



**COLD
REGIONS WARMING**

**A TRANSITIONS
EXHIBITION
LONDON
2020**



AN INTER-DISCIPLINARY COLLABORATION
AN ART-SCIENCE PROJECT



GLOBAL WATER FUTURES PROJECT

COLD REGIONS WARMING

An exhibition of paintings on the dramatic impacts of climate change on the Northern Hemisphere's vast cold regions focussing on Russia and Canada.

3rd-20th NOVEMBER

TRANSITIONS EXHIBITION PROJECT

ARTIST GENNADIY IVANOV
PROFESSORS JOHN POMEROY AND
TREVOR DAVIES

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**DRAWINGS
PAINTINGS**

2018-2020

Many of these drawings and paintings are exhibited at the Cold Regions Warming Exhibition by Transitions at Rossotrudnichestvo, London.
The complete actual archive collection of exhibits is available at
www.gennadiyart.weebly.com.



COLD REGIONS

In the panoply of the growing number of catastrophes caused by human-induced climate change, amongst the most dramatic are those affecting the vast cold regions in the Northern Hemisphere – with Russia and Canada holding the vast majority of global cold regions, but with repercussions around the globe. Even in these Covid-19 times, climate change is still, by far, the biggest challenge facing humanity. The very worst of possible catastrophes can still be avoided, but this demands a rapid and unprecedented mobilization of all sectors of society. Communication and representation of the challenge, and ways to inspire and inform the response, need to be more imaginative and effective. Even in today's age of mass and digital media, and much 'fake news', artists can - as they have done throughout so much of human history - play a crucial role in revealing and exhibiting difficult truths. "Art is truth" is a common cliché - sometimes contentious - but that is what is attempted in the Rossotrudnichestvo exhibition.

One of the artists at the forefront of the endeavour for visual art to embrace the challenge of global climate change is Gennadiy Ivanov. His own mantra is "art hurts"; when the truth hurts it is even more important to portray it. He is working in a unique pioneering collaboration with climate scientists Professors John Pomeroy and Trevor Davies, and the works on display result from this interdisciplinary collaboration, known as the Transitions project. Transitions is part of Global Water Futures, which is the largest university-based freshwater research programme in the world. Global Water Futures has taken a global leadership role in water science in the world's colder regions, focusing on the inter-connections amongst climate change, the hydrological cycle, snow and ice and the security of water supply and quality.

Ivanov is a prolific, sometimes controversial, artist who was born in Russia, lived in Belarus, and has been resident in the UK for the last 15 years. His techniques and styles – and exceptional imagination - are well-suited to portraying and communicating the many dimensions of what can seem to be an overwhelming challenge "Gennadiy Ivanov's paintings have a distinctive communicative power. Within the raw energy of colour and motion Gena captures his subject with elements of pure stillness - an absolute likeness suggesting sensations or emotions that are instantly recognisable. This immediacy gives Ivanov's work an unusually broad appeal, as audiences are drawn to paintings that are brilliantly beautiful and perfectly legible" (Amanda Geitner, Director of the East Anglian Art Fund, UK, 2019).

Rossotrudnichestvo Director, Anton Chesnokov, says "One of the most noticeable features of the current pandemic crisis is that, for many, it has highlighted – almost changing the narrative for – the existing, and growing, threat of climate change. I am so pleased to host a genuinely groundbreaking exhibition that, for the first time, extends the art-science narrative into those vast circumpolar tracts of land shared by Russia and Canada, which are unique in their susceptibility to climate change and in the severity of the change they are experiencing. That we have a Russian-born artist, the Canadian Director of Global Water Futures, and a UK climate scientist bringing this exhibition to our London home seems particularly apposite".

Russia and Canada together hold the overwhelming majority of the world's permafrost and boreal forest (taiga) zones. They also have many mountain glaciers and ice-sheets. Large regions of these zones, in both countries, have recently experienced warming rates, due to human-kind's emissions of greenhouse gases, which are amongst the very highest on the planet. The impact of melting and thawing on these important and sensitive landscapes and biomes has been dramatic; it will progress at an accelerating rate. Ivanov and his two science colleagues have worked together, in the field, in some of these landscapes to capture the essence of these impacts in visual art, producing impressions and imaginations of the forms, the significance of which has been identified by the dictating science, and which short narratives of the relevant science accompany. Videos will show how Ivanov, informed by his colleagues, produces field paintings sometimes in difficult conditions which form the basis for many of his larger impressionistic and allegorical oil paintings. Tapes of music from new compositions by Edwin Pope, especially produced to accompany the paintings, will be played.



WARMING

Headlines on the impacts of climate change on these cold regions are now commonplace. In June this year was the extraordinary observation of over 38o C at Verkhoyansk in the Russian Arctic. Reports of record occurrences of forest and peat fires in both countries are tied to pervasive droughts and heat waves and vie with stories of unprecedented floods - often leading to major infrastructure damage. Major shifts in temperature are changing the amounts and distribution of snow- and rainfall throughout the year, increasing melting of snow- and ice-cover, and a dramatic overall reduction in the area of reflective snow and ice are having major impacts on the hydrological cycle and on feedbacks to the climate system. Water availability and quality have suffered serious disruption affecting fisheries, power supply, and agriculture in contiguous areas.

This increase in the frequency of severe events in recent decades is set against the back-drop of longer-term reductions, over a century or more, in both countries, in the volume of glaciers and ice-sheets. In some regions this means that recent severe events are compounding longer-term trends in water supply.

One of the most dramatic impacts of human-induced warming has been the melting of large tracts of permafrost, leading to ground instability, slumping, opening up of large holes in the ground, and the shifting and collapse of forests. Witnessing these events can invoke apocalyptic impressions. There can be serious impacts on infrastructure; the collapse of a fuel tank at a power plant in Norilsk in Russia this summer led to the spill of 20,000 tonnes of diesel into a river. The release of methane from thawing permafrost has been recorded in both countries and represents a highly uncertain but potentially massive increase in greenhouse gas emissions.

The permafrost and boreal landscapes are changing, but the way the ecosystems work are also changing; for example, insect attack is increasing tree mortality in the Canadian boreal forest. Vast tracts of forest are destroyed in ravaging fires, which can take decades to recover.

Perhaps because they are more attuned to their historic homelands, but also because many of them are directly impacted because of changes to their traditional lifestyles, many indigenous peoples are acutely aware of the devastating impacts of human-induced climate change and fearful of the devastation still to come. The Chief of the Gwich'in people in north-western Canada said "it is like watching a nuclear explosion in slow motion" whilst declaring a state of emergency due to climate change.

But it is all of us who should be fearful of the impacts of climate change in cold regions. The permafrost zone is a vast store of carbon. Permafrost melting releases the powerful warming gases carbon dioxide and methane which will significantly contribute to further global warming. Tundra stores carbon during the summer and releases some during the winter, but research has shown that the release of carbon in winter is now starting to outweigh the summer-time storage; again increasing the greenhouse gas burden in the atmosphere. The boreal forest zones are particularly important stores of carbon; permafrost melting (where permafrost underlies the forest), peat wildfires and increasing disturbances from insect attack and fires are presenting the risk that these zones are turning into sources of carbon.

Who could have missed the "Arctic on Fire" headlines in July? Increasing forest and peat fires are producing more smoke and debris, which produces palls thousands of kilometres downwind. The smoke, when deposited on glaciers and ice-sheets, reduces their reflectivity to the Sun's rays; hence accelerating their melting and enhancing localised warming. There are many such "positive feedback" mechanisms now being enacted in Russia and Canada, augmenting the already-rapid rate of climate change.

Despite the major impacts of climate change, and the undeniable cause of emissions of greenhouse gases through human activity, there is still - in some sectors and interest groups - a dismissal (at best) and a denial (at worst) of observational facts and detailed and rigorous scientific analysis and prediction.

THE TRANSITIONS TEAM

PROFESSOR JOHN POMEROY
PROFESSOR TREVOR DAVIES
ARTIST GENNADIY IVANOV

Transitions presents an art-science perspective on the climate change threats to the vast cold regions shared by Russia and Canada. The burning forests, thawing permafrost, melting glaciers and declining snow and ice cover are damaging the natural capital of the vast boreal and arctic ecosystems that support our economies and the Arctic Ocean. A rescue will require an immediate mobilization for a great common endeavour, on a scale that vastly exceeds that for any previous great cause in human history.



GLOBAL WATER FUTURES



Transitions is a Global Water Futures interdisciplinary art-science project. Global Water Futures is directed by Professor John Pomeroy and headquartered at the University of Saskatchewan in Canada. It is a trans-disciplinary, inter-institutional programme in partnership with 17 other Canadian universities and hundreds of national and international partners, including in Russia.

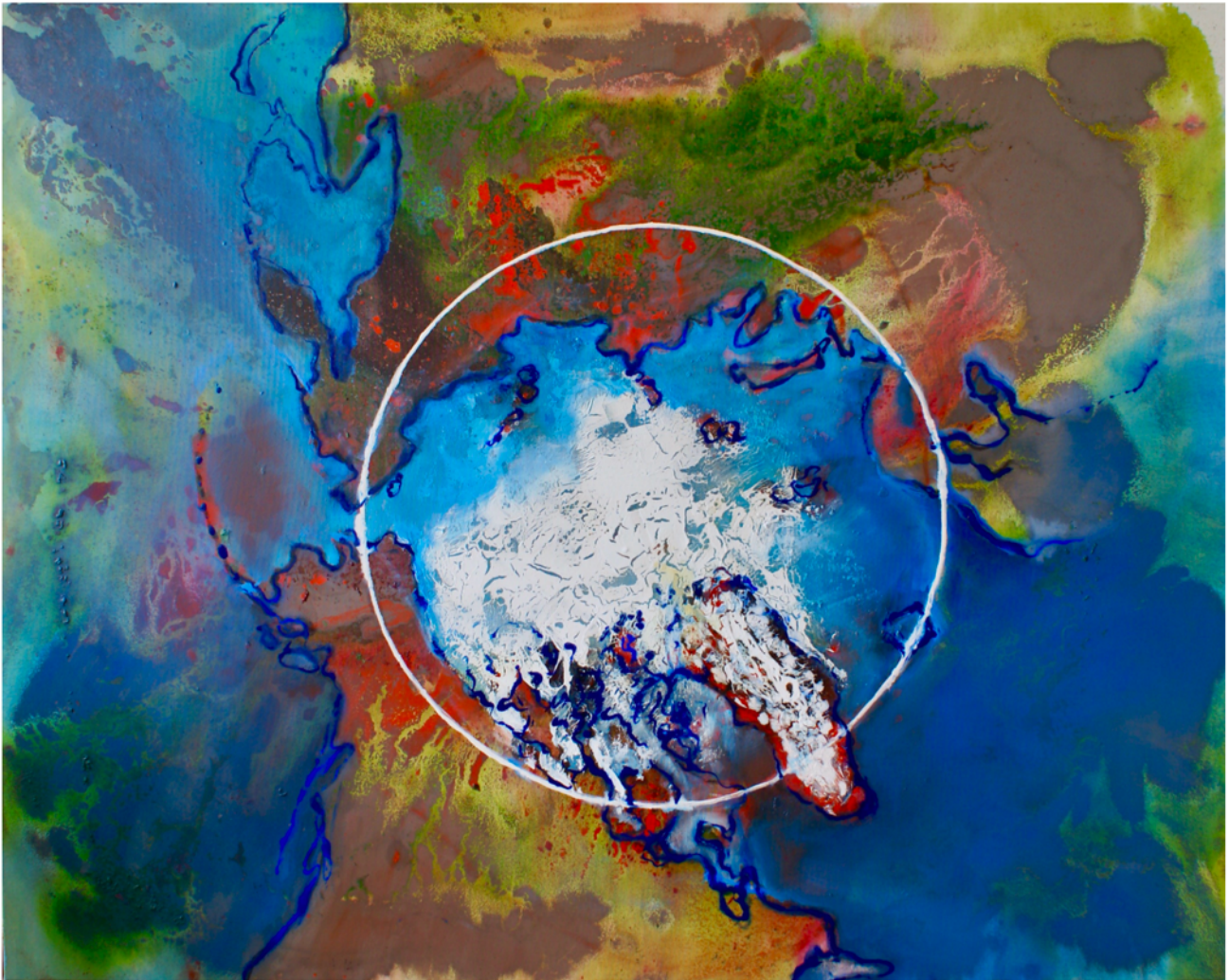
The commonalities of cold regions have long been the subject of collaborative or co-ordinated research by Russian and Canadian scientists. Both countries have developed formidable expertise in cold regions hydrology and climate science that is shared through international scientific institutions, and have worked together to develop the water, snow and climate scientific techniques and models that are global tools in preserving cold regions water security against climate change. Professor Pomeroy was recently awarded a certificate for his presentation to a Moscow conference organised by the Water Problems Institute of the Russian Academy of Sciences.

Global Water Futures is the largest university-based water science programme in the world. Its strategic aims are to demonstrate global leadership in water science in colder regions, and to address economic needs in adapting to change and managing the risks of uncertain water futures and extreme events. It is improving disaster management by extending scientific knowledge, and improving observation and modelling technologies. This is enabling greater forecasting capacity to predict the risk and severity of extreme events which are increasing due to climate change.

A critical mission is to utilise all relevant data in order to make better decisions about our water futures, and to improve models in order to assess changes in climate, land and water systems – fully accounting for human/environment interactions.

In these ways Global Water Futures is helping to reduce the risk of water threats and improve the design of climate change adaptation strategies, to the benefit of economic well-being. The programme is an important source of input to policy, governance and management of water issues in systems which are changing rapidly, much of it due to climate change. There is powerful theme of community engagement running through the programme, including with the Indigenous Communities in Canada which are profoundly impacted by changing water security.





Cold Regions Warming

Oil on canvas, 100x150 cm

The vast cold regions of Russia, especially, and Canada extend far southwards of the Arctic Circle. This summer in the Northern Hemisphere has been the hottest on record. The Arctic sea-ice is thinning and contracting. The Greenland ice-sheet is melting at unprecedented rates. Vast tracts of the permafrost zones in Russia and Canada are collapsing. Vegetation and peat fires are now extensive. The red hues in this painting of the circumpolar regions by Gennadiy Ivanov are an artistic metaphor for these dramatic changes.



Permafrost Thawing Reunites Distant Cousins

Oil on canvas, 200x150 cm

Thawing permafrost has led to more and more discoveries of woolly mammoths, especially in Siberia; some of the specimens are remarkably well-preserved. Most died out at the end of the last Ice Age, about 10,500 years ago, but some persisted on Wrangel Island in the Russian Arctic until about 4,000 years ago. Their demise was a result of climate and environmental change, but hunting by humans was also a factor.

Finds of well-preserved Cave Bears are much rarer, but a well-preserved specimen was discovered recently in the Russian Arctic Lyakhovsky Islands, dating from 22,000-39,500 years ago. Cave Bears were enormous, the largest weighing as much as 1,000kg - bigger than Polar Bear - and became extinct about 15,000 years ago. The Cave Bear lineage split from the Brown Bear lineage before the Brown Bear and Polar Bear lineages split.

There are still 22-31,000 Polar Bears in the Northern Cold Regions but, with predictions of around 30% decline over the next two decades, to many, the Polar Bear has become the icon of the threat which human-induced global warming poses for many animals.

Ivanov has brought these animals together with impressions of: meltwater cascading from water-rich permafrost in an exposed bank; a water-runnelled glacier; and the trunks of dying trees slumping as the soil becomes mobile though permafrost thawing. In the background is the Aurora Borealis.

Ivanov's juxtaposition of extinct and threatened animals acknowledges the role of climate change over tens of millennia, but the changes in recent decades are primarily related to human activity, are exceptionally rapid, and - unless we take strong and quick action - will be one-way.



The Peyto Glacier in Alberta, Canada, is one of the world's longest-studied glaciers. It is rapidly receding because of climate change, having lost more than 70% of its volume since the beginning of the 20th Century. In this impression by Ivanov, the remaining ice is seen in the distance, behind strange deposits of black cryoconite, and glacial silt in the foreground. The cryoconite accumulated on the ice surface and is then washed off by the copious summer meltwater; it consists of ash and soot from wildfires, bacteria, fungi and algae. Each year it darkens the glacier's surface, reducing its reflectivity, and exacerbating melt. The deposits of glacial silt are cracking in the summer heat.

Glacier Decline; Emergence of Strange New Landscape

Oil on canvas, 150x100 cm

There Was a Green Forest

Oil on canvas, 200x150 cm

The Boreal Forest, or Taiga, is also known as the snow forest. It is the world's largest biome and, territorially, Siberia and Canada dominate its distribution. Increasing temperatures lead to slumping and death of trees in permafrost-rich zones. Sometimes strange landscapes of "drunken trees" are created because of the collapsing ground. Higher temperatures are also leading to a greater frequency of forest fires razing vast tracts of forest which take a long time to regenerate. Ivanov's impression captures the elements of permafrost, dying trees and fire. Burning trees emit global warming carbon dioxide into the atmosphere. Permafrost-rich zones contain large quantities of organic carbon which did not decompose because of the low temperatures. Thawing of the permafrost, and increasing temperatures – exacerbated where the shade-providing trees have been burned - allows bacteria to decompose the stored organic matter emitting carbon dioxide and the very powerful global warming gas methane into the atmosphere. Besides the destruction of landscapes, human-induced global warming leads to powerful reinforcing "positive feedbacks" such as those described here.





Impermanent frost

Triptych, Oil on board, 240x80 cm

Because of climate change it is no longer permanent. Large swathes of the permafrost zone are thawing. The consequences are dramatic. The surface layers slide down slopes, sometimes in slow viscous rivers of mud, carrying any vegetation, including trees, with them and leaving bare scars. When the permafrost is relatively water-rich, ice within the soil is clearly visible in the exposed scar, and during warm days, water cascades out of the exposed surface. GWF scientists have examined layers in the permafrost, which are up to 15,000 years old to confirm that the thawing is unprecedented on this scale. As the permafrost thaws, vast quantities of carbon currently locked within it are released as carbon dioxide and methane, adding significantly to the concentration of global warming gases in the atmosphere. It may be such changes in the landscape, which prompted the Chief of the Gwich'in Indigenous People in Canada to proclaim that climate change "was like watching a nuclear explosion in slow motion".



Angels & Devils

Oil on canvas, 90x60 cm (I), 90x70 cm (II)

One of these impressionistic paintings, from Ivanov's imagination, serendipitously, resembles Angel Glacier on the North Face of Mount Edith Cavell in Alberta, Canada. The glacier, now receding rapidly was so-called because of its resemblance to the out-swept wings of an angel.

Also shown are swathes of dying trees – because of the impression from imagination – although, in reality, trees would not have this sort of distribution alongside and above a valley glacier. Many pine trees in mountain forests are suffering die-back because of increasing pest infestations related to climate change. Bark beetles are one of the most serious pests – the Devils.



A major reason for the increase in forest fires across the cold regions is the growing areas of dead and dying trees, representing a tinderbox primed for the ravages of fire. Amongst the most serious of pests are bark beetles attacking pine trees. Rising temperatures reduce the widespread winter die-off of beetle larvae. The beetles also hatch earlier and reproduce more frequently. Some entomologists call beetles "first responders" because they are so sensitive to climate and environmental change. In this painting Ivanov portrays swathes of dead and burnt trees; although an impressionistic painting, many photographs of forested landscapes affected by pests and ravaged by fire would give a similar impression.

Mountain Tinderbox and Ashes

Oil on canvas, 90x70 cm

For many scientists in the Global Water Futures research programme, this location is iconic – because of the dramatic scenery, and the importance of this automatic observation station, and others in the near-vicinity. The location is Fortress Mountain in the Canadian Rockies. The observation network has been built to improve understanding of rapid climate and environmental changes which have occurred in recent decades and to further develop predictive models of the effect of future climate change on the local hydrology – a particular challenge is such complex terrain.

Ivanov has produced a number of paintings of the nuclear explosion in slow motion (a phrase attributed to a Gwich'in Chief when describing what it is like to witness the profound changes caused by climate change of the landscape of his people in Northwest Territories. The cauldron where once a valley glacier flourished is the seat of Ivanov's slow nuclear explosion.

Nuclear explosion in slow motion

Oil on canvas, 150x100 cm





After a Short Winter

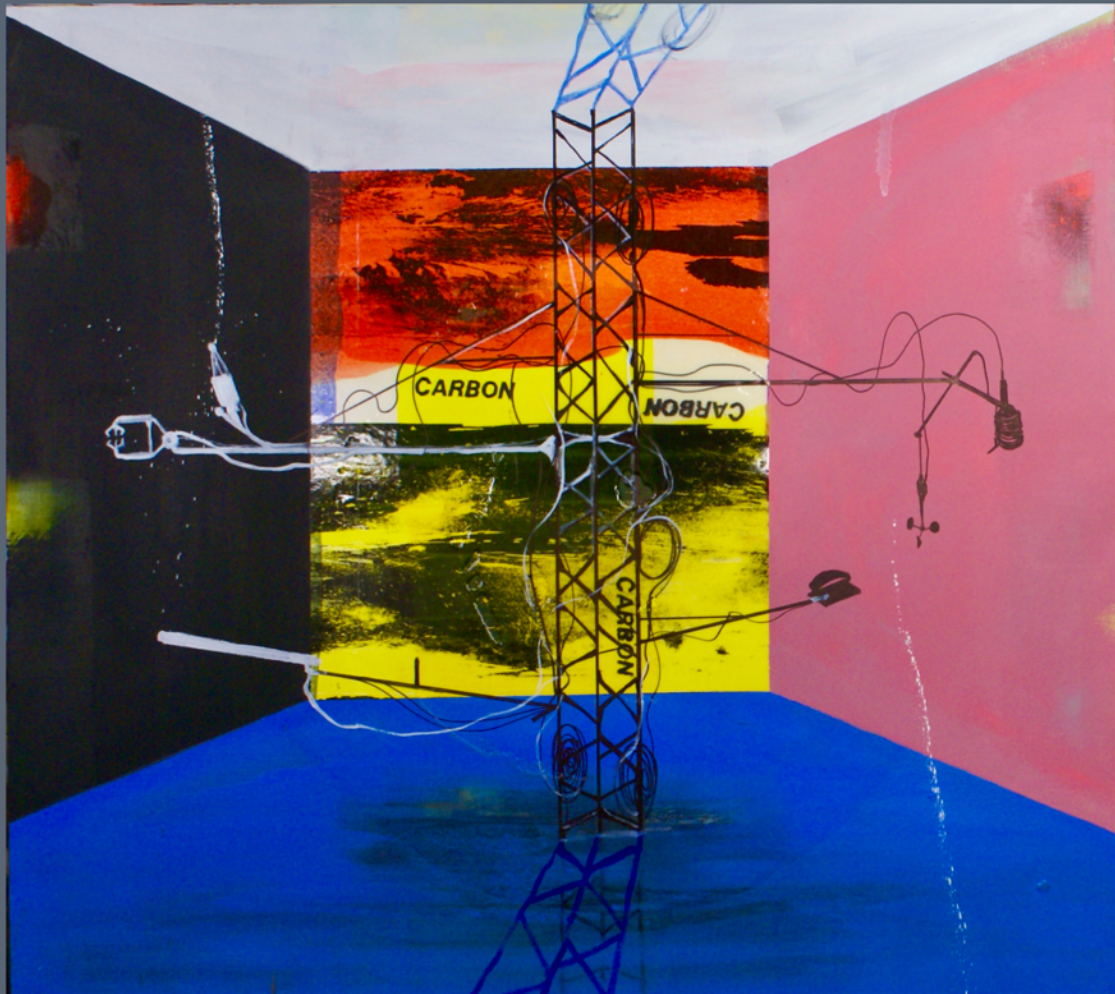
Oil on canvas, 70x90 cm

Rivers in northern Canada and Russia are normally frozen for half the year or longer. However, earlier spring river ice break-up is occurring across Russia and Canada and leading to longer ice-free seasons, warmer water temperatures, and changes to the aquatic ecosystem, including the loss of fish species that rely on cold water. Earlier river ice break-up is being triggered by warmer winters and springs, and earlier snowmelt – another indicator of the loss of cold that cold regions are experiencing around the world. Ivanov's oil on canvas captures the essence of this visually-obvious phenomenon.



"Ivanov's stunning paintings of some of our study sites in Canada has led to him being accepted by hundreds of Global Water Futures scientists as an important member of our team" says **John Pomeroy**.

"I am delighted that he is now also turning his eye, and hand, to paintings which portray the impacts of climate change in the even more vast cold region of Russia. Exhibitions of his paintings of climate impacts in Canada and the UK have been exceptionally well-received, by scientists, by artists, and all members of the public. Community involvement is an important part of the Global Water Futures strategy, so it is satisfying to read so many unsolicited complimentary Comments in the exhibition visitor books; one that really struck me was: "Beautiful, moving, great how art and science can reveal truths that people still refuse to look at. Keep going! Thank you". "One of the aspects of Global Water Futures of which I am most proud is the involvement of indigenous communities. Indigenous people have a deep understanding of how humans are part of natural ecosystems and have lived sustainably in cold regions but are disproportionately impacted by climate change. With indigenous communities we have co-developed a strategy for water research that brings together indigenous knowledge and modern science to find solutions for water security. The need for such strategies is brought forward in some of Ivanov's paintings and the accompanying descriptions".



Deniers' station

Oil on canvas, 95x90 cm

Ivanov's inspiration for this painting was the cold regions field research stations of the Global Water Futures programme. The instruments record meteorological variables including water vapour flux and carbon dioxide exchange. Ivanov has inverted the instruments since, to him, it represents the way in which climate deniers turn logic upside-down.

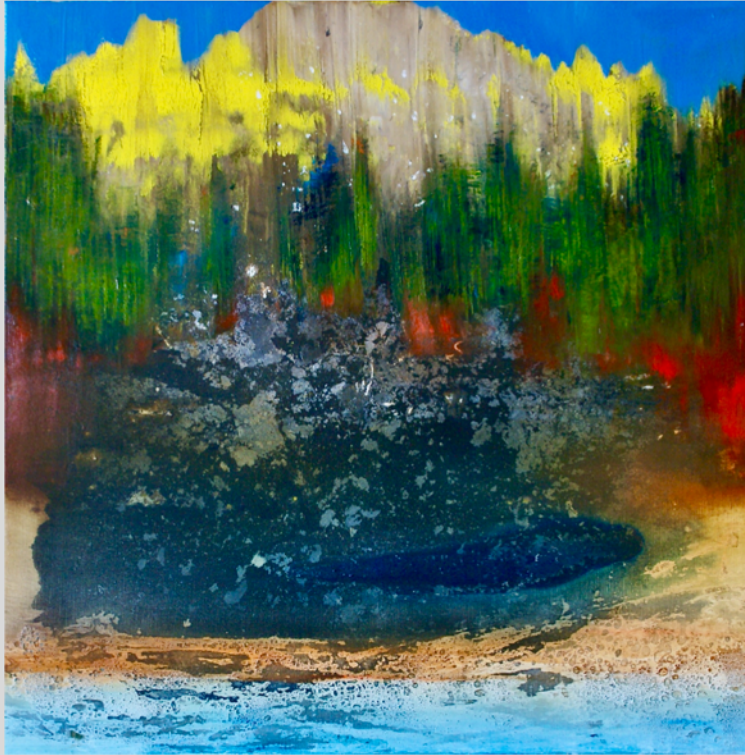


The end of the endless oil train

Oil on canvas, 90x90 cm

The oil trains traversing the Canadian Prairies seemed endless. Eventually they did end. Is this painting prophetic?

Transporting oil this way presents risks from spills and contamination. Two recent derailments in two months near Guernsey, 115 km south-east of Saskatoon, led to spills of 1.5 and 1.6 million litres of oil. These incidents can be catastrophic; the derailment of a train carrying oil from the United States in 2013 caused an explosion with a 1-km blast radius and deaths of 47 people in Lac Mégantic, Québec.



Vermillion Pass forest fire

Oil on canvas, 80x80 cm

Vermillion Pass gets its name from the colouration which originates in mineral springs of iron oxide. These ochre springs are important for the indigenous people, and are known as the paint pots. Scientifically, it is an interesting location because of the pronounced influence of groundwater chemistry on surface waters. "This felt a special – and elemental – place to me. The paint pots and the stream-water downstream were amongst the most vivid colourations I have seen in nature". (Gennadiy Ivanov).



Fire – global warming's shockwave

Oil on canvas, 90x90 cm

Fire has been a recurring theme of the Transition's team experience and represents the shockwave of global warming: more frequent, more intense and larger wildfires burning forests, grasslands, tundra, homes, and communities. Wildfires can spread faster than a human can run and the accounts of fires from the oil train derailments in Saskatchewan and Quebec and the partial burning of the City of Fort McMurray by wildfire in 2016, the most expensive natural disaster in Canadian history, haunted the team.

Wildfires are an important part of natural ecosystem renewal and small wildfires were part of how Indigenous peoples managed forests and grasslands and prevented larger wildfires. Modern global warming-driven wildfires are large, intense and dangerous and can also cause increased flooding after fires have burned soils and vegetation and so reduce the natural ability of river basins to retain and evaporate water from snowmelt and rainfall. "This painting is based on a bonfire I saw near Saskatoon, set during a wet period in a rural area that had almost burned down in the previous record-dry spring due to a grass wildfire. It is menacing and foreshadows the greater destructions that wildfire can cause." (Gennadiy Ivanov)



The Salt lake

Oil on canvas, 80x80 cm

Near Clavet Research Farm the changing patterns of flood, salinization and drought have led to the evaporation of a shallow lake, leaving salt deposits. In the distance are hay bales and a traditional grain elevator. "I have used this scene to produce another expressionistic painting. I have supplemented the hay bales with stacks of oil pipe sections, which are a common sight across the Prairies. I have also introduced a coal power station. Around one-third of Saskatchewan's power comes from coal-burning."
(Gennadiy Ivanov).



The autumn feelings, South Saskatchewan river

Oil on canvas, 80x80 cm

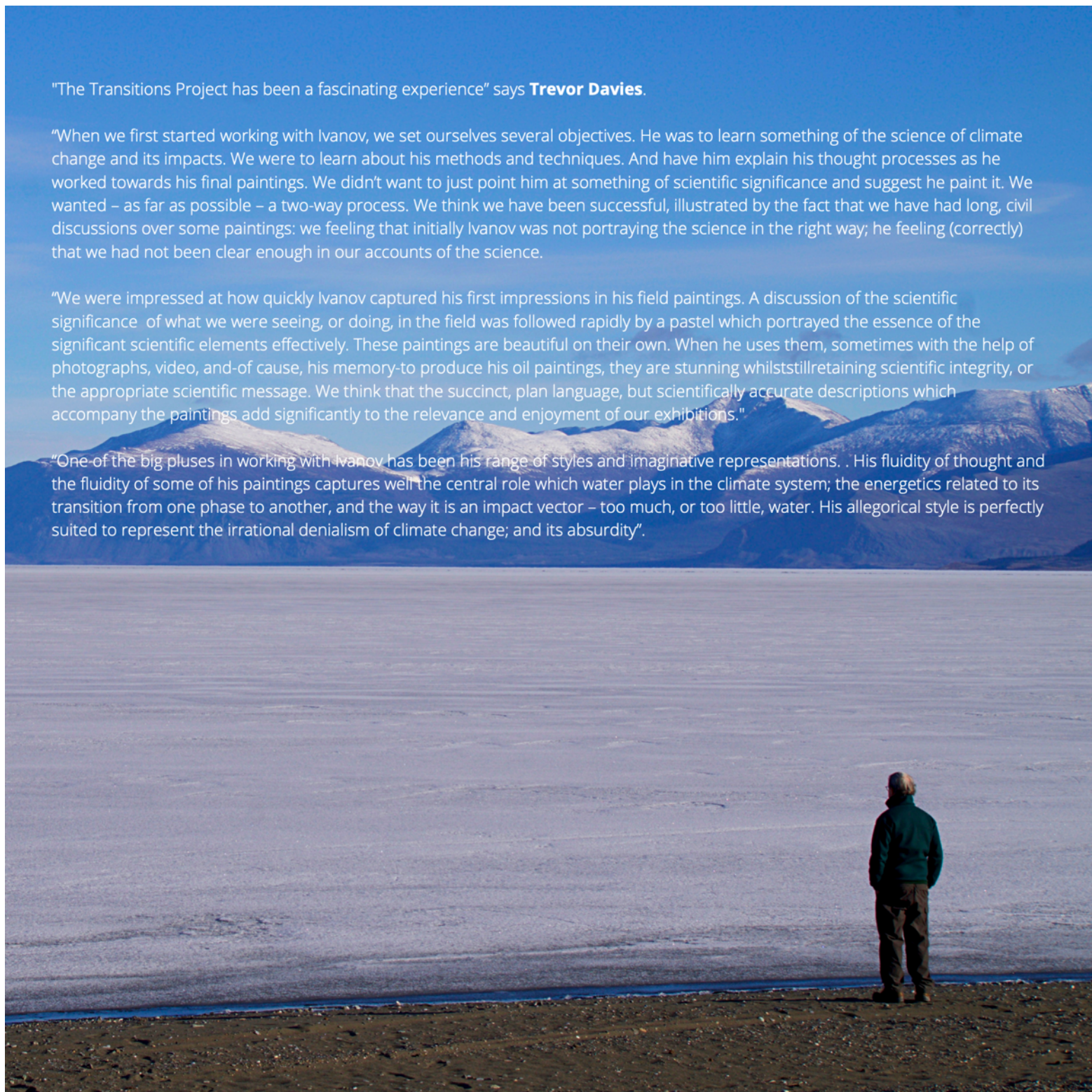
Hundreds of miles to the east, some of the meltwater from the Canadian Rockies flows through the Canadian Prairies in the South Saskatchewan River. The streamflow regimes in the Canadian Prairies are also changing because of climate change and human use for irrigation and hydroelectric power. Pronounced floods and droughts (which are leading to earlier and more frequent wildfires) are increasing in frequency and intensity, with implications for agriculture, infrastructure and transport. The worst floods and droughts since colonisation of the region in the late 1800s have occurred in the last two decades. The South Saskatchewan River flows through the city of Saskatoon, the home of the University of Saskatchewan and the headquarters of the Global Water Futures research programme. The slumping banks of the river, and the changing pattern of sand bars, show evidence of shifting patterns of erosion and deposition in response to recent hydrological changes. The best way of seeing this evidence is from a canoe, and this series of pastels illustrates the changing views – very different from the sculpted landscapes of the Rockies – painted on a 12km sojourn on the river, downstream towards Saskatoon, under the paddle power of the scientists!

"The Transitions Project has been a fascinating experience" says **Trevor Davies**.

"When we first started working with Ivanov, we set ourselves several objectives. He was to learn something of the science of climate change and its impacts. We were to learn about his methods and techniques. And have him explain his thought processes as he worked towards his final paintings. We didn't want to just point him at something of scientific significance and suggest he paint it. We wanted – as far as possible – a two-way process. We think we have been successful, illustrated by the fact that we have had long, civil discussions over some paintings: we feeling that initially Ivanov was not portraying the science in the right way; he feeling (correctly) that we had not been clear enough in our accounts of the science.

"We were impressed at how quickly Ivanov captured his first impressions in his field paintings. A discussion of the scientific significance of what we were seeing, or doing, in the field was followed rapidly by a pastel which portrayed the essence of the significant scientific elements effectively. These paintings are beautiful on their own. When he uses them, sometimes with the help of photographs, video, and-of course, his memory-to produce his oil paintings, they are stunning whilst still retaining scientific integrity, or the appropriate scientific message. We think that the succinct, plain language, but scientifically accurate descriptions which accompany the paintings add significantly to the relevance and enjoyment of our exhibitions."

"One of the big pluses in working with Ivanov has been his range of styles and imaginative representations. His fluidity of thought and the fluidity of some of his paintings captures well the central role which water plays in the climate system; the energetics related to its transition from one phase to another, and the way it is an impact vector – too much, or too little, water. His allegorical style is perfectly suited to represent the irrational denialism of climate change; and its absurdity".





Yukon Sunrise

Oil on canvas, 100x100 cm.

The Front Ranges near Haines Junction face east and appear to guard the St Elias Icefield, the largest icefield in the world after Greenland and Antarctica, from the warmth of sunrise and the warm winds that can blow through the headwaters of the Yukon River Basin in an early spring. As if to signal their alertness to changing weather and sunlight, these ranges change their hue spectacularly throughout the day, but start with the salmon colour of an early spring sunrise in the Yukon.



Fire Across the Ice

Oil on canvas, 80x80 cm.

The Arctic Ocean has undergone a massive warming in the last 40 years, with the loss of over half of its multi-year sea ice. This ocean is surrounded by the Arctic lands of Russia, Canada, Greenland and Scandinavia – much of which are warming three times faster than the rest of the world – and receives the warmer and increasing freshwater flows from the major northward flowing rivers of Russia and Canada such as the Ob, Yenisei, Mackenzie, Lena etc. as well as freshwater from melting glaciers and ice sheets. Here, the view from the Arctic coast of Canada looks across the remaining ice to Russia, a view that foretells the increasing temperatures, permafrost thaw, greenhouse gas emissions, wildfires, floods and streamflow volumes that span the circumpolar North. The bubbles in the ice remind us of methane emissions from permafrost through lake ice that are ubiquitous in northern peatlands.



Permafrost Thawing Releases Fossil Fuel

Oil on canvas, 70x90 cm

The extraction and use of fossil fuel world-wide has led to a catastrophic thawing of permafrost. It is ironic that permafrost thaw can lead to the release of contained fossil fuel into the environment. This painting is based on satellite imagery of a major pollution incident at Norilsk in Siberia, starting on 29 May 2020. Around 17,500 tonnes of diesel stored at a power plant leaked into the local waterways turning them red. President Putin declared a state of emergency. A major cause was permafrost thawing which caused the collapse of the storage tank. On 4 June, booms on the Ambarnaya River, which has been installed to contain the spill, were broken by large amounts of drifting ice. After the incident, which followed weeks of abnormally warm weather, the Russian authorities ordered urgent safety checks on all potentially hazardous installations built on Arctic permafrost. The tundra polygon cracks visible in this painting portray the shifting ice-laden soils of Arctic permafrost which have become more dynamic and unstable as deeper and deeper thaw sets in. This puts at risk not only Arctic rivers but the massive infrastructure in the North such as mines, pipelines, roads, railways and communities and the disaster at Norilsk illustrates a common problem that Russia and Canada have in sustaining northern economies and environmental protection during the climate crisis.



Cryoconite sediment

Oil on canvas, 80x60 cm

"One of the most fascinating outcomes of conversations with scientists has been my growing realisation of how interconnected the world is and how something that is very small can affect the whole planet." (Gennadiy Ivanov).

Worlds within worlds

Oil on oval canvas

There is a connection between the rate of melting of the ice and the "brightness" (the albedo, in scientific terms) of the ice surface. Clean ice is very bright and melts slowly and dark ice absorbs solar energy and melts more quickly. Rapid ice melt leads to sea level rise and deglaciation. This dark material is known as cryoconite, and is teeming with life, including pollen and living organisms such as algae and bacteria. Cryoconite accelerates glacier melt. It can be studied through the technique of scanning electron microscopy (SEM), which produces images at, typically, around 10,000 magnification. These World Within World paintings are based on SEM images of cryoconite samples from the Peyto Glacier – collected and analysed by Global Water Futures scientists. This normally unseen "microworld" has profound impacts on our Earth - the accelerated glacier melt caused by these microorganisms even contributes to the sea level rise that low-lying coastal regions such as East Anglia in the UK are experiencing.





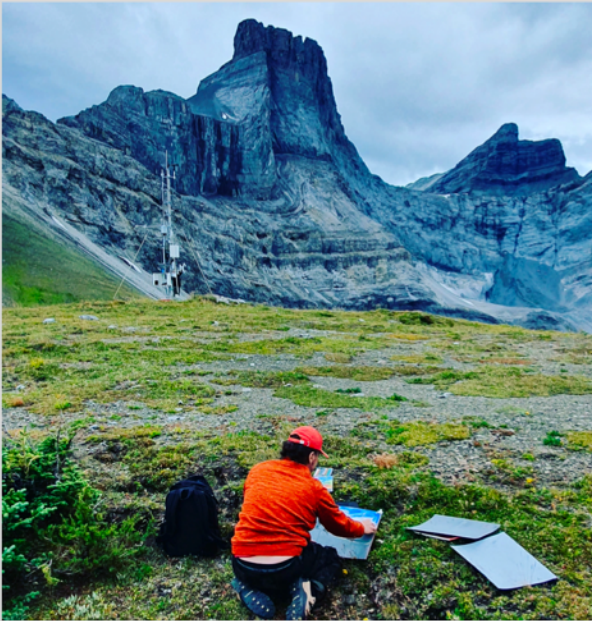
Predator. Series: Powerful & Vulnerable

Oil on canvas, 100x100 cm

Ursus maritimus evolved as a powerful and efficient predator. They are hunters specialising in ice seals. They also eat plant material and land mammals, but they do not get sufficient calories from these terrestrial sources. Their sea-hunting depends on sea-ice, and there has been a plentiful supply of food during fall, winter and spring. This has been changing for some time: climate change means less extensive and shorter-lived sea ice. It is now quite common to see Polar Bears scavenging around human communities for garbage. The current population is estimated to be between 22-31,000, with 60-80% living in Canada. North-east Canada and northern Greenland are likely to be the two regions which retain a fringe of sea ice throughout the year. Predictions are that global Polar Bear populations will decline by around 30% over the next two decades.



The field drawings series.



Still frozen, for now

The field drawings, pastel on paper

These scenes were painted from atop the St Elias Icefield – the third largest icefield in the world, after Antarctica and Greenland. From this vantage point can be seen the ancient ice-sculpted forms of distant mountains including Mount Logan, Canada's highest, which rises to almost 6000m. The St Elias Icefield feeds diminishing valley glaciers. Across the whole St Elias mountain range, ice cover has reduced by a quarter over the last 50 years.





Quill Creek cracking

The field drawings, pastel on paper

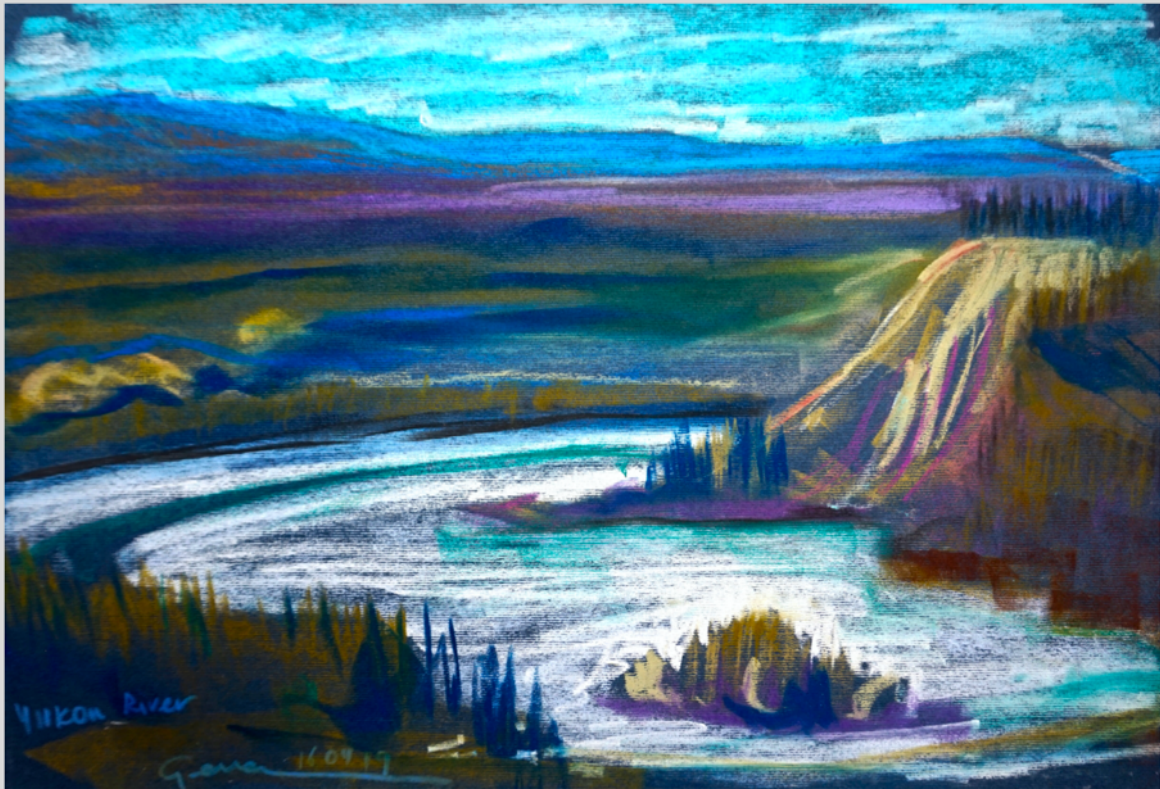
Spring melt defines the beginning of summer in the North and the excitement of this period of long daylight and warmer weather, as water begins to flow, the natural ecosystem awakens and life is renewed, involves cracking ice revealing the stream, much like how an egg cracks open to reveal new life. Here, Quill Creek, cracks open to announce the start of a new freshet and the return of liquid water to the North.



Hail on Kathleen Lake

The field drawings, pastel on paper with a contribution from a hailstorm

Kathleen Lake, in Kluane National Park, is still ice covered. This scene was captured when the artist was on the lake, together with two Indigenous People who were fishing through a hole in the 80cm thick ice. An enormous hailstorm started, and the stippled appearance of the drawing is the result of hailstones falling on the paper. (Artist's note: so I feel that this painting truly captures something of - and from! - the atmosphere of this beautiful location). Kokanee salmon live in the lake; a landlocked version of Sockeye salmon, trapped by a surging glacier in a Glacial Age, which have adapted to living wholly in freshwater. The Kokanee population is now recovering from a crash with a low point in 2008. The reasons are not fully understood, but it may be related to an interaction between climate and the hydrological cycle (including hydro-chemistry); and example of the importance have having good scientific observations.



Ice to water, too soon April 23, 2019

The field drawings, pastel on paper

The channels of surface water, which is seen bisecting the ice cover on this bend of the Yukon River, presages the equal earliest date (April 23) of ice break-up during 123 years of continuous observation, further downstream at Dawson City.



Waiting to move, 2019

The field drawings, pastel on paper

Movement of the tripod sitting on the Yukon River ice at Dawson City is the indicator of river ice breakup – the main hydrological event of the year for the vast northward flowing rivers of Russia and Canada. River ice breakup has been observed since the 1896 gold rush at Dawson City and represents an important event for humans and for nature as massive ice jam floods can form during breakup and have severely damaged Dawson City in the past. Breakup has been occurring earlier and earlier since the 1890s as the climate has warmed, advancing 5 days earlier per century. The flowing open water upstream portends another early breakup, and the event occurred a few days after this scene was painted, tying the earliest date ever recorded (April 23).



Caribou Creek Collapse

The field painting, mud, gouache on canvas, board

Global warming is magnified in the circumpolar regions and at Caribou Creek, near Inuvik, Canada, winter minimum temperatures have increased 5.5 C since 1960. Here, as in most of the circumpolar region, permafrost is thawing rapidly, leading to massive ice and mud landslides called retrogressive thaw slumps. Here, slumping is widening the valley of Caribou Creek, causing sedimentation of stream waters and the collapse of forests that were supported by the ice-rich permafrost. A whole drainage system and landscape is thawing and collapsing before our eyes in this region. The sediment load, makes this stream unsuitable for many fish and the shifting land makes it too insecure for trees. Ecological devastation in the blink of an eye.



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