



G7 Research Summits
Sommets de la Recherche du G7

Seizing G7 Opportunities 2018

May, 2018



G7 Research Summits Sommets de la Recherche du G7



2018 is a banner year for Canada as an international leader addressing global problems using robust science and scholarship. Canada is President of the G7 from January 1, 2018 through December 31, 2018. Canada's hosting of the G7 offers an ideal opportunity to share insights and evidence about urgent global issues, and, along the way, to illustrate how Canada's substantial research capacity contributes to the making of a better future for all.

In order to seize the G7 opportunity, and in collaboration with domestic and international partners, the RSC has developed a full-year program of initiatives. In this planning, we are benefiting from engagement with The Right Honourable Julie Payette, Governor General of Canada; The Honourable Kirsty Duncan; Canada's Chief Science Advisor, Dr. Mona Nemer; Canada's G7 Sherpa, Mr. Peter Boehm; and those in related government departments and agencies.

As a result of this engagement, and in keeping with the established practice of the G7 Science Academies, the RSC selected two topics for joint statements: (1) The Global Arctic: The Sustainability of Northern Communities in the Context of Changing Ocean Systems; and (2) Our Digital Future and its Impact on Knowledge, Industry and the Workforce. Under the leadership of the RSC, the National Academies of the G7 countries co-authored these statements to highlight key issues based on the best available knowledge.

The final texts of the statements have been submitted to enhance the deliberations of G7 Summit of Leaders on June 8-9 in the Charlevoix region of Quebec.

Using the statements as a starting point, the RSC and G7 Academy counterparts, together with provincial, federal and international partners, have organised events throughout 2018 that will enrich discussion on Canada's official G7 themes, all of which relate to the topics of the statements.

The RSC's International Engagement Strategy and Strategic Plan, entitled "*Mobilize, Catalyze, Sustain*", will sustain the momentum established in these important thematic areas throughout 2018, into 2019, and beyond.



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The RSC warmly acknowledges those who have collaborated with us on the 2018 G7 Research Summits program



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G7 Research Summits Sommets de la Recherche du G7



2018 Calendar of G7 Research Summits

G7 ACADEMIES' SUMMIT (OTTAWA)

MARCH 19	14:30 – 19:00	Roundtable on Advancing Gender Equity in Research
MARCH 20	7:30 – 9:00	Breakfast on Parliament Hill and Arctic Discussion
	9:00 – 9:30	Meeting with the Honourable Kirsty Duncan
	10:00 – 12:00	Finalizing the Statements of the G7 Science Academies

"OUR DIGITAL FUTURE" SUMMIT (OTTAWA)

APRIL 26	12:30 – 19:30	Summit and Reception
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"ARCTIC SUSTAINABILITY" SUMMIT (MONTREAL)

MAY 23	8:00 – 19:30	Summit Day 1, and Reception
MAY 24	8:00 – 16:15	Summit Day 2

"DATA TO INSIGHTS" SUMMIT (OTTAWA)

SEPTEMBER 24	9:00 – 16:00	Summit Day 1, and Reception
SEPTEMBER 25	9:00 – 16:00	Summit Day 2

"SUSTAINABLE OCEANS" SUMMIT (HALIFAX)

SEPTEMBER (TBD)



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SUMMIT OF THE ACADEMIES - MARCH 19-20: OTTAWA

In welcoming delegations from the G7 Science Academies to Ottawa, the RSC convened several dozen leaders from agencies, universities and institutes for a dialogue to address the goal of advancing gender equity in research. Co-Moderated by Cara Tannenbaum, Director of the CIHR Institute of Gender and Health, and by Chad Gaffield, President of the RSC, the discussion explored promising next steps to enhance equity within the research community.

The following morning, the leaders of the G7 Academies participated in a breakfast in the Parliamentary Restaurant featuring, among others, Dr. Jackie Dawson, chair of the drafting group for the statement focusing on Arctic sustainability. The leaders then met with Minister Kirsty Duncan in the Library of Parliament in order to present and discuss the 2018 G7 Action Plan.

The G7 Academies then proceeded into meetings to finalize the two statements.



The G7 Academy Leaders and RSC President, Chad Gaffield, with the Honourable Kirsty Duncan on March 20, 2018, in the Library of Parliament.

OUR DIGITAL FUTURE – APRIL 26: Ottawa



"Our Digital Future" was the first of two events in the 2018 G7 calendar related to digital technologies. The summit took place on April 26th at the National Research Council in Ottawa. The programme first addressed Transparency and Openness in the context of the current digital transformation. The second portion of the program addressed Inclusion and Equity of Access. During the proceedings, the statements of the G7 Science Academies were presented by the RSC to the Honourable Kirsty Duncan (left) and to Mr. Peter Boehm (right), Canada's G7 Sherpa.





STATEMENT OF THE G7 SCIENCE ACADEMIES

REALISING OUR DIGITAL FUTURE AND SHAPING ITS IMPACT ON KNOWLEDGE, INDUSTRY, AND THE WORKFORCE

Executive Summary

Digital technologies are transforming the early 21st century, leading to the creation of entirely new industries based upon machine learning and artificial intelligence and lowering barriers to participation in and access to data, education, and communication tools for citizens around the world. It is believed that international cooperation will be essential in key areas of security, accessibility, and regulation to secure a digital future that is inclusive, democratically governed and ethically minded in which open data and reliable information can circulate. With these objectives, the Academies propose the following principles of action:

- Inclusion and access with the goal of equal opportunity to participate in and gain from the digital transformation, to channel gains equitably and eliminate digital divides.
- Information literacy relying on a comprehensive educational plan for all age groups with the objective of providing skills and tools allowing citizens to critically interpret, verify and validate the quality of information circulating in the digital infrastructure.
- Quality of tools and standards through robust mechanisms for production, validation, access and dissemination of open data, information and machine learning systems, to strengthen reliability and security, preventing tampering, manipulation and privatizing use of data and ensuring that machine learning algorithms are interpretable by non-specialists.
- Democratic governance in the form of regulatory frameworks to set up an oversight of internet service providers, social media and other entities and prevent private monopolistic or oligopolistic power in the digital economy and to ensure open and neutral internet, protection of digital data and respect for norms of individual privacy.
- Employment and training policies to encourage new economic activities, foster emerging technological sectors and ensure that the benefits of new technologies also be distributed to workers and that schemes be available for their training and reemployment.
- Ethics and human values should guide the development of digital technologies, artificial intelligence and big data analytics and intervene in all stages of digital innovations to preserve values of freedom, democracy, justice and trust.



REALISING OUR DIGITAL FUTURE AND SHAPING ITS IMPACT ON KNOWLEDGE, INDUSTRY, AND THE WORKFORCE

The promises and challenges of the digital revolution continue to expand and change, making the precise character of our digital future profoundly uncertain. We must urgently focus on key policy challenges and principles for action in order to make optimal decisions and choices for realizing our digital future and shaping its impact on knowledge, industry and the workforce. This statement highlights these challenges and principles by drawing upon insights and evidence from across scientific and scholarly fields.

Civil society groups, governments, businesses and individuals have been embracing information and communication technologies (ICTs) in digital tools that drive innovation, economic growth, and social prosperity. These tools support the capturing of data to drive insight and knowledge creation while facilitating access to information, collaboration, learning, discovery, and sharing across geographical distances and national borders. Technologies such as artificial intelligence, machine learning, crowdsourcing, big data analytics, blockchain, digital transactions, and automation increase efficiencies in production and service delivery, change the nature of work, and make new business models possible. Future developments, including quantum computing, may accelerate these changes. New ways of conducting science, learning and collaboration across all research fields emerge from increasing insights from data.

At the same time, potential vulnerabilities and perils expand and change with the increasing importance of the digital revolution. Digital technologies disrupt existing business practices, social structures, and economic relationships. Such technologies reshape economies, changing the boundaries between market and non-market activities, disrupting jobs, reducing individual agency in decision-making, diminishing control over personal data, and devaluing labour. The rate and scale of change brought about by the digital revolution magnify the challenges for those unable to take advantage of its opportunities or disproportionately affected by rapid transformations. As ICT developments increasingly affect individual and collective decision-making and understandings of the world, those without adequate digital literacy are seriously disadvantaged. Accordingly, a central challenge of our time consists of harnessing this wave of widespread disruption to ensure that benefits are distributed equitably, that deleterious effects and vulnerabilities are addressed, and that increasing risks are contained.

Governments around the world have been preparing for the digital future, working in partnership with international organizations, national scientific academies, and other agencies. Initiatives are underway to better reflect social needs as tomorrow's digital technologies and information resources are developed.

Strategies to enable universal access to the tools and networks that power digital economies and support social inclusion are being implemented, albeit unevenly. Individuals, businesses, civil society, and governments are now positioned to reap massive benefits from the adoption of digital technologies by collectively recognizing, critically reflecting upon, and addressing five policy challenges.



REALISING OUR DIGITAL FUTURE AND SHAPING ITS IMPACT ON KNOWLEDGE, INDUSTRY, AND THE WORKFORCE: POLICY CHALLENGES

1. Inclusion and Equity of Access: The digital revolution presents tremendous opportunities to reduce socio-economic inequalities within and among countries. At the same time, accessibility gaps and forms of polarization are intensifying existing stratification between ‘winning’ and ‘losing’ economic sectors, businesses, social groups, and even societies—thereby potentially excluding significant parts of humankind from the gains of this revolution. Educational and infrastructure programs to grant all citizens access to digital skills needed for jobs of the future; to high-speed internet; and to media and information literacy remain underfunded or underdeveloped. Digital inequities are particularly evident in remote, rural, and poor communities. Social media platforms and online forums, valued for enabling the free exchange of ideas and networked social interaction, have also become spaces in which some citizens (disproportionately women, Indigenous peoples, racialized communities, and diverse vulnerable groups) experience harassment and abuse. Technological interfaces designed for some groups of users but not others can curtail the ability and willingness of citizens to participate in digitally-mediated public debate.

2. Information Quality, Security, and Resilience: The quantity of data produced and disseminated through digital technologies and platforms has not yet been matched by a corresponding bolstering of procedures and norms to verify and validate the sources, quality, diversity, and technical accuracy of the data, nor by policies to protect the security and ensure the resilience of digital infrastructure. All major infrastructure systems have become digitally-based and have major cyber vulnerabilities. Public understanding of key issues and problems may be stagnating in some areas (such as climate change or vaccinations) as information bubbles have proliferated. The potential for subtle or covert manipulation of public opinion is growing, while public confidence and trust in traditional sources of information and knowledge (such as scientific bodies and media of record) erodes. As dependence on data, ICTs and their related systems grows, so does the significance of their vulnerabilities and potential failures.

3. Transparency, Openness, and Interoperability: Many recent technological transformations have appropriated personal data, fostered proprietary standards, or utilized “black boxed” algorithms. Examples include social scoring to quantify individual risk, shortlisting of job candidates, setting of prices for online transactions, and the selection of optimized and suppressed information in social media. The lack of regulatory structures to ensure oversight, transparency, interoperability, interpretability, and scrutiny of digital data and its uses presents a challenge to democratic principles of openness and accountability. Where the complexity of some systems, such as those based on deep learning, makes their outputs difficult to explain, new approaches to ensuring openness and accountability may be required, based on understanding how these systems work in practice.

4. The Future of Work: Driven by developments in artificial intelligence and machine learning, digital technologies and business strategies are leading to the automation or replacement of jobs across various skills and economic sectors, while creating a variety of new jobs and augmenting the abilities of workers to perform in existing and emerging industries. The ultimate effects of these changes depend on the direction of technological innovation, and how workers, employers, and policy makers respond to it. The evidence thus far shows that the resulting disruption is producing an uneven distribution of work-related gains and losses within and between societies, in terms of job security, wages, working time, or entrepreneurial opportunities.



5. Ethics: Digital capacities have outpaced the institutional arrangements and public understanding on which normative frameworks can be based to ensure that innovation respects principles of public good and human welfare. The fact that something can be done does not necessarily imply that it should be done, notably in the absence of clearly defined ethical guidelines (in the cases of autonomous systems and weaponized artificial intelligence, for instance). The shift from analogue to digital life demands new ethical frameworks to address new fundamental questions regarding the reconciliation of digital technologies to human values, the consequences of human interactions with intelligent machines, and the meaning of responsible innovation.

PRINCIPLES FOR ACTION

Broad engagement across civil society, industry and governments will be essential to collectively address the five policy challenges noted above, and thereby to realize the potential of the digital revolution to enhance quality of life for everyone. Equity, inclusion, security, and prosperity in our digital world is the responsibility of all. We suggest the following principles for action.

1. Inclusion and Access: The goal of equal opportunity for all to participate in and gain from digital transformations requires consultative design and continuing public dialogue and public programs. Public programs should aim to disseminate technical skills and make data and digital infrastructure accessible to citizens regardless of geographical location or socio-economic status. It is essential to measure and monitor inclusivity in emerging technological areas. Public programs are essential to channel the gains of technological disruption equitably across societies, while preventing disruption from disproportionately affecting vulnerable segments of the population and workforce. While progress has been made on this front, digital divides persist and must be eliminated as a matter of priority.

2. Information Literacy: In addition to access to data, citizens need general digital skills and tools. Citizens now require increasing familiarity with ethical issues surrounding the uses and applications of ICTs, and critical literacy to interpret and validate the quality of information. Among multiple benefits, such capacity can help guard against false claims and coordinated disinformation campaigns. Citizens should be able and encouraged to participate in online interaction through which they can express their opinions and disseminate information. In this way, digital public spaces such as social media platforms can better find a balance between two fundamental democratic norms—protecting freedom of expression and eliminating hate speech. Comprehensive education to develop such digital literacy skills is required for all ages.

3. Quality of Tools and Standards: Robust mechanisms, procedures, and standards for the production, validation, and dissemination of data and information are needed to strengthen data reliability, infrastructure security and resilience, interoperability, accessibility, transparency, and factual accuracy. This could include new standards or guidance to create trustworthy and resilient cybersecurity systems. At the same time, action is required to prevent tampering, manipulation, and arbitrary or privatizing uses of data and digital infrastructure. Quality control measures and open standards are essential for effective evidence-based scientific research and societal decision-making, and to secure citizens' trust in democratic institutions. Long-term preservation and curation of data resources are essential. Such measures and standards must be co-designed, implemented and enforced by stakeholders within governmental and international organizations, the private sector, and civil society. Developers should ensure that machine learning methods and algorithms are interpretable by non-specialists and thus open to public scrutiny.



4. Democratic Governance: Regulatory frameworks and policies are needed to provide democratically governed oversight of internet service providers, social media corporations and other entities that serve as gatekeepers and data stewards. The emergence of private monopolistic or oligopolistic power in the digital economy should be prevented in order to safeguard the principles of an open and neutral internet. It is vital to ensure service neutrality and to ensure the protection of digital data to respect norms of individual privacy and safety while preserving data in the public domain. Patterns of data use in the 21st century have led to a reflection on ownership and control of personal data and information by the individual; humans and their digital selves must enjoy rights to dignity and respect. International cooperation will be essential to the implementation of this principle.

5. Employment and Training: Appropriate public policies and private investment models must encourage new economic activities and employment opportunities, and foster the growth of small- and medium-sized players, as well as fund and support—through tax incentives or targeted strategic investments—training and re-employment opportunities for workers. Education, training, and mentoring are needed to complement technical knowledge. Such opportunities should also address creativity, innovation, adaptability, and interpersonal skills to adjust to changing labour markets. Policies should ensure that the benefits of new technologies be distributed to workers in the form of reduced or more flexible working hours, higher wages, and better working conditions. These benefits should also contribute to societal needs via appropriate tax policies.

6. Ethics and Human Values: Appropriate ethical models must guide the development of digital and computationally-based technologies, artificial intelligence and the use of big data. Innovation should be pursued within a framework of ethical considerations regarding human welfare and ecological preservation. Shared social norms, moral frameworks, and technical principles—such as open data standards, responsible technological development, and the protection of nature—are essential to our global digital future.

CONCLUSION

The digital revolution is transforming the early 21st century, leading to the creation of entirely new industries based upon artificial intelligence and machine learning, and lowering barriers to participation in and access to data, education, and communication tools for citizens around the world. By drawing upon insights and evidence from across scientific and scholarly fields to address specific policy challenges and guided by the principles highlighted in this statement, we believe that significant gains can be harnessed and optimized, via national and regional governments and institutions, civil society and private sector actors. International cooperation will be essential in key areas of security, accessibility, and regulation. Our Academies intend to continue our efforts to inform this process and contribute to ongoing communication and international collaboration amongst all stakeholders. Together, we can secure a digital future that is inclusive, democratically governed, ethically minded, and in which open data and reliable information can circulate—that is, a future in which all citizens will be equipped to respond to challenges and take advantages of emerging opportunities.



ARCTIC SUSTAINABILITY SUMMIT

As a major component of the G7 Research Summit Series throughout 2018, the Arctic Sustainability Summit will occur on May 23 and 24 at the Palais des Congrès in Montreal. The objective of the summit is to gather domestic and international leaders to envision a future of Arctic sustainability that gives life to the G7 Science Academies' declaration entitled "The Global Arctic: the sustainability of northern communities in the context of changing ocean systems".

On May 23, the programme will begin with the International Council for Science (ICSU) and Future Earth providing a global perspective, and then shifts to Inuit Tapiriit Kanatami President Natan Obed (invited) to describe the impact of climate change on Inuit in Canada and an emerging research agenda for the Arctic that includes all ways of knowing – natural, social and indigenous. Oceans have immense impact on the climate, and these implications – biophysical and socio-economic – are explored in the morning of Day 1.

In the afternoon, a panel will examine the ways that the natural environment increasingly demands closer collaboration – across countries, across cultures, and across disciplines. Day 1 of the Summit closes with the Royal Society of Canada's Romanowski Lecture. Following the context-setting on Day 1, Day 2 turns our focus to the future.

Taking stock of the scientific legacies of the Arctic, Day 2 features the voices of students and scientists who are envisioning the ways that, together, we will address pressing challenges in the Arctic through education, training, and preparing the next generation of science and scientists. The morning will begin with the Rutherford Memorial Lecture, followed by a shift in focus to training capacity and accessible science.

The afternoon foregrounds emerging student voices, as well as representatives of agencies that play lead role in relation to science and its application in the Arctic. The day will close with a keynote that emphasizes the interconnectedness of the Arctic, as well as the formal presentation of the G7 Arctic declaration to the Government of Canada.



ARCTIC SUSTAINABILITY SUMMIT

MAY 23, 24, 2018 | PALAIS DES CONGRÈS | MONTREAL, QUÉBEC

DAY 1 – Wednesday, MAY 23

TIME	EVENT	SPEAKER
8:00 a.m. – 5:00 p.m.	Registration	
8:30 a.m. – 8:45 a.m.	Acknowledgement of Traditional Territory	Otistsakenren Patton, <i>Elder from the Mohawk Council of Kahnawà:ke</i>
8:45 a.m. – 9:00 a.m.	Welcoming Remarks	Chad Gaffield, <i>President, The Royal Society of Canada</i> Rémi Quirion, <i>Chief Scientist of Quebec</i>
9:00 a.m. – 9:45 a.m.	Global Perspectives & Future Earth	Gordon McBean, <i>President, ICSU</i> Amy Luers, <i>Executive Director, Future Earth</i> Gail Whiteman, <i>Professor-in-Residence, World Business Council for Sustainable Development</i>
9:45 a.m. – 10:30 am.	Opening Keynote	Natan Obed, <i>President, Inuit Tapiriit Kanatami</i>
10:30 a.m. – 11:00 a.m.	<i>Health and Networking Break</i>	
11:00 a.m. – 11:45 a.m.	Arctic Climate Change and Global Implications	Jean Lemire, <i>Envoy for Climate Change, Northern and Arctic Affairs</i> Don Lemmen, <i>Manager, Research and Scientific Assessment, Natural Resources Canada</i> Louis Fortier, <i>Science and Innovation Director, Institut nordique du Québec and ArcticNet</i>
	Moderator:	Eric Wolff, <i>Royal Society Professor, Cambridge University</i>
11:45 a.m. – 12:30 p.m.	The Changing Arctic Ocean – biophysical and socio-economic implications	Jane Francis, <i>Director, British Antarctic Survey</i> Jackie Dawson, <i>Associate Professor, University of Ottawa</i> Jeff Maurice, <i>Policy Advisor, Fisheries, Nunavut Tunngavik Inc.</i>
	Moderator:	Mona Nemer, <i>Canada's Chief Science Advisor</i>



12:30 p.m. – 1:45 p.m.

Networking Lunch

1:45 p.m. – 2:30 p.m.

Healthy Oceans,
Healthy Communities,
Healthy Peoples

Norma Kassi, *Director Indigenous Collaboration, Arctic Institute of Community-Based Research*

Andrey Petrov, *University of Northern Iowa*

Sherilee Harper, *Assistant Professor, University of Guelph*

Ashlee Cunsolo, *Director, Labrador Institute*

Moderator:

TBC

2:30 p.m. – 3:15 p.m.

Science Sovereignty in
the Arctic

Scot Nickels, *Director, Inuit Qaujisarvingat, Inuit Tapiriit Kanatami*

Ashlee Cunsolo, *Director, Labrador Institute*

Bronwyn Hancock, *Associate Vice President of Research Development, Yukon College*

Moderator:

Tim Argetsinger, *Executive Political Advisor, Inuit Tapiriit Kanatami*

3:15 p.m. – 3:45 p.m.

Health and Networking Break

3:45 p.m. – 4:30 p.m.

Enhanced Research-
Technology and Policy
Cooperation

Martin Fortier, *Executive Director, Sentinel North Université Laval*

Henry Burgess, *Head of Natural Environment Research Council Arctic Office, United Kingdom*

Ian Mauro, *Principal, Richardson College for the Environment, University of Winnipeg*

Moderator:

Maria Uhle, *Program Director for International Activities, National Science Foundation*

4:30 p.m. – 5:15 p.m.

Royal Society of
Canada Romanowski
Lecture: Canada's
Arctic Wildlife and
Climate Change

Mark Boyce

Moderator:

Cristiana Paşca Palmer, *Executive Secretary of the Secretariat of the Convention on Biological Diversity (tbc)*

5:15 p.m. – 7:30 p.m.

Reception

Performance of Innu poetess Natasha Kanapé Fontaine



ARCTIC SUSTAINABILITY SUMMIT

MAY 23, 24, 2018 | PALAIS DES CONGRÈS | MONTREAL, QUÉBEC

DAY 2 – Thursday, MAY 24

TIME	EVENT	SPEAKER
8:00 a.m. – 3:00 p.m.	Registration	
8:30 a.m. – 9:00 a.m.	Opening	
9:00 a.m. – 9:45 a.m.	Rutherford Memorial Lecture Moderator:	Eric Wolff, <i>Royal Society Professor, Cambridge University</i> Rémi Quirion, <i>Chief Scientist of Quebec</i>
9:45 a.m. – 10:15 a.m.	<i>Health and networking break</i>	
10:15 a.m. – 11:00 a.m.	Accessible, Usable, and Timely Science Moderator:	Gregor Gilbert, <i>Senior Resource Development Department Coordinator, Makivik Corporation</i> Jamie Snook, <i>Executive Director, Torngat Wildlife, Plants and Fisheries Secretariat</i> Deborah McGregor, <i>Associate Professor & Canada Research Chair in Indigenous Environmental Justice, York University</i> Louis Fortier, <i>Science and Innovation Director, Institut nordique du Québec and ArcticNet</i>
11:00 a.m. – 11:45 p.m.	Training & Science Capacity in the North, By the North, For the North Moderator:	Karla Jessen Williamson, <i>Assistant Professor, Educational Foundations, University of Saskatchewan</i> Erin Freeland, <i>Director, Dechinta Centre for Research and Learning</i> Karsten Henriksen, <i>Vice President, Nunavut Arctic College</i> tbc
11:45 a.m. – 1:00 p.m.	<i>Networking Lunch</i>	



1:00 p.m. – 1:45 p.m.

The Student Perspective

Glenda Sandy, *Master's candidate in Community Health, Université Laval*

Gwyneth Anne McMillan, *Doctoral candidate in biological sciences, University of Montreal*

Nicolò Giordano, *Postdoctoral Fellow, Centre Eau-Terre-Environnement, INRS-ETE*

Marianne Falardeau Côté, *PhD candidate, Department of Natural Resource Sciences, McGill University*

Moderator:

Karla Jessen Williamson, *Assistant Professor, Educational Foundations, University of Saskatchewan*

1:45 p.m. – 2:30 p.m.

The Future of Arctic Science and the National Inuit Strategy on Research

Tim Argetsinger, *Executive Political Advisor, Inuit Tapiriit Kanatami*

Leah Braithwaite, *Executive Director, ArcticNet*

Dominique Bérubé, *Vice-President Research programs, SSHRC*

Moderator:

David Scott, *President and CEO, Polar Knowledge Canada*

2:30 p.m. – 3:00 p.m.

Health and Networking Break

3:00 p.m. – 3:30 p.m.

Keynote

Her Excellency the Right Honourable Julie Payette, *Governor General of Canada*

3:30 p.m. – 4:00 p.m.

Closing

Chad Gaffield, *President, The Royal Society of Canada*

4:00 p.m. – 7:00 p.m.

Joint reception hosted by the Royal Society of Canada, the Fonds de recherche du Québec and INQSA





STATEMENT OF THE G7 ACADEMIES

THE GLOBAL ARCTIC: THE SUSTAINABILITY OF COMMUNITIES IN THE CONTEXT OF CHANGING OCEAN SYSTEMS

Executive Summary

The Arctic is being profoundly transformed by climate change. This has implications on terrestrial and marine ecosystems, affecting those who live on and from them. It is time to develop a shared scientific vision to protect these vital ecosystems as best we can, produce science for evidence-based decision-making and enhance collaborative scientific investigations of these issues. The G7 Academies propose the following:

- Research cooperation relying on augmented interdisciplinary research supported by large scale international science initiatives in combination with cooperative decision-making among Arctic nations;
- Training individuals from a diversity of fields and backgrounds, including those residing in the Arctic, to ensure the necessary scientific capacity to address global and local issues;
- Accessible, usable and timely science databases that can be shared among all stakeholders and decision makers;
- Programs on remote sensing linked with in-situ monitoring activities integrating sustained high-inclination satellite missions, new technologies for underwater measurements and regionally-integrated in-situ monitoring that incorporates local knowledge.



THE GLOBAL ARCTIC: THE SUSTAINABILITY OF COMMUNITIES IN THE CONTEXT OF CHANGING OCEAN SYSTEMS

A Changing Arctic Ocean and Ecosystems

Arctic air temperature is increasing at twice the rate of the global average, equating to an approximate 2°C increase over the course of the 20th century. Since satellite measurements began in 1979, Arctic sea ice extent has declined in all months of the year and at an astonishing rate of 13.2% per decade for the month of September (or 86,100 square kilometers per year). These changes have global consequences for ocean temperatures, salinity, water circulation and acidification. Particularly significant is the Greenland ice sheet, which has been losing about 270 billion tons of ice every year since the early 2000s, and as a result now contributes to around 25% of global mean sea level rise. Fresh water increases in the Arctic due to sea ice melting, Greenland ice mass loss, and Siberian river runoff alter Arctic ocean circulation patterns, and impact air-sea interactions and related chemical exchange processes that can have consequences on a global scale.

Changes to the Arctic climate system have resulted in less predictable weather patterns; sea ice formation occurring later, earlier sea ice break-up; melting of glaciers; thawing permafrost, with the potential increase of methane release; increased coastal and soil erosion. Most researchers expect that, due to climate change, the Arctic will become largely free of sea ice (i.e. less than 1 million km² in extent) during the summer months sometime between 2030 and 2070, profoundly transforming regional and global environmental processes. All of these factors will result in profound changes to important feedback loops such as when sea ice, which reflects light, turns to open water that absorbs heat – meaning that climate change will continue in the region and at an accelerated rate. Furthermore, there will be a significant shift in the abundance of species, their seasonal occurrence and geographic distribution, thereby affecting Arctic food webs and local food security.

Healthy Oceans, Healthy Communities, and Healthy Peoples

The Arctic is being significantly impacted by climate change. Biophysical impacts related to changing temperature, precipitation, extreme weather events, sea ice, and permafrost will have implications for terrestrial and marine ecosystems, which in turn have consequences for the health and well-being of the numerous coastal communities in the region. All communities in the Arctic will be affected as they rely on the services of healthy ecosystems for hunting, fishing, local economic enterprises, as well as for physical and mental health. The seaways enable bulk maritime re-supply with essential north/south and international economic connections that are fundamental to domestic and international trade. There is also a strong and vibrant Indigenous presence in many communities across the Arctic where cultural networks transcend national borders, where travel over water and importantly over sea ice has occurred for thousands of years, and where connections to a healthy ocean are entwined in the cultural fabric and well-being of local society.



THE GLOBAL ARCTIC: THE SUSTAINABILITY OF COMMUNITIES IN THE CONTEXT OF CHANGING OCEAN SYSTEMS

Sovereignty, Security and Sustainability

The changing Arctic Ocean also has major implications for global security, national sovereignty, and international trade related to: increased access to new global marine trade and transportation routes; lengthened ice-free shipping seasons; and increased opportunities and pressures related to Arctic tourism, Arctic fisheries and natural resource development. It is predicted that climate-related changes to the Arctic regions could stimulate investments ranging from US\$ 85-265bn over the next decade, offering the potential for significant and long-term sustainability opportunities for communities and governments in the region. However, with these largely climate change-induced socio-economic changes come increased potential risks such as: oil spills, shipping disasters and environmental contamination with subsequent public health risks, as well as the potential for the introduction of invasive species. There are also ramifications for search and rescue operations, human safety, mortality, and morbidity, together with impacts to infrastructure and livelihoods in the North. There are also risks related to local capacity, whereby larger global forces may overwhelm and impede locally led initiatives.

While the Arctic marine environment sustains unique and globally important ecosystems, it remains among the least-understood basins and bodies of water in the world. This lack of scientific understanding is concerning, as changes to the Arctic Ocean have complex and wide-reaching biophysical implications for local and global environmental processes. They also have significant repercussions for the health and well-being of local communities, and they could influence the future of global maritime trade, and with it, the potential for altered global power relations.

Sharing a Scientific Vision for Peoples and Marine Environments

The G7 Academies stress the critical need to support and enhance basic Arctic research endeavours and cooperation that promote healthy and thriving coastal communities in the context of changing ocean systems. To address this need, the G7 Academies propose a vision of broad international collaboration that includes natural, social, and health sciences, engineering, humanities, and Indigenous knowledge in order to:

- Understand how climate change and human activities impact vital Arctic ecosystems;
- Develop innovative and interdisciplinary approaches and technologies to address these challenges;
- Use this knowledge to enable rich and robust evidence-based decision-making to inform decisions and manage and minimize environmental and sociological impacts.



The G7 Academies recommend:

1. Research Cooperation

- Funding considerably more international and interdisciplinary research, including Indigenous knowledge, in both natural and social sciences to ensure that sound scientific, environmental and societal decisions are made for future development and the well-being of all;
- Developing innovative conservation and governance approaches to support the health and well-being of Arctic ecosystems.

2. Building Science Capacity

- Training individuals from a diversity of fields and backgrounds that will ensure the necessary expertise is available internationally;
- Training those residing in the Arctic is essential: this will incorporate locally-driven science questions and foster development of circumpolar research infrastructure.

3. Accessibility of Information

- Develop interoperable and open data-sharing platforms and sample-archiving systems;
- Provide appropriate communication infrastructure that enables information sharing in a timely manner and is usable by diverse communities.

4. Enhanced and Linked Remote Sensing and in-situ Monitoring Programs

- Continue high-inclination satellite missions dedicated to monitoring long term changes in terrestrial ecosystems, as well as in ice and ocean conditions; this would also ensure safe and optimal navigation across the Arctic;
- Extend the development of research vessels, and autonomous vehicles, platforms, cabled observatories and sensors that operate in open water, under the sea ice and on the ocean floor;
- Integrate these broader scale systems with regionally-integrated in-situ monitoring programs that incorporate local knowledge.



THE RSC'S INTERNATIONAL ENGAGEMENT STRATEGY

Following a year-long period of consultation with the membership, The Royal Society of Canada has established three strategic priorities for the next five years: (1) mobilizing the membership to engage across research fields, generations, Canada and the world on societal issues; (2) catalyzing new contributions through convening national institutions, agencies and international players to provide advice on critical issues; (3) sustaining the momentum of 135 years of history of the RSC through an effective and efficient organizational structure made sustainable through its expanded role.

The RSC will implement these priorities through specific initiatives within Canada and beyond. Internationally, the RSC will mobilize the membership to achieve four goals: (1) Address major global challenges collaboratively by catalyzing new contributions, (2) Advance inclusive excellence through international cooperation, (3) Contribute to the defense of human rights, and (4) Monitor emerging trends of research globally to sustain momentum during the coming years.

1. The RSC will address major global challenges collaboratively by mobilizing its multidisciplinary and multigenerational leadership with other National Academies to understand the current state of knowledge; to identify research or knowledge gaps in technology and policy development; and to share approaches and action plans to address some of the world's most pressing issues.
2. The RSC will advance inclusive excellence through international collaboration. In proactively updating our own practices with respect to gender, diversity and inclusion, the RSC recognizes that a wide range of approaches are required to address these global issues. The RSC will work collaboratively with other national academies to enhance mutual learning toward more effective modes of inclusive excellence.
3. Through its Committee on Intervention, the RSC will continue its commitment to contributing to the defense of human rights through the leadership of the Human Rights Network based at the US National Academies.
4. The advisory capacity of the RSC will be marshalled in collaboration with our cohort Academies around the world to monitor emerging trends of research and provide a 'Canadian perspective' on selected advisory documents from partners such as expert panel reports.