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HORIZONS



Climate Change

Recognizing our role to protect our health

In this issue of *Horizons*, we focus on the effects of climate change on our health, and how we can address these implications.

But what do we mean when we say *climate*, *climate change*, and *global warming*?

The term *climate* refers to the average and variability of weather conditions over many years.

Climate change refers to the significant variation of average weather conditions persisting for an extended period, typically decades. It is attributed directly and indirectly to human activity that changes the

global atmosphere, and is in addition to the natural variability measured over a comparable time frame. Climate change refers to longer-term trends, thus, differentiating it from weather variability.

While climate change and global warming are often used as substitutes (or verbal stand-ins) for each other, such transposing can confuse the debate. Global warming (meaning the observed and projected rise in global temperatures) is an aspect of climate change.

In simple terms, when the sun's energy is reflected off the earth or when the earth's atmosphere releases energy, the earth cools. When the earth absorbs the sun's energy or when atmospheric gases prevent heat the earth releases

from radiating into space (greenhouse gases), the earth warms.

This effect isn't to say that the earth hasn't experienced warming and cooling in the past. What is different is that today's warming is occurring more rapidly than in the past, and can't be explained by natural climate change causes alone.

To be sure, we can understand these changes through data obtained from weather satellites, meteorological stations, and ocean buoys. However, paleoclimatology and paleolimnology data collected from ice cores, tree rings, corals, and ocean / lake sediments can provide climatic records dating back millennia. Together, this data can inform climate models to predict climate trends.

The World Health Organization notes: “The scale of environmental health problems has expanded from household (indoor air pollution) to neighbourhood (domestic refuse) to community (urban air pollution) to regional (acid rain) to global level (climate change).”

Human activity is a primary source of greenhouse gas emissions, namely through the burning of fossil fuels. While the earth’s forests and oceans can absorb greenhouse gases through photosynthesis and other scientific processes, they can’t sustainably continue with the rising amount of greenhouse gas emissions. And health professionals are increasingly aware that increased greenhouse gas emissions will only put human health at greater risk.

In fact, we now know that there are demonstrable relationships between higher temperatures and morbidity and mortality. We also know that climate change is negatively impacting air quality, resulting in respiratory health issues, not just for individuals with asthma, but also allergy sufferers through increased pollen. And warmer, wetter conditions can help propagate insect-borne diseases, such as Lyme disease.

Throughout this issue of *Horizons*, and within the Queen’s Department of Family Medicine’s Global Health Program, we hope that by giving consideration to the impact of climate change on health, we can raise the profile – and thus research, education, and advocacy – of how the long-term good health of populations depends on the continued stability and functioning of the biosphere’s ecological and physical systems, often referred to as life-support systems.



Photo courtesy of Gaye Jackson, CAPE.

Active Travel, Transportation

Shifting the Way We Move

By Kim Perrotta

Active travel – which includes public transit that usually involves walking or cycling at one end of the trip – and active modes of transportation such as walking and cycling can mitigate climate change while producing significant health benefits.

Active travel has the potential to substantially mitigate climate change, which, in 2016, the World Health Organization (WHO) declared the “greatest threat to global health in the 21st century.” The WHO estimates that climate change will claim 250,000 additional lives each year by 2030 because of heat stress, malnutrition, diarrhea and insect-borne diseases that result directly or indirectly from extreme weather events and the changing climate (WHO, 2016).

The transportation sector in Canada is one of the most significant sources of greenhouse gases (GHGs) that contribute to climate change. In 2005, it was responsible for about 26 per cent of the country's emissions, and about 57 per cent of those emissions were from cars and light-duty trucks used for passenger transport. To meet Canada's commitments under the [*Paris Agreement on Climate Change*](#), the federal government wants to reduce emissions from this sector by 80 per cent by 2050, from 195 to 38 megatons (Canada, 2016).

It has long been recognized that public transit involves far fewer GHGs than travel alone in one's vehicle. The U.S. Department of Transportation, for example, reported in 2010 that heavy rail transit such as subways produce 76-per-cent fewer GHGs per passenger mile than an average single-occupancy vehicle, while light rail and bus transit produce 62-per-cent and 33-per-cent fewer GHGs respectively (U.S. DOT, 2010). In the Greater Toronto Hamilton Area (GTHA), it was estimated that the new regional transit plan, *The Big Move*, could prevent GHGs from vehicles from increasing by 30 per cent as the population in the region grows by two million people (GTHA Medical Officers of Health [MOHs], 2014).

A number of studies suggest that active modes of transportation can also produce substantial reductions in GHGs. For example, a modelling study conducted in San Francisco estimated that GHGs from vehicles could be reduced by 14 per cent by increasing walking and cycling time among residents from 4.5 to 22 minutes per day (Maizlish et al., 2013). Another modelling study, directed at a region that includes 31.3 million people in 11 metropolitan areas in the U.S., found that the elimination of all short automobile trips (less than or equal to eight km), with cycling being used to replace 50 per cent of those trips, could reduce vehicle miles travelled and GHGs by 20 per cent (Grabow et al., 2011).

Active travel can significantly reduce rates of chronic disease by increasing levels of physical activity. Physical activity has been found to reduce the risk of more than 25 chronic health conditions, including coronary heart disease, stroke, hypertension, breast cancer, colon cancer, Type 2 diabetes and osteoporosis (PHAC, 2011). It also has benefits for mental health (Bingham, 2009). And yet, fewer than one in five Canadian adults and fewer than one in 10 Canadian children are achieving the levels of physical activity needed for healthy growth and development (Colley et al., 2011a; Colley et al., 2011b). This is a serious concern for Canada's health-care system because chronic diseases consume approximately two-thirds of the health-care budget and cost Canadians approximately \$200 billion per year in treatment and lost productivity (PHAC, Elmslie).

Lack of time is one of the leading barriers to increased levels of physical activity (CFLRI, 1996). Active travel can increase physical activity by allowing people to "get the exercise they need" while commuting to work or running errands. Many studies have demonstrated that active modes of transportation can produce significant health

benefits. For example, a recent long-term study conducted in the United Kingdom found that people who walk to work have a 36-per-cent lower risk of dying prematurely from cardiovascular disease, while those who cycle to work have a 40- to 52-per-cent lower risk of dying prematurely from cancer, cardiovascular disease and all causes (Celis-Morales C et al., 2017). The San Francisco study mentioned earlier estimated that premature deaths from chronic diseases could be reduced by 13 per cent or more by increasing walking and cycling among residents from 4.5 to 22 minutes per day. In San Francisco, this would translate into approximately 2,400 avoided premature deaths each year (Maizlish et al., 2013).

Several studies have found that transit use increases the levels of physical activity as well. A Montreal study, for example, found that a round trip on public transit involves, on average, 2,500 steps each day. The researchers estimated that transit users can get approximately 25 per cent of the physical activity recommended for good health by simply walking to and from transit (Morency 2011). The medical officers of health in the GTHA found that the modest increases in active transportation and transit use predicted for the regional transit plan could prevent 184 premature deaths per year and produce health benefits valued at \$1.2 billion per year in the GTHA by increasing levels of physical activity (MOHs, 2014).

Active travel can produce a number of other health benefits. It can:

- reduce acute and chronic health conditions that result from air pollution by reducing emissions of air pollutants from the transportation sector. The transportation sector is a major source of air pollution as well as GHGs. The GTHA MOHs have estimated that the regional transit plan, *The Big Move*, could prevent 154 premature deaths and produce health benefits valued at \$1 billion per year by improving air quality in the GTHA (MOHs, 2014).
- reduce vehicle-related injuries and deaths. In 2014, 1,834 Canadians were killed in vehicle-related collisions while 149,900 were injured. Of those killed, 15.7 per cent were pedestrians and 1.9 per cent were



Photo courtesy of Gaye Jackson, CAPE.

cyclists (Transport Canada, 2014). Studies have found that vehicle-related injuries and deaths for vulnerable road users can be significantly reduced with a combination of measures including speed reductions, separated bike lanes and improved pedestrian crossings (Retting et al., 2003).

- increase health equity by making jobs, services and recreational opportunities more accessible to low-income populations. Car ownership is the second-largest expense for many Canadians. It can cost, on average, \$9,500 per year to own and operate a car in Canada (CAA, 2016). By building communities and transportation systems that foster walking, cycling and public transit use, we can reduce the need to own a car and the attendant financial pressures on low-income populations.

Because of the health and climate benefits associated with active travel, public health and health-care professionals are becoming engaged in the land use and transportation planning processes that dictate how communities and transportation systems are designed and developed to advocate for the policies and programs that encourage, support and foster active travel among Canadians. The Canadian Association of Physicians for the Environment (CAPE) has developed a toolkit, [*Prescribing Active Travel for Healthy People and a Healthy Planet: A Toolkit for Health Professionals*](#), to build capacity for advocacy among those professionals. This toolkit can be downloaded and printed for free.

Kim Perrotta is executive director of the [*Canadian Association of Physicians for the Environment \(CAPE\)*](#).



Physicians Connecting the Dots ... and Advocating for Action

By Dr. Cathy Vakil

In 2009, *The Lancet* described climate change as “the biggest global health threat of the 21st century.” For a number of years, Fiona Godlee, editor of the *British Medical Journal*, has been writing articles urging physicians to take a lead on climate change, recognizing it as a public health emergency.

According to the [*2017 Lancet Countdown Report*](#), “The human symptoms of climate change are unequivocal and potentially irreversible – affecting the health of populations around the world, today. Whilst these effects will disproportionately impact the most vulnerable in society, every community will be affected.”

Climate change is causing unprecedented heat waves, extreme weather events, coastal erosion, wildfires, droughts, floods and vector-borne diseases, and will cause migration of millions of people from their homes (climate change “refugees”) in numbers never seen before. These all have significant health impacts that are not recognized in the climate change dialogue that occurs in the public sphere, which involves mostly discussion of short-term costs and political expediency.

Representatives of the health-care sector are conspicuously absent at global meetings about climate change. The economics and politics of adaptation and mitigation of climate change and its consequences are not being addressed with a health-care lens.

Why should doctors be at the forefront of this political global environmental issue? Doctors are uniquely positioned to reframe climate change as both an important environmental issue and an extremely urgent health issue.

Doctors are influential, trusted, respected and recognized as having no financial or political vested interest in political issues such as climate change. They are perfectly positioned to encourage policy-makers to protect the health of Canadians and world citizens by acting to reduce greenhouse gases. One of the Royal College of Physicians and Surgeons of Canada’s CanMEDS roles is that of “health advocate,” both inside and outside the clinical environment, and according to this role, “physicians are accountable

to society and recognize their duty to contribute to efforts to improve the health and well-being of their patients, their communities, and the broader populations they serve.” Advocating for action on climate change fits perfectly with this role.

What can physicians do as health advocates for this thorny political, sometimes extremely polarized, issue? Firstly, they can deal with it on a personal level by reducing their own carbon footprints. This would mean using active transportation (such as walking and cycling, which have their own health benefits), buying sustainable products, reducing meat consumption and investing in sustainable investments.

Physicians can be advocates in their clinical lives. They can apply knowledge about health effects of climate change to their practices – such as knowledge of appropriate treatment of Lyme disease and preparation for heat illness in vulnerable populations – and they can use more sustainable products in their offices, hospitals and clinics (“greening the health-care system”). They can encourage medical schools and continuing medical education organizations to include the health effects of climate change in their curriculum.

Physicians can also advocate on a community level, by speaking out about local issues that directly or indirectly affect greenhouse gas emissions (such as bylaws about idling, regulations for local polluting industries, encouragement of local organic or sustainable farming, and support of renewable energy businesses and

industries). They can visit their MPs/MPPs, write letters to the editor of their local newspaper, speak at local meetings and support local advocacy organizations.

Physicians can act through organizations such as national and provincial medical associations, colleges and other specialist organizations. Traditionally, these groups have not been politically active in issues outside of health care, but they are ideal to promote action and to influence decision-makers regarding important public-health issues such as climate change.

Action on the part of physicians is an opportunity to practise preventative medicine on a local and global level, and this would go a long way to convince the public and policy-makers that climate change is an urgent health issue.

There are many things physicians can do within their comfort levels that can have significant impact on climate change, and even small efforts can make a big difference in the long term. The health of the planet and human health are intricately connected, and physicians should be integral to the process of addressing climate change, and protecting human health.

When physicians connect the dots ... the planet can become healthier and safer for all.

Dr. Cathy Vakil is a physician at the Queen’s Department of Family Medicine’s Queen’s Family Health who has a strong interest in environmental issues and physician advocacy.

Unpredictable Extremes: The New Normal



Photo of Bridget Doherty courtesy of the Sisters of Providence of St. Vincent de Paul.

By Bridget Doherty

What a winter. Temperatures this year were far from normal. Environment Canada issued province-wide extreme cold-weather warnings, advising people who ventured out to cover up due to the risk of frostbite. On January 5, Toronto experienced the coldest January 5 in the city’s history.

But you’re not thinking about winter. Spring is here, and you’re likely getting ready to open the cottage, maybe hike the K&P trail or cycle to Gananoque. Perhaps you’re booking a camping spot at Frontenac Provincial Park.

If you grew up in Ontario or have lived here for years, you are probably planning every minute of the precious summer months ahead.

But who’s to say this summer will promise to be normal? While scientists continue studying the



Photo courtesy of Ian MacAlpine, The Kingston Whig-Standard.

In 2017, carp emerged from the overflowing Cataraqui River to the fourth and sixth fairway of Kingston's Belle Park Driving Range.

impacts of climate change, one thing is becoming certain – unpredictability is the new normal.

In 2016, we experienced our driest summer since the 1880s. Temperatures between 31C and 35C persisted, with overnight lows in the mid-20s. Heat alerts were almost everyday occurrences. That camp fire you dreamt about the previous winter was banned, and the well at your cottage was drying out. Hiking and cycling were best done early in the morning or not at all. With your air conditioner on high, you might have chosen to jump on some indoor exercise machine, the outdoors seeming dangerous. And if you didn't have a car to escape town or access to air-conditioned space, you would have been in trouble.

The summer of 2017 turned out to be the wettest summer. An unusually mild winter and wet spring resulted in the highest water levels on Lake Ontario since record-keeping began in 1918. (Almost 100 carp were found swimming in a puddle in front of the second green at Belle Park Fairways.) The water was so high that lowering Lake Ontario by as little as one cm would have resulted in a one-metre rise in the Montreal region. The high water levels increased the risk of E. coli, and KFL&A Public Health set up an E. coli testing system for Wolfe Island residents.

Summer or winter, many of us, particularly the disadvantaged, struggle to deal with extremes.

Turning the heater up or air conditioner down are not always options; neither are buying rubber boots or down jackets. Some people in Kingston, and far beyond, are forced to make tough decisions. Do they pay for rent

or pay for utilities? Imagine having to choose between eating or heating.

The Sisters of Providence of St. Vincent de Paul were founded in Kingston in 1861 to care for the needs of the poor. Recognizing that charity without justice is incomplete, the Sisters opened an expanded social justice office, the [*Justice, Peace and Integrity of Creation*](#) (JPIC) office, to include the environment.

Staff advocate for government and corporate policies that address poverty, promote peace, and protect the environment. This work includes working with organizations like the province-wide Low Income Energy Network (LIEN). A JPIC staff member sits on the steering committee, helping LIEN to promote programs and policies that address energy poverty while reducing Ontario's greenhouse gas emissions.

Climatologists warn us that we have felt some effects but much more is yet to come. But, as with all disasters, many suffer while some thrive. When you go back to planning the summer ahead, you may want to check out [*How to Protect yourself from Ticks*](#) on Ontario Parks' web blog. Ticks are best known for transmitting Lyme disease, but they also carry the Heartland virus, Powassan and a host of other diseases and viruses. Thanks to climate change, these arachnids are moving farther north and are starting to bite people earlier in the year.

Bridget Doherty advocates for policies and programs that address energy poverty, reduce greenhouse gas emissions, and promote a healthy economy benefitting everyone. She works in the Justice, Peace and Integrity of Creation Office with the Sisters of Providence of St. Vincent de Paul in Kingston.

Influence on Clinical Practice:

Residents Share Perspective



Dr. Erin Budd



Dr. Antoinette Mihaylova

By Dr. Erin Budd and Dr. Antoinette Mihaylova

[The Lancet](#) [Impact Factor: 47.831] states that, “Climate Change is the biggest global health threat of the 21st century.” For those who work in clinical medicine, this may seem an odd statement for a medical journal to make. Such a broad topic as climate change is typically one reserved for conferences and research articles in the realm of public health. However, climate change has already begun to influence clinical practice in tangible, everyday ways.

In our own rotations, we have begun to notice a few direct impacts. For example, on call for family medicine, a patient phoned, wondering about their risk of Lyme disease after going camping for the weekend and discovering a round skin rash and a tick embedded in it. According to the Government of Canada’s [Surveillance on Lyme Disease](#), Lyme disease has increased more than six-fold in the past six years. Public Health Ontario attributes this rise mainly to the increasing number of days above 0C, as well as fragmented forests causing humans and species such as deer to live much closer together.

On emergency medicine rotations, we scrambled to review how to prepare medications with a shortage of IV mini-bags. This shortage was due to a massive hurricane wreaking havoc on Puerto Rico, where many medical supplies are produced. In Belleville recently, the anesthesiologists received an email from Public Health advising that epinephrine is now in short supply, for the same reason.

According to an article published in *Scientific American*, [Was the Extreme 2017 Hurricane Season Driven by Climate Change?](#), models suggest that as temperatures increase there will actually be fewer hurricanes, but the ones that do occur will be much stronger and more intense, “with one doing the work of four.”

Last year, wildfires were rampant in Western Canada, significantly impacting air quality. Globally, the incidence of asthma is increasing, and climate and environmental change are impacting this. The B.C. Centre for Disease Control actually formed an official policy, [Guidance for BC Public Health Decision Makers During Wildfire Smoke Events](#), in 2014 to address this issue because in the decade prior, wildfires’ intensity and frequency had increased so much that the health system was overwhelmed without a process in place to manage poor air quality in rural hospitals. Regardless of where we practise in Canada, the

effects of climate change have already begun, and are real and tangible.

Most residents and physicians are likely aware of climate change as an issue, and despite noticing the above impacts, most of us probably don’t do much about it because we are too busy working, studying, sleeping, etc., to know where to start. It’s easy to feel hopeless in the face of such a vast problem.

It may help to know we are not alone in this feeling. At a recent presentation by Canadian Association of Physicians for the Environment (CAPE) member Dr. Joe Vipond, he spoke of the impact of climate change on his mental health. In a [personal essay written by past CAPE President Dr. Courtney Howard](#), she spoke of how she experienced six months of dysthymia as she realized

that if patterns of consumption/production don’t change, projected global temperatures in the next century aren’t considered consistent with global organized civilization. For us, it was disheartening to find out that if everyone made the same lifestyle choices we did, we would need four Earths to support our lifestyle (estimated using an [online carbon footprint calculator](#)), which is clearly unsustainable.

“

We are the last generation that can put an end to climate change, so we [must] address climate change.

”

Ban Ki-Moon
(UN Secretary-General)

If you've ever felt that (or are perhaps feeling this now), know that you are not alone.

So, what can we do?

Thankfully, other people have started to tackle this question. Climate change initiatives trickle down to medicine in all sorts of ways.

Interested in obstetrics? As per the Union of Concerned Scientists' 1992 warning to humanity, campaigning for global reproductive rights for women can lead to more sustainable population numbers by allowing population numbers to change by choice.

For those passionate about healthy active lifestyles for their patient (and own) communities, developing active transport strategies is one of the seven suggestions of the [*Lancet Countdown 2017 Report: Briefing for Canadian Policymakers*](#) announced at CHEO last year.

Are you passionate about working with Indigenous populations and/or mental health? Another of the Countdown's policy goals is to look at local health impacts of resource extraction with a focus on working with Indigenous populations.

All this to say: climate change is happening, and we can do something about it. Those of us with a vested interest in the future, for ourselves, family, or children, have good reason to be worried. But we are capable to take action – and it will feel better. Trust us.

As per CAPE's [*Code Green Fact Sheet*](#), "All your patients live on planet Earth. N=1. NNT=1. So let's give'er."

Dr. Erin Budd and Dr. Antoinette Mihaylova are PGY1 residents at Kingston's Queen's Family Health Team.

Practical to-dos:

- Eat a plant-rich diet. Plant-based protein requires many fewer resources for production than meat. If that's not something you can commit to right now, consider limiting consumption of large animals such as beef (i.e. eating chicken instead).
- Minimize car use – take the bus or a bike, or carpool.
- Limit waste – buy what you can eat.
- Limit plastic usage (e.g. straws are often unnecessary).
- Write a quick email to your MP telling them climate change is a critical health issue (feel free to contact us for help, or a template).
- Read through *The Lancet* report and see if any of the recommendations catch your own personal interests.



Photo courtesy of Dr. Courtney Howard.

Plant-Rich Diets Promote Health for People, Earth

By Dr. Courtney Howard

So. The World Health Organization tells us that climate change is the biggest global health threat of the 21st century, and *The Lancet* says that tackling climate change may be the biggest health opportunity of our time. Yet, climate change and health is part of the curriculum at a minority of medical schools in Canada, which makes it one of the worst-covered topics ... perhaps rivalled only by ... nutrition?

So what's a doctor supposed to recommend their patients eat?

Luckily, at this very moment, multiple processes are underway to help us figure this out.

Firstly, Health Canada is revamping the familiar rainbow of foods that is Canada's Food Guide in an impressive process that has barred one-on-one meetings with industry and instead focused on the evidence. In their draft guiding principles released in spring 2017, they recommend reducing our intake of processed foods high in salt and sugar; encourage sharing meals with family and friends; and suggest a "shift towards a high proportion of plant-based foods."

There is good reason to respect the advice regarding a shift towards a plant-rich diet. On the level of a single patient, plant-rich, low-meat diets have modest benefits in terms of [all-cause mortality](#), decrease risk of [colorectal cancer](#) and [cardiovascular disease](#), and [improve glycemic control](#) in people with diabetes.

On a planetary level, plant-rich, low-meat diets reduce greenhouse gases, land use and water consumption by [a median of 20 to 30 per cent](#) across studies. This is not a factor that should be regarded as "nice to have," but in fact must be an essential component of our thinking moving forward.

The 2017 *Lancet Countdown* report indicated that undernutrition was likely to be the major health consequence of climate change this century. The 2015 Lancet Planetary Health Commission laid out myriad challenges to feeding our population: drought, desertification and unintended consequences of heavy pesticide use amongst them. Failing [planetary health](#), defined as, "the health of human civilization and the state of the natural systems on which it depends," is now recognized as an existential threat to our ability to live well and has even spawned the new *Lancet* journal, *Planetary Health*.

The food guide process is taking place at the same time as multiple Canadian ministries are involved in the creation of a national food policy. Given the risk of human health considerations receiving reduced weight around a table crowded with many other considerations, vocal support from health professionals for the food guide's draft principles was one of the main recommendations of the jointly produced [Lancet Countdown – Canadian Public Health Association](#) policy brief.

There will always be important reasons to include animal products in the diet, particularly with regards to Indigenous traditional land-based foods, and to enhance food security in particular environments and via agroecology. Emotional connections to a given meal run deep – we picture our grandmother's hands shaping the crust on a meat pie, our fathers carving a turkey at

Christmas. Increasing numbers of people are folding these traditions into a "reducitarian" approach – simply eating less meat and more plants.

As these processes take place within Canada, a larger one is playing out internationally. A new Lancet Commission, *Our Food in the Anthropocene: Healthy Diets from Sustainable Food Systems*, is bringing together 20 scientists from across the globe to determine what constitutes a healthy and sustainable food system. Their findings will be released this spring. One of the commission's co-chairs, Walter Willett, chair of the Department of Nutrition of the Harvard School of Public Health, has long advised that we regard meat as a treat.

Could it be, then, that Canada could find itself shortly with a new food guide that provides evidence-based content that has been guarded from undue bias by industry, and that is in line with the latest in international thought? Could we end up leading the wave?

It's not impossible. And perhaps once the documents are in, we can fold them quickly into our medical school curricula – tackle both nutrition and climate health at the same time – and help docs out in their quest to recommend food that is healthy for both people and planet.

Dr. Courtney Howard is an emergency physician in Yellowknife and the president of the Canadian Association of Physicians for the Environment (CAPE).



Dr. Courtney Howard (submitted photo).

Dr. John Smol

Professor, Queen's
Department of Biology and
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Canada Research Chair in
Environmental Change

Researching the Environment to Affect Change and Protect

Dr. John Smol, an affable Queen's University professor and the Canada Research Chair in Environmental Change, is helping researchers and policy makers understand – and take action to address – climatic change and environmental pollution. He has been providing outstanding research contributions to many well-known national and international environmental policies and policy debates since the 1980s.

Dr. Smol is one of the world's top Arctic researchers, a leading lake expert, and a pioneer of paleolimnology, which uses the physical, chemical and biological information stored in lake sediments to track environmental and ecological change. These sediment cores provide a record of change over centuries, thus offering insights into the history of climatic and ecological change. Dr. Smol's research can be distilled as the more we know about our environment, the better policy decisions we can make to protect it.

A cross-appointed professor in the Queen's Department of Biology and School of Environmental Studies, Dr. Smol is always keen to discuss his research, which focuses on the role human industrial activities play in climate change and their effects on ecosystems. His research, and that of a team of about 40 members he co-leads at the [Paleoecological Environmental Assessment and Research Laboratory \(PEARL\)](#), has led to increased protection for inland waters and has provided evidence of human-made contributions to climate change.

Recipient of the [Order of Canada](#) in recognition of "his influential research on historical changes to inland waters, contributing to increased protection of lake ecosystems," Dr. Smol has received prestigious honours including the [NSERC Herzberg Gold Medal](#) in 2004, awarded to Canada's top scientist or engineer; and the [3M National Teaching Fellowship](#) in 2009, considered Canada's highest teaching

award. He has also been elected as a fellow in senior collegiums in his field, including the Royal Society of Canada in 1996. This year, he will be presented with the Canadian Association of University Teachers (CAUT) Distinguished Academic Award, recognizing excellence in teaching, research and service.

Dr. Smol was the founding editor of the [Journal of Paleolimnology](#), and is editor-in-chief of the journal [Environmental Reviews](#). He is also the series editor of the book series [Developments in Paleoenvironmental Research](#), and is on the editorial boards of several other journals. He teaches courses using lectures, labs, field work and seminars on topics that include water pollution, climate change, contaminant transport and overall global environmental change. For Dr. Smol, these topics have meaning outside academia; these environmental problems are at the forefront of many people's minds, since they have many ecological, economic, and social repercussions. It's clear from his (and his team's) research that he is certainly seeking to honour the Order of Canada's motto, "*Desiderantes meliorem patriam*." – "They desire a better country."

Dr. Smol is published in more than 550 journals and book chapters, and he has received more than 60 research, teaching and outreach awards related to his environmental research work. He has lectured on all seven continents and has authored more than 1,000 conference presentations.

Notwithstanding his numerous awards, Dr. Smol remains humble, acknowledging that much of the recognition he has received comes from working with talented and dedicated colleagues and students. Through PEARL, he and his team will continue to lead an international program on using "paleolimnological and other techniques to provide historical perspectives to environmental change" so the resulting data can define natural environmental variability and environmental change.



Dr. John Smol (submitted photo).