

TRANSITIONS

AN INTER-DISCIPLINARY COLLABORATION

GLOBAL WATER FUTURES
GLOBAL INSTITUTE FOR WATER SECURITY
UNIVERSITY OF SASKATCHEWAN

PROFESSOR JOHN POMEROY

AN ART-SCIENCE
PROJECT
CLIMATE CHANGE
IN CANADA

PROFESSOR TREVOR DAVIES

ARTIST GENNADIY IVANOV

GLOBAL WATER FUTURES: SOLUTIONS TO WATER THREATS IN AN ERA OF GLOBAL CHANGE

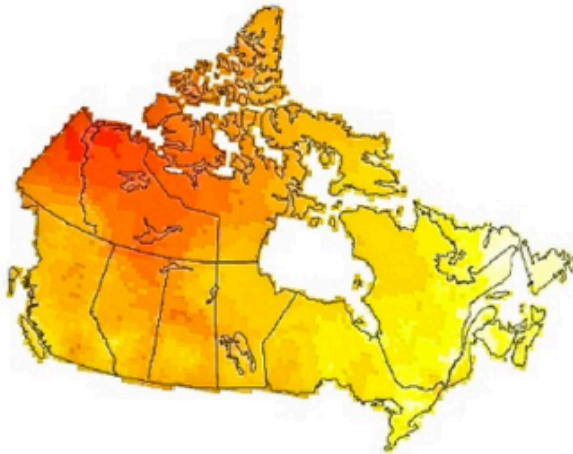


Professor John Pomeroy

TRANSITIONS is a Global Water Futures (GWF) interdisciplinary art-science project. The paintings, drawings, photographs and video of locations in Canada are due to the generous support of this Canada First Research Excellence Fund supported research programme. GWF is headquartered in the Global Institute for Water Security at the University of Saskatchewan in Saskatoon, Canada and is directed by Professor John Pomeroy. It is a transdisciplinary, inter-institutional programme, in partnership with 17 other Canadian universities and hundreds of national and international partners. GWF supports the research of 167 Canadian academics through 45 projects and core teams. They have employed 500 students and researchers making GWF the largest university-based water science programme in the world.

GWF's strategic aims are to demonstrate global leadership in water science in colder regions, and to address the needs of the national economy in adapting to change and managing the risks of uncertain water futures and extreme events. It is improving disaster management by increasing scientific knowledge, and developing observation and modelling technologies. This is directly related to the improvements it is making in forecasting capacity to predict the risk and severity of extreme events that 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, GWF is helping to reduce the risk of water threats and improve the design of climate change adaptation strategies, to the benefit of the national economy. GWF 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. Throughout all these aims and activities runs the powerful theme of community engagement, including full engagement with the Indigenous communities in Canada that are so profoundly impacted by changing water security.

1948-2016



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WARMING RATES IN NORTHWEST CANADA ARE AMONGST THE GREATEST ON THE PLANET.

The map shows observed increases from 1948 to 2016 in the average temperature; the deeper the orange colour, the greater the warming. This has led to a range of impacts including accelerated glacier recession, earlier snowmelt and thinner snowpacks, shrub and forest expansion into former tundra, more and earlier vegetation fires and permafrost thaw. There have been important changes in local and regional hydrology. The influence on the landscape is pronounced. Members of the Transitions project visited locations in Yukon, Northwest Territories and Alberta's Rockies in April 2019 in order to capture some of these impacts in paint. This publication shows some of the outcomes from that journey.



JOHN POMEROY

Fellow of the Royal Society of Canada; Distinguished Professor Department of Geography and Planning and Canada Research Chair in Water Resources and Climate Change, University of Saskatchewan; Director Centre for Hydrology and Coldwater Laboratory, Canmore Alberta; Director Global Water Futures Programme.

"When Trevor sent me examples of Gennadiy's work, I -like him -felt that his style and approach could help visualise aspects of climate change and some of the science research related to human-induced changes in our environment. I was pleased to be able to invite him to Canada to witness first-hand some of our work and some of the pronounced impacts of climate change. Trevor and I have a long-standing collaboration on field research in Canada and the UK, so it was an appropriate partnership. An important element of the Global Water Futures (GWF) programme is public engagement and awareness-raising. We have worked hard on inclusion of Indigenous Peoples in the planning of our activities, and so I was keen that Gennadiy joined our routine checking of observation stations, and saw some examples of the impacts of climate change where Indigenous Peoples are being most affected. As scientists, we were impressed with how quickly and effectively Gennadiy captured his first impressions of what he was seeing, sometimes under trying conditions. It was important that - as he produced his later and final paintings - we could come to a joint understanding of what was being portrayed. We saw this as an iterative process - a genuine working-together - and I think it has been successful. Certainly, my science colleagues in GWF are thrilled by what Gennadiy has produced. I showed slides of his work to 600 GWF participants at our annual meeting in May. I have been very pleased by the positive response of those members of the art community who have seen the paintings.

TREVOR DAVIES



Former: Dean of the School of Environmental Sciences UEA; Director of the Climatic Research Unit UEA; Director for International Development of the Tyndall Centre for Climate Change Research; Distinguished Professor and Director of the Fudan Tyndall Centre at Fudan University Shanghai; Pro Vice-Chancellor for Research, Enterprise and Engagement, UEA.

"I was struck by Gennadiy's paintings of the Norfolk coastline, and felt that his style and imagination could work very well within a wider collaboration with scientists. If this was to be a genuine fusion of art and science, I felt we needed to understand each other methods and techniques, and the processes which go into producing our outcomes; and we needed to travel together along the route to the final representation on paper or canvas. Gennadiy was a willing student of the fundamentals of climate science. Water plays an important role; transitions between the phases of water, and the distribution of those phases, influences the energetics of the climate system. Water is also a vector of impact: too much of it (floods); or too little (droughts, fires). To cope with change, we will also have to make transitions in the way we do things. Transitions seemed to be a good title for this project. I thought it would be beneficial for Gennadiy if he could experience and portray landscapes which were less gentle than those of Norfolk and where some of the impacts of climate change are dramatic. I contacted a long-standing research colleague, Prof John Pomeroy, whom I first worked with when he did post-doctoral research with me at UEA. John is now Director of the crucially-important Global Water Futures programme head-quartered in Saskatchewan. Canada is experiencing an increasing frequency of extreme events, directly related to pronounced climate change; unprecedented floods, droughts, vegetation fires, permafrost melting, snow- and ice-cover reductions, and so on. These dramatic changes are having significant impacts on big-city infrastructure, Indigenous Peoples, agriculture, and hydro-electricity generation".

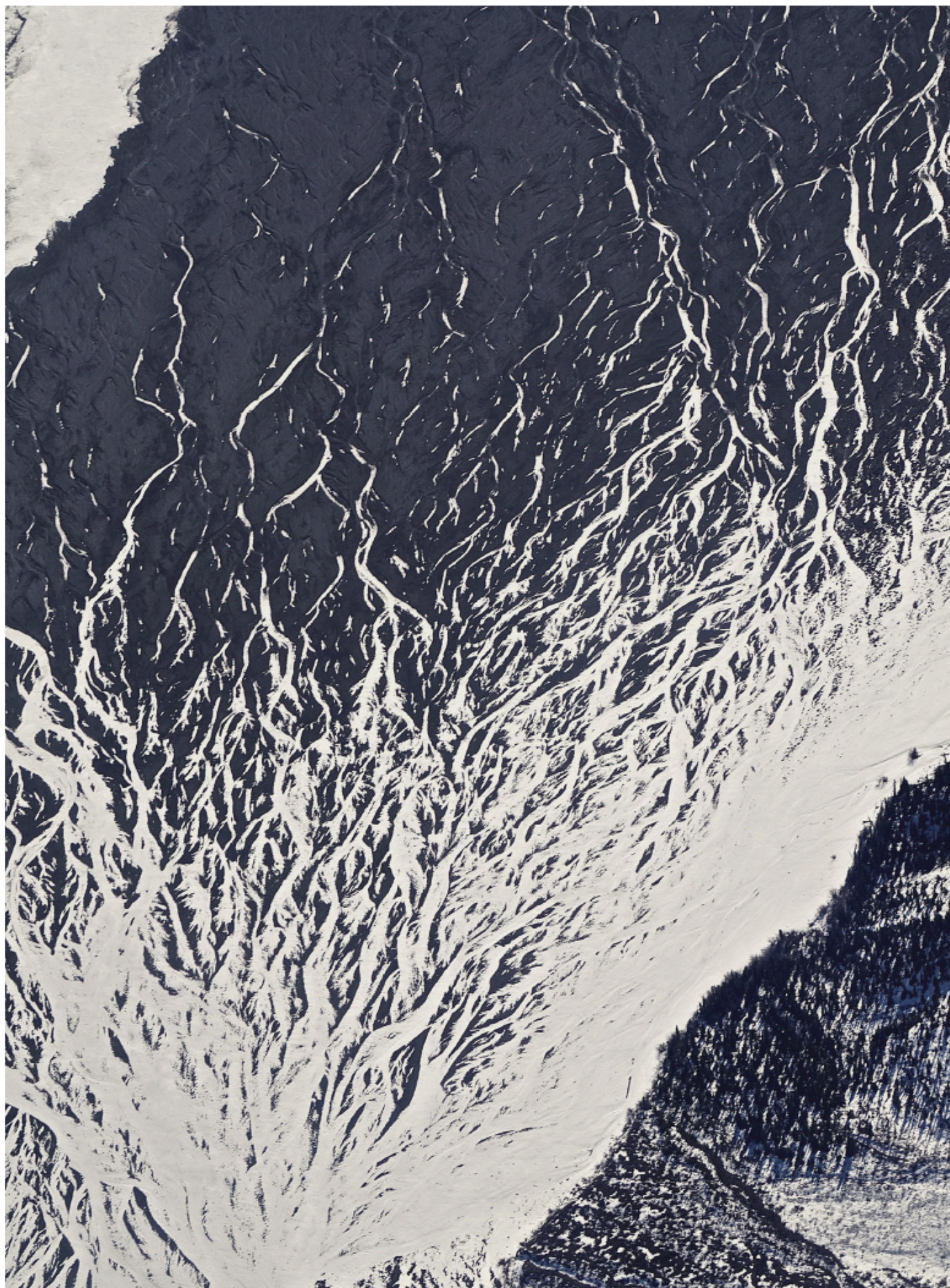


GENNADIY IVANOV

Gennadiy Ivanov is a UK-based artist. Originally from Belarus, born in Russia. Graduated with MAFA from Norwich University. He is the artist with synthetic thinking and a technique artist. This allows him to work simultaneously in several directions and styles. His paintings demands from a spectator intellectual as visual and emotional effort.

"I had painted scenes of the Norfolk coastline in the knowledge that coastal erosion is a challenge for the County, and that rising sea-level resulting from climate change is increasing problem. The predictions for future sea-level rise alarmed me, and I wanted to capture something of the existing beauty of our coast and, somehow, represent this growing challenge. The experience of producing that series of paintings led me to contact Professor Trevor Davies. I knew that Norwich was a hot-bed of climate and environmental research and the possibility of collaboration with a local scientist was something I felt I had to explore. I know that art can stimulate interest in, and raise awareness of, issues which deserve more attention; and I hoped to be able to make a contribution in this regard. What has happened since I contacted Prof Davies has astounded me. I have unbounded admiration for the dedication and sheer hard work of the scientists. I feel privileged to have been able to witness their important research involving sophisticated instrumentation in remote and difficult terrain in Canada, some locations of which could only be reached by specialized transport. My visit was possible only with the fantastic support of the Global Water Futures research programme and, especially, its Director Prof John Pomeroy, opened my eyes. In this document are some of my first paintings from our journey to research stations and locations in Yukon, Northwest Territories and Alberta. There are also examples of paintings inspired by my memory of, and my imagination fired by, that journey. Whilst I was waiting on tenterhooks for that trip, I produced some polar bears in my studio in Norwich! I hope my work does justice to the scientists, and adequately captures some of the challenge that is climate change"

**DRAWINGS &
PAINTINGS**



PHOTOGRAPHS



THERE ARE STILL WOLVES

The field drawing, pastel on paper.

The ecosystem at Wolf Creek is in rapid change. Here are a number of scientific monitoring stations, which have observed the environmental change over the last 25 years. The vegetation is responding. Shrubs are growing more prolifically. Wolves still roam, but other predators, including lynx and coyote, are moving northwards. The ecosystem will continue to change.



THE RED INVASION AT WOLF CREEK

Oil on canvas, 91x116 cm.

The GWF observation station was established over bare ground with scarce low alpine vegetation in the 1990s. In the meantime, shrub has moved into the area and is now overwhelming the station. The red bushes are represented as flickering flames consuming the instrumentation, heating the surroundings. They carry black seeds of the continuing invasion. This painting is a good example of iterative collaboration between artist and scientists, who felt that early versions of the impression did not adequately represent the true scale of the invasion and disruption to the instrumentation. The station is no longer useful as a source of aerially-representative observations, but is retained to record the modifications caused by the vegetation close to the ground.



QUILL CREEK CRACKING

The field drawing, pastel on paper.

As with other creeks and rivers across Yukon and Northwest Territories, the recent pattern of very early ice break-up was occurring. Snow was hanging in on the north-facing sides of the mountain gullies, but most of the south-facing sides were bare.



HAIL ON KATHLEEN LAKE

The field drawing, pastel on paper, with a contribution from a hailstorm.



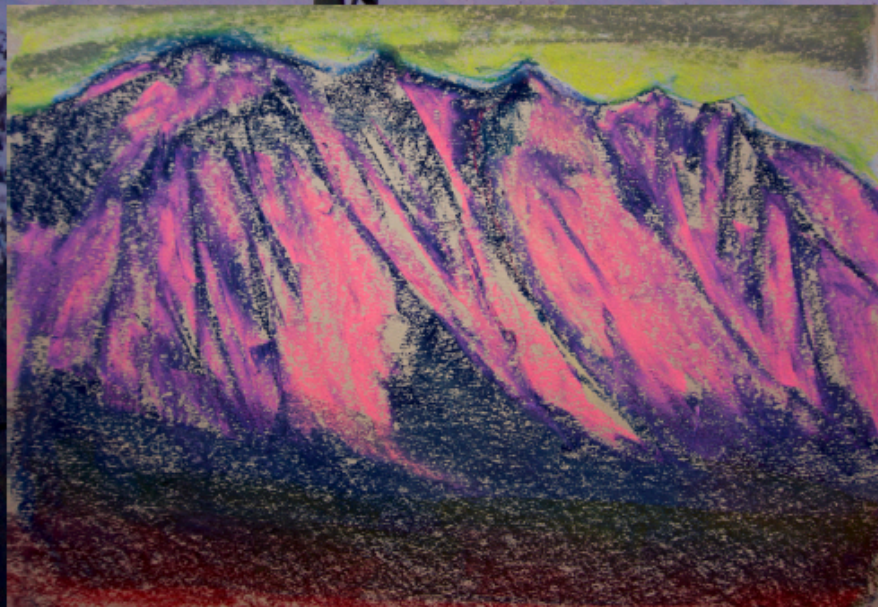
Kathleen Lake, in Kluane National Park, is still ice covered. This scene was captured when the artist was on the lake, together with two Indigenous People who were fishing through a hole in the 80cm thick ice. An enormous hailstorm started, and the stippled appearance of the drawing is the result of 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.



THE YUKON SUNRISE

Oil on canvas, 100x100 cm

Two field drawings, pastel on paper



The fore-mountains, near Haines Junction, beyond and above, which lay the St Elias Ice-field, change their hue spectacularly through the day. This is how they respond to the rising of the Sun.



THE YUKON SUNSET 1 & 2

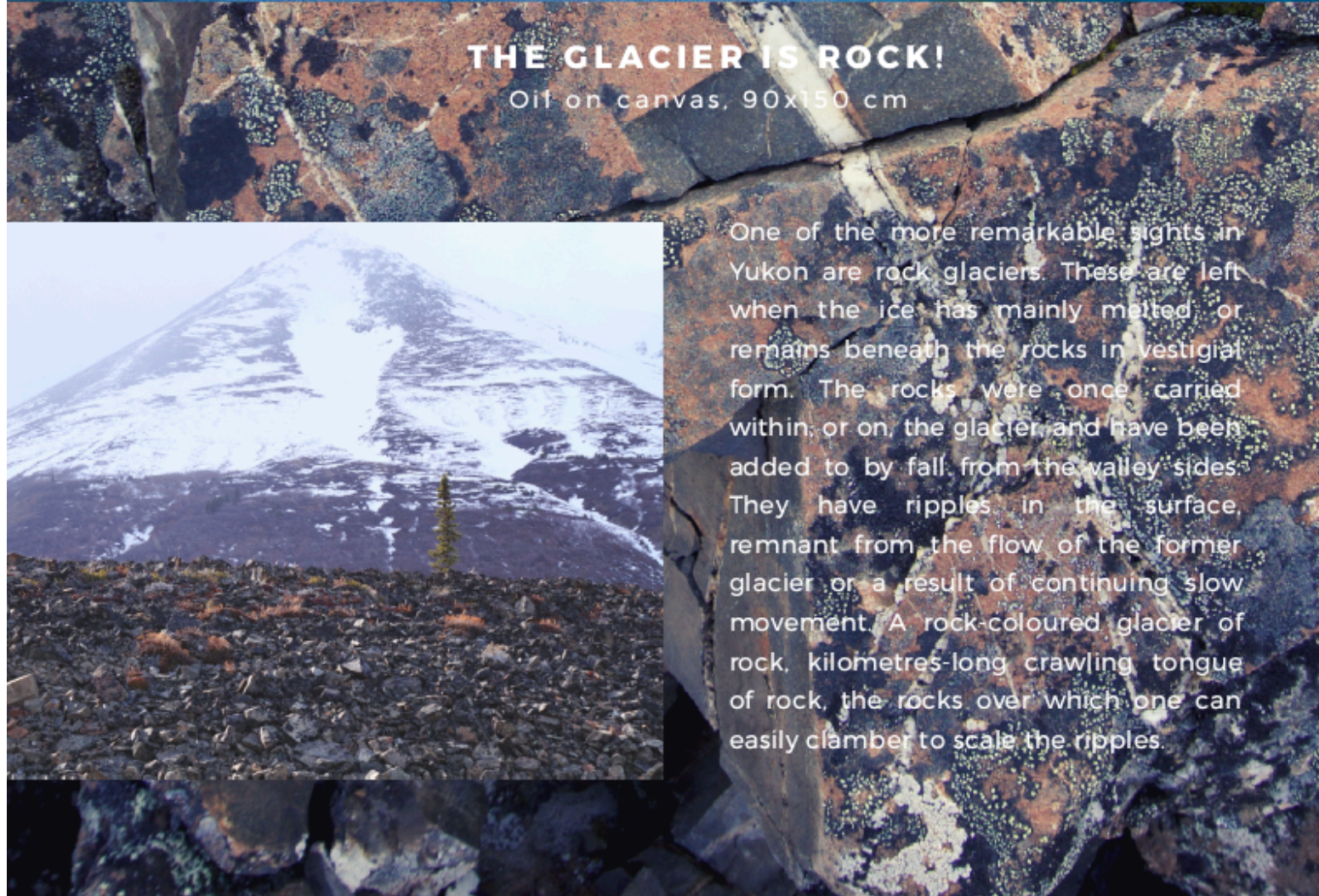
The field drawing, pastel on paper

The mountains near Haines Junction are equally, but differently, attractive at sunset.



THE GLACIER IS ROCK!

Oil on canvas, 90x150 cm



One of the more remarkable sights in Yukon are rock glaciers. These are left when the ice has mainly melted or remains beneath the rocks in vestigial form. The rocks were once carried within, or on, the glacier and have been added to by fall from the valley sides. They have ripples in the surface, remnant from the flow of the former glacier or a result of continuing slow movement. A rock-coloured glacier of rock, kilometres-long crawling tongue of rock, the rocks over which one can easily clamber to scale the ripples.



GHOST GLACIER

Oil on canvas, 91x116 cm

Inspired by the Rock Glacier in Kluane Park, Yukon, sitting in the distance above the ribbon of rock is the ghost of a glacier, shrouded in snow re-suspended by the wind from one of the north-facing sides of a mountain gully. In the foreground are the waters of Dezadeash Lake, which is still drip-fed by the waters flowing beneath the rock glacier, the rocky remains of what was once a glacier of ice.

ICEFALL

Oil on hessian, 161x95 cm



Atop the St. Elias Ice-field - the third-largest ice field in the world - after Antarctica and Greenland. The ancient ice-sculpted forms of distant mountains, including Mount Logan which rises to almost 6000m, are being pointed out by the diminutive figure of Prof Pomeroy. The St. Elias mountain range has lost a quarter of its ice cover in the last 50 years. The ice-field still feeds the receding Kaskawulsh Glacier that used to support the now diminished Kluane Lake.



STILL FROZEN, FOR NOW

The field drawings, pastel on paper



THE DESERT ON THE LAKE

Oil on canvas, 90x150 cm

A trickle - which remains of the river whose glacial melt-water source was pirated by another valley because of glacier recession - makes its contorted way towards Kluane Lake. Where once was lake-water, there is now silty dust. The strong cold katabatic winds, which flow off what remains of the Kaskawulsh Glacier whip up dust storms. Melt from the thin snow cover on the distant mountains is not sufficient to maintain the lake at its pre-2016 level, when the act of piracy took place.





PLUNDERED BY PIRACY

The field drawing, pastel on paper.

Large areas of what was lakebed as recently as 2016 are now exposed, and it is possible to walk over to what was an island on the second largest lake in Yukon, Kluane Lake. Over the space of 4 days, the 150m wide Slims River, which formerly fed the Lake all but disappeared in what is called "river capture" or "river piracy". As the Kuskawulsh Glacier - whose meltwater fed the Slims River, retreated through climate change the melt water was diverted down a higher valley, depriving Kluane Lake of much of its water input. This is the first known example of human-induced river piracy. It was a dramatic event. The melt water, which fed a river basin, which drained to the Bering Sea in 2016, now feeds a river basin, which drains to the Pacific Ocean.





DESTRUCTION BAY

Oil on canvas, 100x100 cm

The dark, drying mud in the foreground is bounded by the walls of the now redundant harbour once used for the fishing boats of the Indigenous People for whom fishing on Kluane Lake was such an important activity. The lake is still frozen - it is April, but the background mountains are already free of snow. The now useless harbour is on Destruction Bay: an apt name.





DESTRUCTION OF A WAY OF LIFE AT DESTRUCTION BAY 1&2

The field drawing, pastel on paper

Kluane Lake is still ice covered. The piracy of water into the Slims River has caused the lake level to drop by almost 2m since 2016. This means that some fish cannot reach their natural spawning waters. It has also meant that the substantial harbours, which were constructed for the fishing boats of the local indigenous peoples, including the one at Destruction Bay, can no longer be used. They are stranded and useless.



FOX LAKE BURN

Mixed media on canvas, 90x120 cm

Between Whitehorse and Dawson City, in Yukon, there is a vast area (more than 45,000 hectares) of burnt forest, destroyed in fire – which was human-initiated – which raged in July 1998, and smouldered well into the following spring. The burn is still a scar, but small trees are now re-appearing. 'Burns' are becoming more frequent with climate change.



BURN !

Oil on canvas, 100x100 cm

Early, and less, snowmelt combined with higher temperatures prime the vegetation for burns (fires), even in April, in northern and western Canada. The mountains behind the still-frozen lake fringed by its newly exposed silty desert are bereft of even their thin snow cover. A wisp of cloud resembles a glacier arm still clinging on. The burst of yellow and red on the mountains are 'burn'!



ICE TO WATER, TOO SOON.

The field drawing, pastel on paper.



The channel of surface water, which is seen bisecting the ice cover on this bend of the Yukon River at Five Finger Rapids, presages the equal earliest date of ice break-up during 123 years of continuous observation, further downstream at Dawson City.



WAITING TO MOVE

The field drawing, Dawson city.

The tripod sitting on the Yukon River ice at Dawson City is the indicator, when it moves, of the time of ice break-up. This event occurred a few days after this scene was painted: April 23 was the equal earliest date recorded.

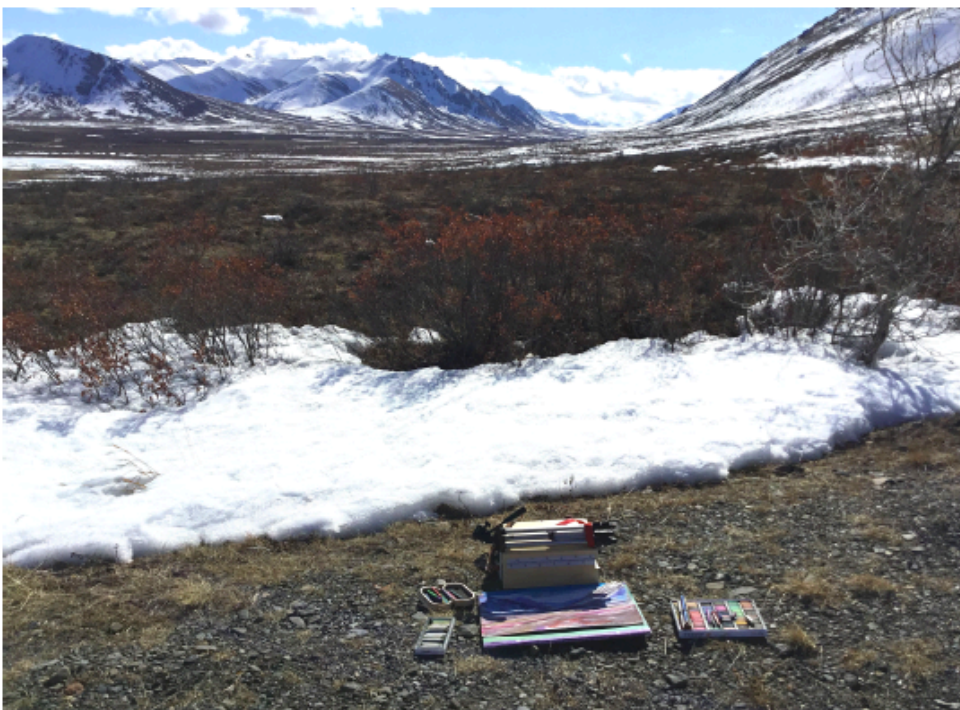




THE RED INVASION

The field drawing, pastel on paper.

In Tombstone Territorial Park, north of Dawson City, Yukon there was much less snow cover than there used to be, and the reddish hues in this painting reflect the increasing encroachment of shrubs into former open tundra - northwards and to higher elevations - because of climate change.



OGILVIE MOUNTAINS, YUKON

The field drawings, pastel on paper



Spring-time checking of Global Water Futures' automatic monitoring equipment in the Ogilvie Mountains include density measurements of the snowcover - extremely patchy and thin this year





TRANSITION

Oil on canvas, 81x116 cm

This painting was from my imagination, fired by my recollected memories of what I saw.

The retreating glacier, pock-marked by rock, mud and silt, overlooks the lake, which together, represent the transitions in the landscape and in the hydrological cycle: less ice, less snow, more water. The title also gestures to the transitions which local communities have to make in response to these changes; and to the transitions which all societies will have to make in order to mitigate the worst consequences of climate change, and to cope with the inevitable continuing changes.





THE SORCERER'S SNOWSCAPE

Oil on canvas, 100x82cm



This painting was produced by 'magic' overnight. I was working on a painting from my re-collected memories, which I left to dry overnight. The paint in the upper half of the canvas 'ran' serendipitously producing an image redolent of the textures in many mountainous landscapes.

As climate change brings warmer temperatures, trees are moving northward and to higher elevations; to firm land, which was previously tree-less. First, one or two individuals establish themselves, followed by more until there are a large number of scattered individuals or, in favoured locations, small copses. As we travelled north through Yukon, especially where the terrain channelled the wind into favoured directions, and causing the trees to bend, it looks as though they were, slowly but inexorably, marching northwards.



MARCHING TREES

Oil on canvas, 90x100 cm.



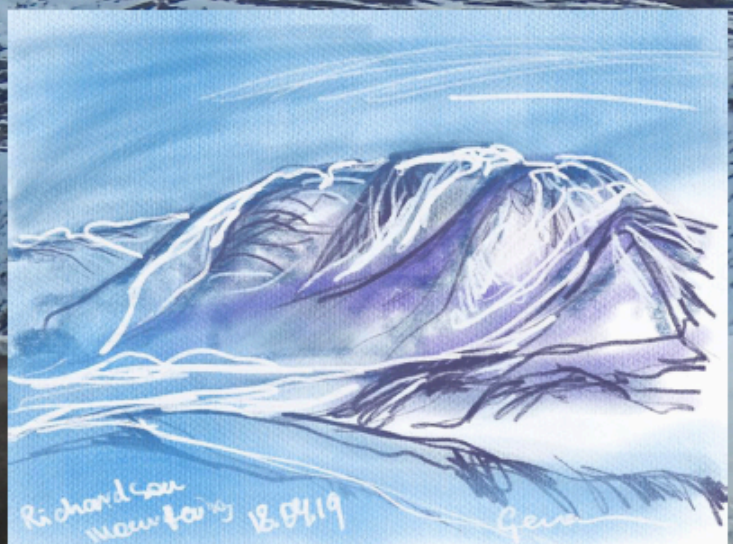


SPRING COMES EARLY AFTER ARCTIC STORMS

Oil on canvas, 80x100 cm (above)

The field Ipad drawing

The Richardson Mountains form the continental divide between Yukon and Northwest Territories above the Arctic Circle. They are known for their howling winds and intense blizzards that trap travellers on the Dempster Highway for days. Here, after many days of wind storms that scoured the snow from ridgetops and left deep snowdrifts on the valleys, a hint of spring comes unnaturally early.



CARIBOU CREEK COLLAPSE

The field paintings, mud, gouache on canvas board, paper



Permafrost melting is changing the landscape. Here, on the south-facing bank of Caribou Creek, melting in the sub-surface layers is causing the bank to collapse. Mud oozes out at the bottom of the slope, and the bank is sliding taking trees with it. This is April.



IMPERMANENT FROST

Oil on canvas, 135x170 cm

Triptych, oil on canvas, 80x150 cm

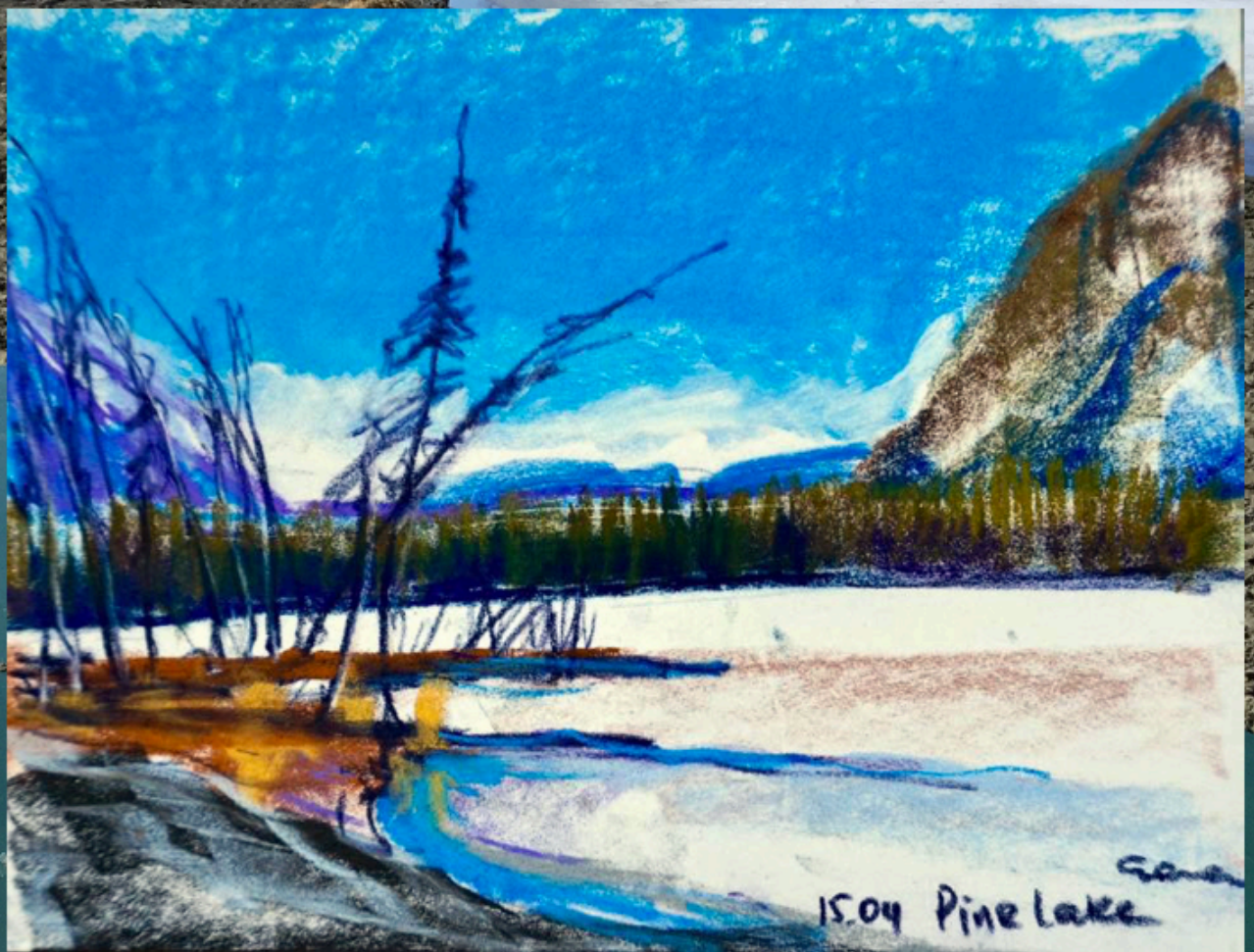
Permafrost is defined as a subsurface layer of soil that remains frozen throughout the year, or permanent. There is an enormous area of permafrost across northern Canada. Because of climate change it is no longer permanent. Large swathes of the permafrost zone are melting. The consequences are dramatic. 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 from the melting ice 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 melting is unprecedented on this scale. As the permafrost melts, 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 to proclaim that climate change "was like watching a nuclear explosion in slow motion".



The stooping trees in this northward facing perspective of Pine Lake appear to be bowing in sympathy for their cousins further north in permafrost regions where large swathes of the frozen sub-surface are melting, causing trees to slide down slopes, or drunkenly collapse on flatter terrain.

PINING AT THE EDGE OF PINE LAKE

The field drawing, pastel on paper.



DRUNKEN TREES

Oil on canvas, 91x116 cm



Some trees can survive the stress, when permafrost melts, which it is increasingly doing across northern Canada, the soil in which tree-roots are embedded starts to become more mobile and loses adherence to the sub-surface layers. On slopes, this means that trees and soil can just slide away down-slope. When the ground is flatter, the trees lean and topple over willy-nilly. Some trees can survive the stress and continue growing, with continuing growth being vertical. Others just collapse, or die from being water-logged.

TRAIL VALLEY CREEK STATION

The field drawing, pastel on paper.



Trail Valley Creek Research Station, in Northwest Territories, was established in the early 1990s. It has grown to be amongst the most instrumented, and well-studied, research basin in this part of Canada, with a number of organizations, particularly Wilfrid Laurier University, installing equipment. This major scientific effort requires significant support, including accommodation and sleeping tents, field laboratories and power supplied via wind turbines and solar cells.



STILL FROZEN, STILL ICE CROSSING.

The field drawing, pastel on paper.

Mackenzie River Basin

The Mackenzie River Basin is a 1.8 million square kilometre basin in northwestern Canada. It drains 20 per cent of Canada's land mass, including waters from the Northwest Territories, the Yukon, British Columbia, Alberta and Saskatchewan. The basin includes two freshwater deltas - the Peace-Athabasca and the Slave River Deltas. Many First Nations communities rely on the natural rhythms of high and low river flows in the deltas and the subsequent increase in biological productivity to sustain traditional livelihoods.



MACKENZIE RIVER
ICE CROSSING
MAXIMUM
WEIGHT LIMIT
6 4 0 0 0 KG

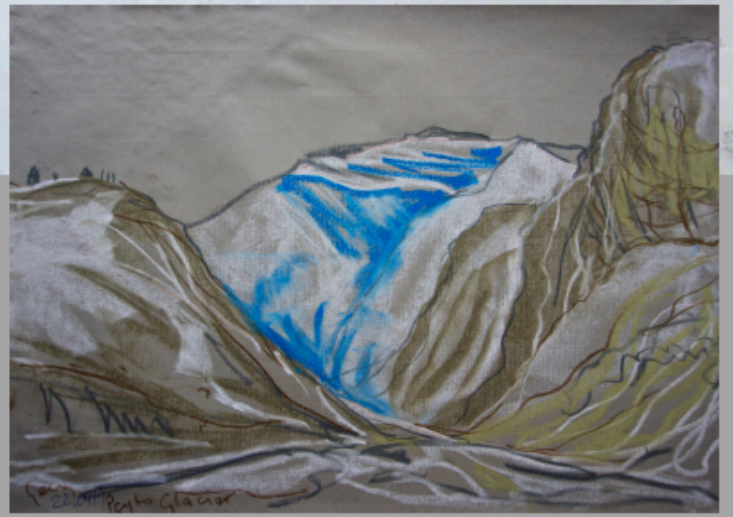




CHANGING PALETTE ON PEYTO

The field drawings, pastel on paper.

The Peyto Glacier, in the Rockies of Alberta, has receded dramatically, particularly in the last 50 years. This rapid recession has produced a changing palette of colours; more greys, browns, and sludges as the vanishing ice - which produces more blues, whites and silvers - leaves behind banks of mud. The helicopter landed on one such bank, sticky and cloying, not frozen, because of the exceptionally warm spring. The suction and additional weight on the helicopter skis required extra thrust for it to take off.





WILD BILL WOULDN'T RECOGNISE IT

Oil on canvas. 90x150 cm

The Peyto Glacier in Alberta is named after Wild Bill Peyto, who was born in England. On moving to Canada he became, from the 1890s onward: pioneer, railway labourer, trapper, prospector, horse outfitter, packer, legendary mountain guide, and eventually one of the first wardens of Banff National Park. One of many stories about Bill is when he released a lynx in a bar. The Peyto is one of the world's longest-studied glaciers. It has lost more than 70% of its volume since the beginning of the 20th Century with the most rapid loss being in the last decades. It is losing 3.5million cubic metres of water each year. Observation stations placed on the glacier in recent years have been lost because the ice is melting so rapidly. Where there was once ice, there are now banks of silt and mud. In the distance, perched on a bank of mud, is a form of transport Bill didn't have access to.





Fortress Mountain is an iconic location in the Rockies in Alberta. Its dramatic countenance has appeared in many Hollywood films. It is an important site for one of the GWF observation stations which automatically records atmospheric and ground conditions. These observations are part of a network, which monitors changes over time and provided invaluable information to help develop predictive models; a necessity for successful modelling in such complex terrain.

THE FORTRESS MOUNTAIN NOW

Oil on canvas, 130x170 cm,
pastel on paper 50x70cm

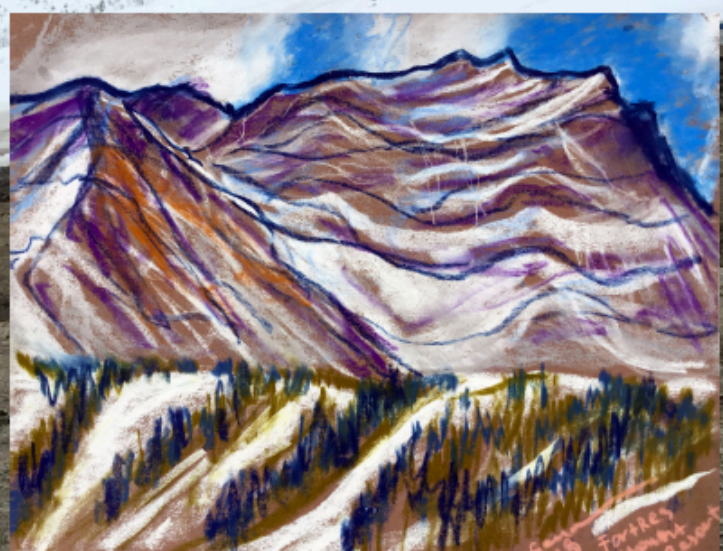


This painting was inspired by the words of the Chief of the Gwich'in Indigenous People, who said in April 2019, that climate change was "like watching a slow nuclear explosion". Although his People's land is further north, this seemed a good location to start developing representations of slow nuclear explosions as a metaphor for the impacts of human-induced climate change across Northwest Canada. This one is starting near the site of the GWF station, which has already been destroyed, on the edge of a cirque, which was once home to a glacier. Even Fortress Mountain can be stormed.

THE SLOW NUCLEAR EXPLOSION AT FORTRESS MOUNTAIN

Oil on canvas, 90x70 cm.

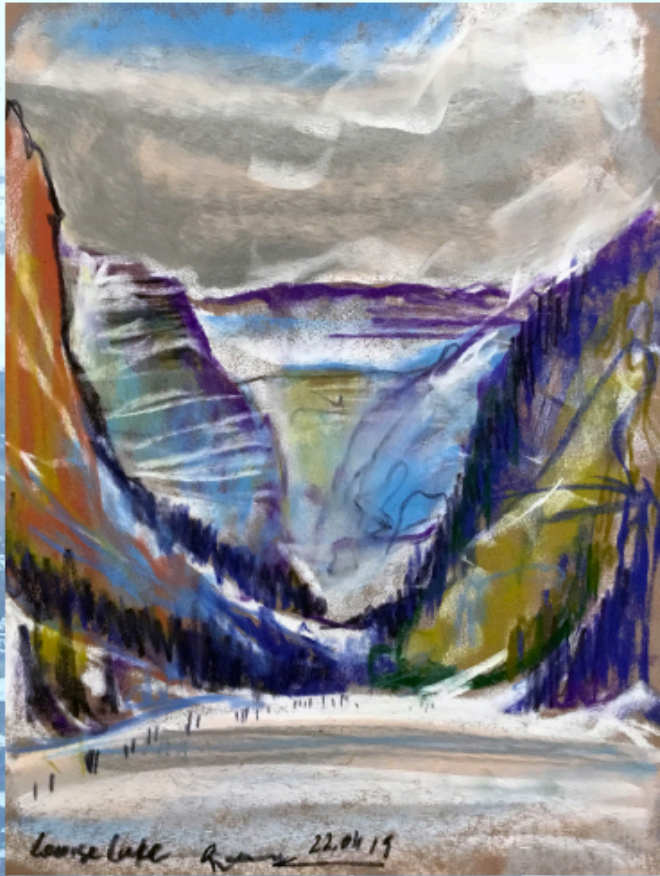




NEAR FORTRESS MOUNTAIN

The field drawings, pastel on paper

Accessing the GWF observation station beneath Fortress Mountain requires significant logistical support: snowmobiles, and so on. These pastels were painted as we awaited the arrival of the GWF support team of the logistics camp.



The glacier above Lake Louise is an ever-diminishing shadow of even its recent former self, because of humans-induced climate change. On geological time-scales the former immensity of its power is evident from the deep U-shaped valley, which it scoured out. Its vestigial form may vanish by the end of the century.

WANING POWER

The field drawing, pastel on paper





PAINTINGS FROM MY RECOLLECTION AND IMAGINATION

OIL, MIXED MEDIA

Painting based on my trip through dramatic Canadian landscapes, some draped in snow and ice, made a deep impression. What I saw is locked in my memory. These paintings are based on my re-collection of those memories.

"I want to do justice, in my own terms, to the incredible landscapes which I saw in Canada, and the way in which they are being deeply affected by man-made global warming. I also want to use this amazing experience to inform my future paintings representing environmental change and, with the help of my scientist colleagues, start to explore in art form how to incorporate possible solutions which will help us rise to the challenge of climate change. I want my art to be a tribute to the dedicated scientists whose work I saw". Gennadiy Ivanov / April 2019



These paintings are inspired by the special light in this dramatic landscape, when passing dark clouds bring gusty winds and small snow flurries; but most of the snow in the atmosphere near the ground is re-suspended by the strong wind from small patches of snow cover in shadowed mountain gullies. The shafts of sunlight squeezing through breaks in the cloud, shining on this blowing snow, produces a special light.

SNOW LIGHT I&II

LANDSCAPES FROM MY MEMORY

Oil on canvas, series





WATERMELON SNOW

Mixed media on canvas, 80x100 cm

Snow cover turning pink or reddish during spring and summer has been a long-observed phenomenon. In recent years it has been commonly called watermelon snow. Blooms of algae cause it with a red pigmentation for protection against high-levels of ultraviolet radiation. The blooms appear when there is melt-water present in the snow-cover. The red colouration makes the snow-cover less reflective (typically around 15%) to radiation from the Sun, causing even more melting. Increasing temperatures due to global warming has produced earlier and more melt-water in the snow-cover, and the resultant greater red algae growth, in turn, results in more melt-water in the snow-pack - a positive feedback.



MELTING GLACIER

Mixed media on hessian, 100x150 cm

"The key is a symbol for our need to adopt existing, and identify new, solutions to climate change"





THE MELTING GLACIERS SERIES

Oil on canvas, 100x100 cm



THE MELTING GLACIERS SERIES

Oil on canvas, 100x100 cm



THE DENIER AND THE BEAR

Mixed media on hessian, 175x135 cm

Despite overwhelming scientific evidence, there are still people who deny climate change and/or the role of humans. The consistent evidence comes from many sources, including GWF monitoring stations, such as the one represented here, at Trail Valley Creek in Northwest Territories, which has support and accommodation tents. The Polar Bear, which - to many - is iconic of the threat which climate changes poses for many animals, has supplemented his already impressive weaponry. He needs all the help he can get.



MELTING POLAR BEAR

Mixed media on canvas, 152x102 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.



FAMILY

SERIES 'POWERFUL AND VULNERABLE'

Oil, ink, charcoal on canvas, 120x90 cm



PREDATOR
SERIES 'POWERFUL AND VULNERABLE'

Oil on canvas, 120x90 cm



PREDATOR
SERIES 'POWERFUL AND VULNERABLE
Oil on canvas, 100x100 cm



THE DREAMS I NOW HAVE I&II

Oil on canvas, 100x100 cm



I want to say thank you Trevor and John for what you are doing for me and for all of us, and especially for the Transitions project, for the planet and nature. We are living in a difficult time, and I have been impressed by the hard work, knowledge, incredible enthusiasm, initiative and support that you, John and Trevor, have generated especially for this science art project. I cannot imagine the amount of time and dedication it takes by both of you and a Global Institute for Water Security. I know I personally appreciate it and without exaggerating I can say that millions of people around the world will grow to appreciate as well. Thank you again. This means a lot for me!

Gennadiy Ivanov / April 2019



GLOBAL WATER FUTURES RESEARCH PROGRAMME
GLOBAL INSTITUTE FOR WATER SECURITY,
UNIVERSITY OF SASKATCHEWAN
Artist Gennadiy Ivanov / Studio Art Gallery
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