to the environment, they become too filled up on the coarse material plugging up their digestive system; then their metabolic system shuts down irreversibly. The stockman must recognize the problem early enough and supplement their diet with a relatively small amount of grain to avert this problem. Sheep are even more prone to a similar metabolic condition called "pregnancy toxemia" (Merck 2005:828), as is "anorexia nervosa" in humans.

When pronghorn die during severe winters, they are described as after making an heroic effort to survive, they give up, become uninterested in food and having a metabolism that has shut down when it is needed most. In my area, I feel that I have rarely encountered it because I see them using some grain as well as the alfalfa. Their metabolic needs must somehow have overcome their inherent reluctance to consume grain before the negative calorie flow has shut down their metabolism, but not enough to cause several problems associated with overeating grain. The important thing is that it is recognized before it is a problem, and better than a human caretaker would be an animal's body to communicate it to itself. Yoakum (O'Gara and Yoakum, 2004:5002) states that "Several misconceptions have resulted from incorrectly analyzing or interpreting pronghorn food data in past years." I suggest that the importance of silver sage in this region is one of them. What else would explain pronghorns continued existence and favouritism, 25 of the last 30 winters of my interest and hundreds of years before that, in a world without silver sage.

Wild ruminants in general seem to have an inherent resilience to many other plants in my area that domestic ruminants don't. Alfalfa, especially in the early stage, is sought after by both groups, but with sheep and cattle, it causes a deadly bloat that I have never seen or heard described in wild ruminants. Very lush early growth crested wheatgrass, winter wheat or rye, or early stage regen of harvested crops can cause grass tetany in sheep and cattle but not the wild species. Grain overload and polio are a big problem in sheep and cattle that, if allowed, will invariably eat too much grain. Goats rarely have these problems perhaps because like pronghorn they are a more picky, forb adapted eater. Regardless, food and space are not the problem in the "Areas" for pronghorn given the enormous area and low population numbers, but as the literature states, availability during periods of snow accumulation is.

I have driven south in the winter several times through the American Southwest to the Mexican border through the ranges described by Yoakum and O'Gara (2004) as good for pronghorn

wintering grounds and have observed that almost everywhere, pronghorn are attached to cultivated fields. Alfalfa is probably the single most common vegetation type but there are harvested irrigated fields and harvested cropland in general where there has been substantial regen of crop and weeds. The most important factor is snow depth. If the snow is deep, they are not there but if it is light or non-existent, in Wyoming especially, with over half of the total pronghorn population, they are everywhere. The attraction of the Special Areas and the adjoining Saskatchewan dry belt to the east must be the mix of the driest dry land farming and dry native prairie. The smaller more delicate grazer style teeth of pronghorns must be suited to young growth grasses and forbs associated with new style cultivation techniques and crop varieties developed for this otherwise less desirable region, and the teeth are able to handle alfalfa style forbs and grain in most winters.

The future for pronghorns in Canada looks like it is improving. The real killer winters don't seem to be occurring anymore and the growing season for cultivated crops seems to have been extended by weeks. A warming climate is a good thing for reducing their critical time, the winters. I feel that the fawning season is earlier than 50 years ago: then it was a May 20 start and now it seems to be May 15. Still pronghorns during the winter, except in the warmer most southern ranges, are half starved (especially with regard to minerals and micronutrients), uncomfortably cold (if for no other reason than they won't seek shelter), heavily parasitized (because of their stressed body condition), and constantly under threat of predation, especially from coyotes. If wildlife management wanted to, it would be very easy to increase pronghorn numbers by providing livestock style supplements (vitamins ADE, calcium/phosphorus, paracidals, anticoccidials), alfalfa, and grain, even in the standing form around the edges of fields, and coyote control. Since the price of coyote hides dropped by 90% 20 years ago, their numbers, and coydog crosses, have soared.

To an old man in his seventies with not much left in life, there still is a spark when he sees a doe with a couple of frisky fawns gambolling around her, a flash of blue during bluebird migration, being woke up in the morning to the raucous roar of many meadowlark males proclaiming their love of life and territories — all because of that accursed AI Oeming.

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UPCOMING Meetings

Canadian Conference for Fisheries Research and Society of Canadian Limnologists Annual Meeting. January 5-8, 2017, Hyatt Regency, Montreal, QC. For more information, see <http://www1.uwindsor.ca/glier/ccffr/>

Great Plains Fisheries Workers Association 2017 Annual Meeting. January 23-25, 2017, Hilton Garden Inn, Casper, Wyoming, USA. For more information, see <http://www.greatplainsfisheryworkers.com/>.

CABIN (Canadian Bioassessment Network) Science Forum 2017. February 28- March 1, 2017, Edmonton, AB. For more information, see <https://www.ec.gc.ca/rcba-cabin/default.asp?lang=en&n=5647F743-1>. Note, there is a free attendance via webinar for this forum.

IAIA17. Impact Assessment Conference 2017. April 4-7, 2017, Montreal, QC. For more information, see <http://conferences.iaia.org/2017/index.php>.

The Children & Nature Network International Conference: Kids Need Nature, Nature Needs Kids. April 18-21, 2017, Vancouver, BC. For more information see <http://cwf-fcf.org/en/events/conferences/the-children-nature-network.html>.

International Conference on Water, Informatics, Sustainability, & Environment - iWISE2017. July 3-5, 2017, Ottawa, ON. For more information, see <https://www.sciencetarget.com/iwise2017>.

ICCE 2017. 6th International Conference & Exhibition on Clean Energy, Aug 21 to Wed Aug 23, 2017, Toronto, ON. For more information, see <http://icce2017.iaemm.com>.

American Fisheries Society 147th Annual Meeting. August 20-24, 2017, Tampa Florida. For more information, see <http://afsannualmeeting.fisheries.org/>.

Canadian Ecotoxicity Workshop (CEW 2017). 44th Annual Meeting, October 1-4, 2017 in the Delta Hotel, Guelph, Ontario. For more information, see <https://ecotoxcan.ca/general-information/2017-announcement/>.

How You Can Help the CSEB

- **Contribute to the quarterly newsletter and/or website.** Give us an article on something you are interested in
- **Write a short paragraph about what you have been doing, articles or reports you have written**
- **Provide us with points of views on issues.** Your Executive is always interested in learning what issues concern you
- **Write a book review for the newsletter**
- **Become a Chapter Chair, or offer to join the Board of Directors**
- **Promote CSEB - put up a poster, distribute membership forms** - download from our website
- **Set up a Chapter** - contact any Director for help
- **Organize a CSEB event** - contact any Director for help
- **Attend the annual conference and maybe present a paper on your work.**

It is only through the work of volunteers from our membership that we can keep the CSEB operational. Without member input and help, the Society cannot continue to function. It is currently the only national Canadian society of environmental biologists, and with our 50+ years of history addressing environmental issues, it would be a shame if the CSEB cannot continue. Please contact one of the executive and volunteer to help the society today!!

CSEB Newsletter Contributors Needed

CSEB has need for Regional Newsletter Contributors and Guest Editors for special editions of the quarterly newsletter.

If you are interested in contributing, please contact Gary Ash at garyash@shaw.ca. It is not an onerous task, and will greatly help strengthen the organization.

Your help would be greatly appreciated.

CANADIAN SOCIETY OF ENVIRONMENTAL BIOLOGISTS LA SOCIÉTÉ CANADIENNE DES BIOLOGISTES DE L'ENVIRONNEMENT

FORMULAIRE D'ABONNEMENT MEMBERSHIP AND NEWSLETTER SUBSCRIPTION APPLICATION

Regular Members: persons who have graduated from a college or university in a discipline of biological sciences, and who are or have been professionally engaged in teaching, management, or research related to natural resources and environment.

Student Members: persons who are enrolled in an accredited college or university in a discipline of the biological sciences, and who are preparing themselves for professional work in teaching, management, or research related to natural resources and to the application of sound ecological principles to management of the environment.

Associate Members: persons who support the purposes and activities of the Society but who do not qualify for Regular or Student membership.

*Complete this form and return with cheque payable to:
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Membres Réguliers: les personnes ayant un degré ou diplôme d'un collège ou une université dans une discipline des sciences biologiques et qui sont ou qui ont déjà été engagé professionnellement en aménagement, enseignement ou recherche tenant à l'environnement ainsi que ressources naturelles.

Membres Étudiants: les personnes qui étudient dans un collège ou une université reconnu dans une discipline des sciences biologiques, et qui se préparent à travailler comme professionnel soit en enseignement, aménagement ou recherche tenant aux ressources naturelles et à l'application de principes écologiques à l'aménagement de l'environnement.

Membres Associés: les personnes qui supportent les activités et les objectifs de la Société mais qui ne se qualifient pas comme membre régulier ou étudiant.

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