SEPTEMBER 2021

Russia's Climate Gamble

The Pursuit and Contradiction of Its Arctic Ambitions

AUTHORS

Heather A. Conley
Cyrus Newlin
Colin Wall
Andrew Lohsen

CONTRIBUTING AUTHORS

Nikos Tsafos
Ben Cahill

A Report of the CSIS Europe, Russia, and Eurasia Program

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

SEPTEMBER 2021

Russia's Climate Gamble

The Pursuit and Contradiction of Its Arctic Ambitions

AUTHORS
Heather A. Conley
Cyrus Newlin
Colin Wall
Andrew Lohsen

CONTRIBUTING AUTHORS
Nikos Tsafos
Ben Cahill

A Report of the CSIS Europe, Russia, and Eurasia Program

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

About CSIS

The Center for Strategic and International Studies (CSIS) is a bipartisan, nonprofit policy research organization dedicated to advancing practical ideas to address the world's greatest challenges.

Thomas J. Pritzker was named chairman of the CSIS Board of Trustees in 2015, succeeding former U.S. senator Sam Nunn (D-GA). Founded in 1962, CSIS is led by John J. Hamre, who has served as president and chief executive officer since 2000.

CSIS's purpose is to define the future of national security. We are guided by a distinct set of values—nonpartisanship, independent thought, innovative thinking, cross-disciplinary scholarship, integrity and professionalism, and talent development. CSIS's values work in concert toward the goal of making real-world impact.

CSIS scholars bring their policy expertise, judgment, and robust networks to their research, analysis, and recommendations. We organize conferences, publish, lecture, and make media appearances that aim to increase the knowledge, awareness, and salience of policy issues with relevant stakeholders and the interested public.

CSIS has impact when our research helps to inform the decisionmaking of key policymakers and the thinking of key influencers. We work toward a vision of a safer and more prosperous world.

CSIS does not take specific policy positions; accordingly, all views expressed herein should be understood to be solely those of the author(s).

Center for Strategic & International Studies
1616 Rhode Island Avenue, NW
Washington, DC 20036
202-887-0200 | www.csis.org

Rowman & Littlefield
4501 Forbes Boulevard
Lanham, MD 20706
301-459-3366 | www.rowman.com

Acknowledgments

It is never easy leaving your intellectual comfort zone and exploring new terrain. CSIS's decade-plus research on the Arctic, and in particular the Russian Arctic, focused in large measure on understanding the Kremlin's bold economic and military development of the region. But we had not dived deeply into understanding the climate implications of these ambitions, both with respect to the physical effects of climate change on Russia's military posture and the economic effects of global energy transitions and decarbonization—itself a reaction to climate change— for Russia's current and future Arctic ambitions.

Whenever you explore new intellectual terrain, you seek the best possible guides and mapping tools for the journey. Thus, the CSIS Europe, Russia, and Eurasia Program turned to and drew from the extraordinary expertise of many different disciplines for this project. We wish to thank Dr. John Farrell, executive director of the U.S. Arctic Research Commission, for helping us identify the best and brightest in their respective fields and for joining us on this journey. We would like to thank the many experts who participated in our three virtual workshops stretched across many time zones in March, May, and August 2021. We benefited from the knowledge of permafrost engineers, oceanographers, ecologists, conservationists, political scientists, geophysicists, energy experts, climatologists, Arctic shipping entrepreneurs, satellite imagery analysts, former military officers, former diplomats, and security analysts. Gratefully, the CSIS Europe, Russia, and Eurasia Program can always turn to the excellence within our own institution, and we benefited enormously from the contributions of our CSIS colleagues Nikos Tsafos and Ben Cahill from the CSIS Energy Security and Climate Change Program.

This publication was funded by the Russia Strategic Initiative, U.S. European Command in Stuttgart, Germany. Opinions, arguments, viewpoints, and conclusions expressed in this work do not represent those of RSI, U.S. EUCOM, the Department of Defense, or the U.S. government.

Contents

Executive Summary	1
1 | Introduction: Russia's Arctic Ambitions and Climate Change	4
2 | An Overview of Physical Impacts of Climate Change in the Russian Arctic	6
3 | Economic Consequences of Climate Change for Russia	14
4 | The Political Economy of Climate Change in Russia	20
5 | Effects of Climate Change on Russia's Arctic Security Posture	29
6 | Concluding Analysis	38
About the Authors	42

Executive Summary

The Russian government has positioned itself as a beneficiary of climate change and has welcomed a rapidly transforming Arctic that is warming three times faster than the rest of the world and becoming increasingly accessible.[1] This study attempts to identify the most significant climate impacts across the Russian Arctic over the next 30 years to understand the broader implications for Russia's economy, internal political dynamics, and security posture. With this information, this study sought to determine whether Russia's considerable economic and military ambitions in the Arctic would fail or succeed and, based on this analysis, tease out meaningful regional and global geostrategic implications.

Physical Impacts of Climate Change in the Russian Arctic

The most pervasive threat to Russia from climate change is permafrost thaw: roughly 60 percent of Russia's territory, encompassing urban centers, energy infrastructure, and military installations, is covered by permafrost.[2] A particularly ice-rich layer of permafrost underlies the Yamal Peninsula, which contains oil and gas projects central to Russia's economic ambitions.[3] Other permafrost "hot spots," where the greatest degradation may occur, can be found near major cities such as Norilsk, Vorkuta, and Novy Urengoy, as well as in the wider Nenets and Yamalo-Nenets Autonomous Okrugs (AOs), on the Novalya Zemlya archipelago, in the areas near the city of Yakutsk, and in select areas in the far northwestern Chukotka AO.

Other climate threats to Russia include:

- Longer periods of dry weather that increase the probability and size of wildfires: by mid-August of 2021, 9.4 million hectares in the Siberian region of Yakutia had burned, setting an annual record for carbon emissions;[4]
- Coastal erosion, itself accelerated by permafrost thaw, causing Russia to lose a land area equivalent to Paris every two years and threatening ports along the Northern Sea Route (NSR);
- Climate change altering the characteristics of Arctic waters through a process known as "Atlantification," creating complications for marine wildlife and Russian fish stocks;
- A seeming increase in the number of gas or methane "blowout" craters, including in areas near key oil and gas facilities, such as the Bovanenkovo fields.

Economic Consequences of Climate Change for Russia

Climate change has direct consequences for the Russian economy and casts doubt on its optimism for economic development in the Arctic. The Russian government has estimated that infrastructure damage related to permafrost degradation and subsequent infrastructure damage will cost $67 billion by mid-century.[5] Private researchers put the number at closer to $105 billion.[6] This burden falls disproportionately on Russia's less-developed Arctic regions.

Russia has benefited economically from its investment in its liquefied natural gas (LNG) facility on the Yamal Peninsula, which will encourage the Kremlin to continue other ambitious projects, such as the Vostok Oil Project. The demand for Russian Arctic hydrocarbons and minerals will be primarily determined by the pace of the global economy and the speed of global decarbonization. Should the European Union, Russia's primary export market, meet its climate targets by 2050, it could reduce Russian oil and gas exports by 40 percent—equivalent to roughly $100 billion. Moreover, Russia is unlikely to meet its ambition to transform the NSR into a major global shipping lane handling 80 million tons of cargo by 2024. While Russia has had success in its Arctic development, its long-term economic viability tilts toward failure.

The Political Economy of Climate Change in Russia

Economic success or failure is unlikely to deter Russia's Arctic ambitions as an array of internal decisionmakers influence Russia's policies, including government officials and agencies, corporate actors, the wider business community, and military leaders. President Vladimir Putin's belief that Russia's vast energy and mineral wealth is one of the country's core geopolitical comparative advantages sets the prioritization for these decisionmakers. Military and national security leaders compete with corporate actors for funding and political patronage from key officials such as President Putin, Nikolai Patrushev (secretary of the Security Council), Dmitry Medvedev (deputy secretary of the Security Council), Sergei Shoigu (minister of defense), and Alexander Kozlov (minister of natural resources and environment). The powerful energy industry lobbies for an acceleration of fossil fuel exports and champions the relatively low greenhouse gas intensity of hydrocarbon production in Russia as justification for a delayed energy transition.

For years, Russian leadership cynically viewed climate change as a Western excuse to use mitigation efforts to undercut Russia's wealth and geopolitical ambitions. Russian government officials have

shifted their policy discourse to reluctantly acknowledge the threat of climate change and the economic threat that decarbonization presents. And yet Moscow's rhetoric and new green initiatives are largely for show. They are designed to avoid diplomatic isolation and slow down or prevent global decarbonization as Russia itself seeks to actually increase its fossil fuel exploration (to include its plans to boost natural gas production to 1 trillion tons annually by 2035, a 50 percent increase from 2019).[7]

Effects of Climate Change on Russia's Arctic Security Posture

Climate change has impacted Russia's Arctic security posture and will continue to do so. The growing accessibility of the region has led to an increased sense of vulnerability: Moscow believes the United States and the North Atlantic Treaty Organization (NATO) intend to challenge Russia's regional supremacy, threaten its sea-based nuclear deterrent on the Kola Peninsula, and endanger its economic projects, particularly the NSR. The Russian military has responded to this vulnerability by increasing its defensive capabilities. At the same time, however, it also has sought to enhance its power projection capabilities.

Russia has pursued offensive and defensive goals simultaneously. It has strengthened its Northern Fleet with new submarines and icebreakers, refurbished Soviet-era military and coast guard installations, procured weaponry hardened to the Arctic environment, enhanced its situational awareness, and conducted hypersonic missile tests and more frequent exercises. Similar to the economic story, the Russian military has had success in growing its military posture in the Arctic, but it also will struggle to meet these ambitions in a vast, remote, and inhospitable region. A number of Russian Arctic military installations may be vulnerable to the physical impacts of climate change: 18 are endangered by permafrost, including 5 in permafrost hot spots, such as Rogachevo and Anadyr-Ugolny air bases; others may be at risk from the effects of coastal erosion, to include the critical shipbuilding yards at Severodvinsk; and still others may be vulnerable to wildfires. These environmental vulnerabilities are compounded by a culture of corruption, engineering shortcuts, and cost-cutting that leads to the frequent use of substandard materials in Arctic infrastructure.

Russia's Arctic Tradeoff

Russia's economic and security policies toward the Arctic have evolved into a high-stakes policy contradiction. The more external investment that Russia pursues in order to develop its Arctic energy resources and transform the NSR into a global shipping route, the more it must securitize the region—eventually deterring the very foreign investment it seeks. The less economically successful the Russian Arctic becomes, the Yamal LNG project notwithstanding, the more likely it is Moscow will force infrastructure construction and military development to continue. The more infrastructure it builds, even if it uses modern geo-engineering, the more susceptible it will be to climate change. The more energy Moscow seeks to export, the more its economy will be impacted when decarbonization become a reality. And of course, the greatest contradiction is the Russian government's view that the country will on net benefit from climate change, when in fact it will profoundly challenge Russia's economic prospects and therefore its geopolitical fate. In other words, the more that Russia implements its near-term Arctic policies as currently defined, the more damaging those policies become for the country's future.

1

Introduction

Russia's Arctic Ambitions and Climate Change

"Absolutely unprecedented"—these were the words President Vladimir Putin used on August 14 to describe the largest wildfire in Russia's history, which at that time had burned 1.3 million hectares in the Siberian region of Yakutia and had catastrophically released over 505 megatons of carbon dioxide equivalent into the atmosphere.[8] This was not a typical presidential video message extolling the benefits of climate change to Russia's Arctic economic and military fortunes. It did not highlight the increase in transshipment tonnage through the Northern Sea Route (NSR) or announce a new Arctic energy exploration. Putin was describing the growing costs of climate change to Russia as its implications for one of his most impressive and economically and militarily important prestige projects: the Arctic.

For Russia, climate change, like its Arctic policy writ large, is a high-stakes contradiction. As Alexey Chekunkov, minister for the development of the Russian Far East and Arctic, noted in a recent interview: "The Arctic is warming faster than the continent—this has a very negative potential, but also a very positive one."[9] This report examines this and other important contradictions in Russia's climate policies and attempts to identify the most significant climate impacts across the Russian Arctic over the next 30 years to understand the broader implications for Russia's economy, internal political dynamics, and security posture. With this information, this report seeks to predict whether Russia's ambitions in the Arctic will fail or succeed and to tease out regional and global implications.

The study team believes this research fills an analytical gap. To date, analysts (including this institution) and policymakers have primarily focused on how Moscow has positioned itself militarily and economically to benefit from a changing climate and a warming Arctic. In other words, the emphasis has been on how Russia will succeed. While important, this analysis has largely omitted consideration of the other side of that coin: the potential costs to Russia of climate change and the geostrategic consequences should its Arctic policy fail. It is clear that climate change has opened opportunities for Russia to pursue its strategic imperatives in the region, but this analysis contends that this pursuit is in fact a high-stakes gamble that becomes riskier every day as climate change transforms the Russian Arctic.

The contradictions begin with the region itself. The Russian Arctic is a critical source of current and future economic potential for Russia; yet it is among the poorest and least developed in the country. Climate change creates the opportunity for ambitious economic projects such as the NSR; yet it also makes the environment and landscape more dangerous, threatening those same projects. While Moscow encourages foreign investment in the Arctic, its heightened insecurity causes it to militarize its long northern border with defensive and offensive capabilities, eroding investor confidence in the region.

While climate change is a conundrum for the Kremlin, it does not dissuade Moscow from its focus of achieving its Arctic ambitions, which are largely driven by three factors: prestige, economics, and security. The development of the Russian Arctic is in large part a legacy project for Putin's enduring leadership. He and his inner circle are well aware of the outsized place the Arctic and Russian Far East hold in Russian historical and nationalistic narratives and indulge in self-mythologizing. The Russian Arctic reinforces Russia's vastness, and it is a place where it can exhibit its strength largely unencumbered. Economically, its Arctic oil and gas fields assure Russian energy export prowess as its Siberian fields diminish, although the sustainment of this prowess will be greatly tested by Europe's green energy transition. Russia achieves its nationalistic and economic goals through the military-industrial complex where it uses the Russian military to not only further and protect its economic projects, but also to defend its sea-based nuclear forces and project power.

Whether or not Russia's leaders acknowledge or make policy adjustments due to the costs of climate change, it will shape and influence their Arctic ambitions. First and foremost, the global energy transition and the decarbonization of major economies will eventually pose an existential threat to Russia's fossil-fuel export-based economy—and raise doubts about the long-term viability of its Arctic energy projects. Second, climate change is threatening Russia's civilian and military infrastructure, with repercussions for both its economy and security posture. Finally, the central government's limited attention and reduced financial resources may cause a failure to address the cumulative threats of climate change—infrastructure degradation, wildfires, air pollution, water contamination, anthrax release, and other challenges—which will fuel public dissent in Arctic and far east regions of the country and exacerbate tensions between regional governors and Moscow. Even without the acute effects of climate change, Russia's Arctic regions have historically performed poorly—relative to Arctic regions in Europe and North America—in several human development indicators, including life expectancy, disposable income per capita, gross regional product (GRP) per capita, and income inequality.[10] It is not surprising that the population of these regions declined by 0.6 percent from 2012 to 2018. While these indicators have stabilized in recent years, climate change will negatively impact how they develop going forward and determine Russia's economic and political success in the region overall.[11]

2

Physical Impacts of Climate Change in the Russian Arctic

The Intergovernmental Panel on Climate Change (IPCC) estimates that global average temperatures have increased by about 1°C since pre-industrial times and are currently increasing by about 0.2°C per decade. In Russia however, warming is occurring at an even faster rate of 0.45°C per decade, about twice the global average, and 0.8°C per decade in Russia's Arctic region, or four times the global average.[12] Climate change has elongated summers and shortened winters, increasing the number of days that permafrost thaws and greenhouse gases are emitted into the atmosphere.

Northern Cities and Permafrost "Red Zones"

Roughly 60 percent of Russia's territory, encompassing 5.4 million people (5 percent of the Russian population), rests on permafrost, defined as any type of ground frozen continuously for at least two years.[13] In the last 30 years, average annual ground temperatures have increased 1 to 2 percent across the Russian Arctic as a result of climate change, resulting in widespread permafrost thaw. This thaw has been most acute in the Taymir and Yamal Peninsula, where several major cities and industrial centers—Norilsk, Vorkuta, and Novy Urengoy—are located, resulting in the cracking or collapsing of urban infrastructure.[14] Permafrost thaw also impacts underground sanitary systems such as sewage lagoons and water treatment plants, which, if compromised, have the potential to release dangerous pathogens into local water systems.

The thawing of ice-rich permafrost around an underground utility line causes structural deformations in the residential area of Oganer near Norilsk (July 2003).

Source: V. Grebenets, Dmitry A. Streletskiy, and Nikolay Shiklomanov, "Geotechnical safety issues in the cities of Polar Regions," *Geography, Environment, Sustainability* 103, no. 5 (2012): 103–119, doi:10.15356/2071-9388_03v05_2012_08. No changes were made to this image, which is licensed under a Creative Commons Attribution 4.0: https://creativecommons.org/licenses/by/4.0/legalcode.

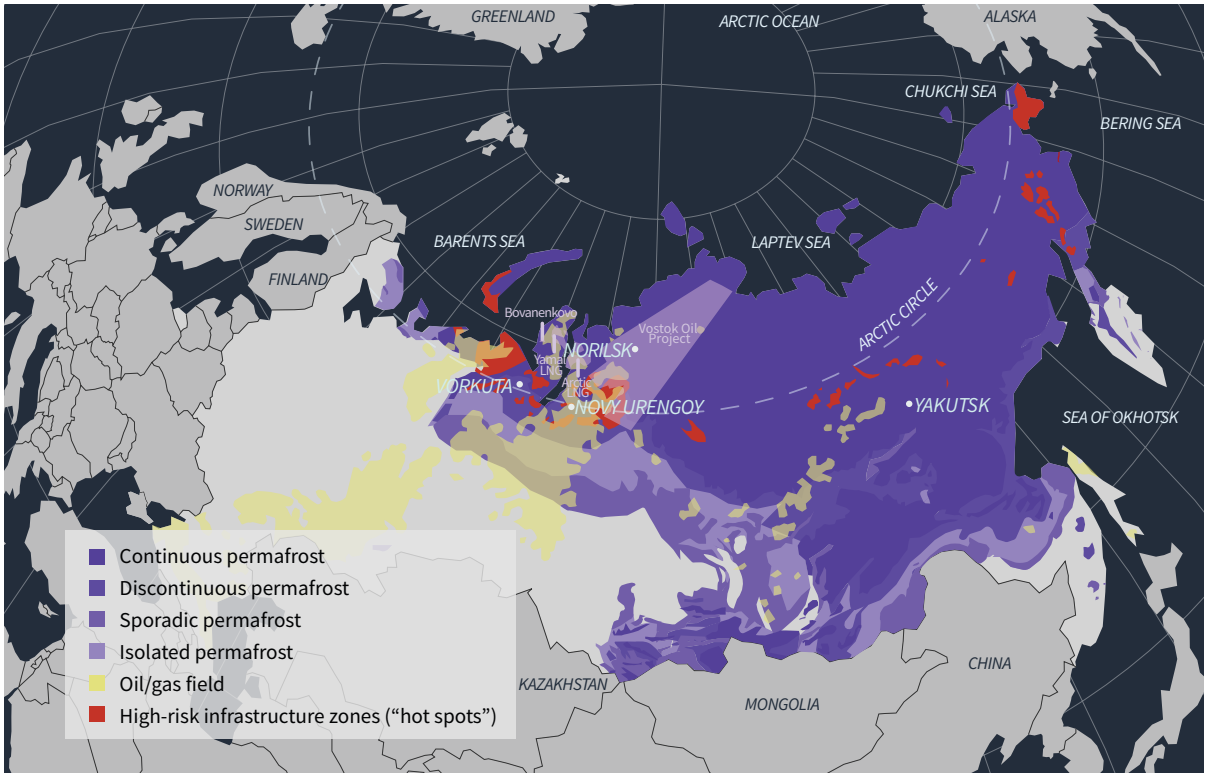
Damage associated with permafrost deterioration necessitates the demolition of a nine-story residential building in Norilsk that had only been in use for 21 years (July 2001).

Source: Grebenets, Streletskiy, and Shiklomanov, "Geotechnical safety issues in the cities of Polar Regions." No changes were made to this image, which is licensed under a Creative Commons Attribution 4.0: https://creativecommons.org/licenses/by/4.0/legalcode

A widespread reduction in building and infrastructure bearing capacity in permafrost-rich zones is expected by mid-century, with associated negative impacts on both urban settings and industrial and energy facilities across the Russian Arctic.[15] Because Russia's northern, continuous permafrost tends to be very ice-rich, it is highly reactive to changes in air temperature. When frozen, soil with high ice content is structurally strong, but it weakens substantially as ice temperature increases and eventually reaches its thaw point. An exchange in soil volume also occurs as ice turns to water and some of the water migrates away, creating depressions in the surface. Even slight ambient warming can have serious implications, causing weakening and increasing susceptibility to coastal erosion and slope instabilities during flooding events.[16]

Permafrost risks to infrastructure in the Russian Arctic are further exacerbated by the nature of infrastructure itself. The overwhelming majority of urban infrastructure in the Russian Arctic was built during the Soviet Union and is composed of heavier concrete structures with shallower foundations that were not designed to withstand significant permafrost thaw. For example, one study of Norilsk found that 70 percent of buildings have experienced some level of permafrost degradation, while another 20 percent have experienced them only in the basement.[17] Although there are a variety of modern engineering solutions to protect against this type of structural damage, including mechanical freezing of soil and building deeper or adjustable foundations, these solutions predate existing infrastructure and are expensive to apply retroactively to old buildings.

Permafrost Hot Spots, Urban Areas, and Critical Energy Projects



Source: Map data comes from Mia Bennett, "Norilsk oil spill: 'There are rivers of fuel'," Crypolitics, June 22, 2020, https://www.cryopolitics.com/2020/06/22/norilsk-oil-spill/; Jan Hjort et al., "Degrading permafrost puts Arctic infrastructure at risk by mid-century."

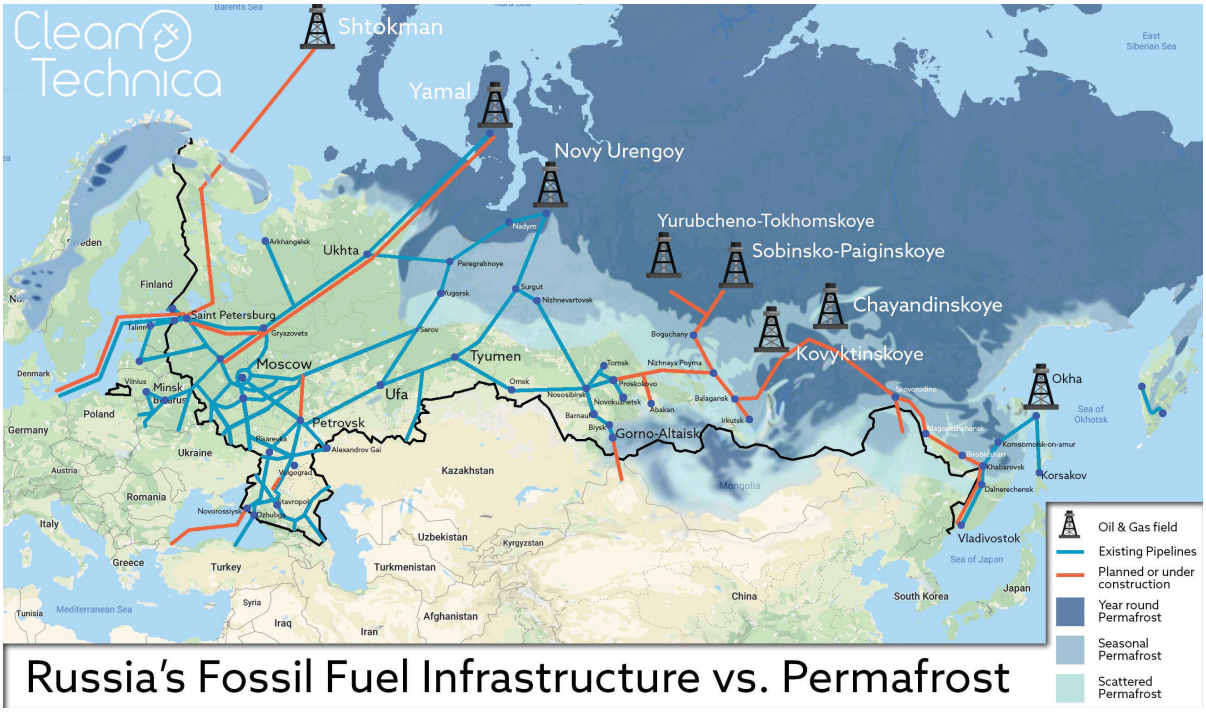
The Yamal Peninsula: Strategically Important and at Risk

The Yamal Peninsula is the geographic epicenter of Russia's Arctic economic ambitions. It contains the largest gas reserves on the planet and the highest concentration of active oil and gas fields and pipelines in Russia, spread across the Bovanenkovo, Tambey, and Southern production zones. The extraordinary development of oil and gas fields in the Yamalo-Nenets AO region has raised its share in the Russian Arctic economy to nearly 30 percent today from 23 percent in 2015.[18] The region's largest gas field, Bovanenkovo, is linked by a transmission corridor to Russia's legacy Unified Gas Supply System. The controversial Nord Stream 2 pipeline will carry gas from Bovanenkovo directly to Germany. Most notably, the Yamal Peninsula is also home to a landmark $27 billion LNG project with an estimated export capacity of 16.5 mtpa (metric tons per year). The project's first train came online in 2017, and after several delays, its fourth and final train reached full capacity in June 2021. Russia has geared much of its regional military presence toward protecting these energy production sites.

The outermost layer of permafrost in the Yamal region is particularly ice-rich, ranging from 10 to 20 meters thick, and is therefore even more sensitive to increases in air temperature. This fact, coupled with the high concentration of energy infrastructure on the peninsula, makes Yamal a "hot spot" for infrastructure risk stemming from permafrost degradation. Predictive models of surface temperature change show that the most severe and worrisome changes in bearing capacity in the Russian Arctic through mid-century are likely to take place in the Yamalo-Nenets AO.[19] Permafrost thaw also carries risks for the region's maze of oil and gas pipelines, and in particular oil pipelines, since they emit heat and are frequently laid directly atop frozen ground, which can expedite local permafrost thaw. (Gas pipelines face a different set of issues:

because gas is compressed and travels as a frozen conduit, water migrates to gas pipelines and often freezes, which can have the effect of raising or buckling the pipeline and creating leaks.) In addition to permafrost thaw, recent pipeline accidents related to the Kharyaga oil field in the Nenets-AO have been attributed to the depressurization of pipelines.[20]

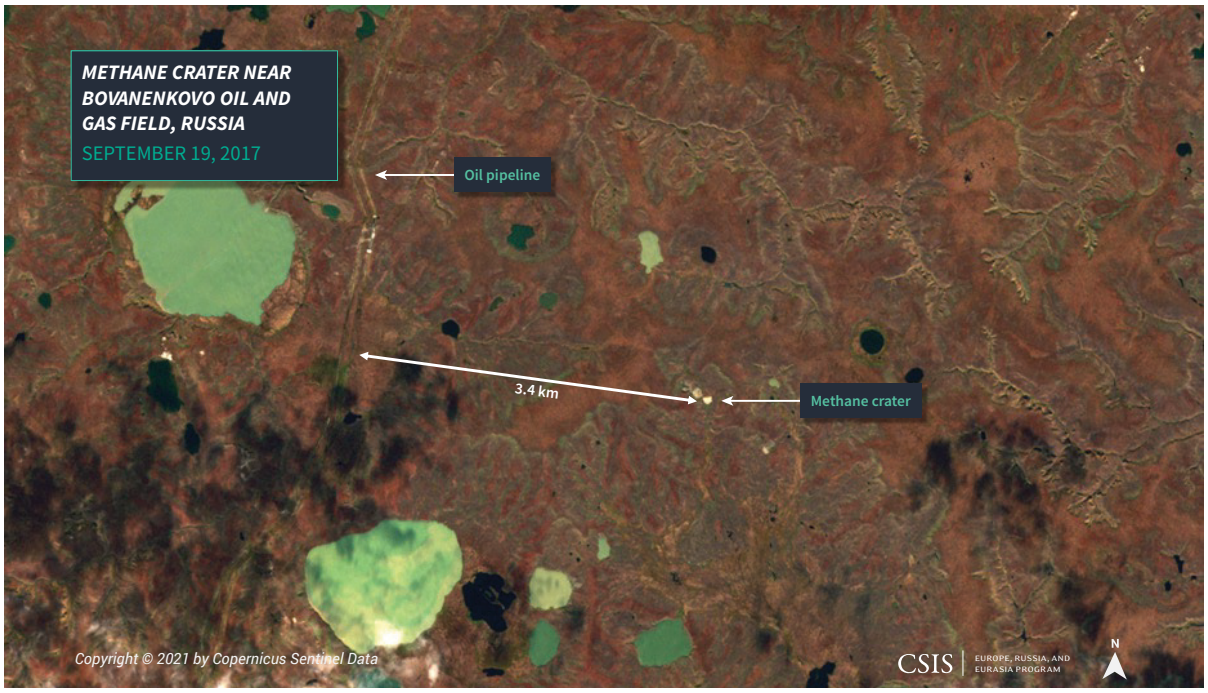
Permafrost and Pipelines



Source: Chanan Bos, "Melting Permafrost Claims Its First Major Victim, Russia's Oil & Gas Network," CleanTechnica, June 9, 2020, https://cleantechnica.com/2020/06/09/melting-permafrost-claims-its-first-major-victim-russias-oil-gas-network/.

According to the state-owned gas company Gazprom, roughly 13 percent of its pipelines are new (under 30 years), over 60 percent are between 30 and 50 years old, and 25 percent are 50 years or older. To avoid damage to infrastructure arising from changes in the surface soil, a standard engineering practice is to raise pipelines onto struts and, in permafrost hot spots, to implement cooling of oil pipelines in order to prevent localized warming of subsoil (unlike oil pipelines, gas pipelines do not heat the ground underneath). These practices are widely but not universally employed in the western part of the Russian Arctic. The Power of Siberia pipeline to China, for example, was laid using a combination of the traditional method of dropping the pipeline into a trench for certain stretches of the route and raising it on stilts for others.[21] Though Power of Siberia does not run across permafrost hot spots, it is still at some risk of permafrost degradation as it does run across permafrost zones on its way from the Lake Baikal region into northern China.

Another and less well understood terrestrial risk is a seeming increase in the number of gas or methane "blowout" craters, including in areas near key oil and gas facilities such as Bovanenkovo. In 2014, for example, a crater was discovered a mere 3.5 kilometers from the Bovanenkovo-Ukhta pipelines. Several others have been found nearby in the Yamal Peninsula.[22] These craters appear to be a product of rapid permafrost collapse or an explosion due to a buildup of gases. These unpredictable explosions could have a devastating impact on new and old infrastructure alike: the Bovanenkovo-Ukhta pipelines were built after 2008 but could nonetheless have been damaged by a crater blowout.



Finally, it is important to note that climate impacts in the Russian Arctic do not stay in the Russian Arctic. Studies have shown there is a significant amount of carbon dioxide and methane stored in its permafrost and co-located rock formations that will be released into the atmosphere as it thaws.[23] In the worst emissions scenarios, this carbon release could be tens to hundreds of billions of tons, according to a 2019 report from the IPCC.[24] The extent of that carbon release is thought to be equivalent to roughly one-tenth the emissions produced by burning fossil fuels to the end of the century, a fact that is of great concern.[25]

River Systems, Coastal Erosion, and Ocean Acidification

The sea level rise of one meter over the next century is associated with an IPCC warming rate of 2 to 3°C, the world's current trajectory.[26] Such a dramatic increase in sea levels has implications globally and for Russia's coastal cities, including St. Petersburg and Kaliningrad on the Baltic Sea, Murmansk on the Barents, and Vladivostok on the Pacific, as well as Russian coastal military installations. Russia's long coastline means a sea level rise of one meter could result in significant loss of land for Russia, which is already losing an area equivalent to Paris every two years due to coastal erosion.[27]

Another accelerant of coastal erosion is a combination of permafrost thaw and the rapid diminishment of Arctic sea ice, which is most visible in the Russian Arctic along the NSR. The combination of degrading soil and the lack of a sea-ice buffer from storms and related storm surge more rapidly erodes the coastline. Warmer Arctic surface waters combined with rising sea levels globally pose a unique risk to Russia's vast Arctic coastline, which is between 70 to 80 percent comprised of ice. These include more rapid coastal land retreat and elevated risks to coastal infrastructure, possibly to include ports along Russia's NSR.

Less polar ice and warming seas are also associated with two phenomena that have global weather ramifications. It is believed that the thinning of the Arctic halocline layer and a concomitant "shallowing" of the warmer Atlantic layer in the Barents Sea—a process known as "Atlantification"— disturbs marine wildlife and, by warming sea ice from below, may contribute to a self-reinforcing feedback loop of melting sea ice leading to Atlantification leading to still more melting.[28] Another phenomenon, known as "Arctic Oscillation," is a further complicating variable. During the "negative" phase of the oscillation, the polar vortex—a band of winds enclosing freezing air that usually stays suspended in the air over the North Pole—may slow down, in turn causing the polar jet stream to bring freezing air further south toward the mid-latitudes of the Northern Hemisphere leading to extremely harsh winters.[29] Some scientists believe this negative phase is becoming more frequent due to climate change.

The Russian Arctic is also particularly vulnerable to ocean acidification, resulting in Arctic waters increasingly absorbing high carbon dioxide levels, which carries risks for marine life and food chains. Already, there has been a 40 percent increase in atmospheric carbon dioxide levels since the start of the industrial revolution and a concomitant 26 percent increase in ocean acidity.[30] Based on paleontological records from the Eocene period, it appears that rapid acidification can occur more quickly than organisms can adapt, potentially producing widespread extinction of marine wildlife.

Changes in sea temperature have significant repercussions for the migratory trends of commercially valuable fish stock. In the last decade, for instance, the distribution of pollock—part of a $2 billion dollar industry—has reconcentrated in the northern part of the Bering Sea and even begun to move into the Chukchi Sea.[31] Although the United States has traditionally refrained from granting commercial licenses in this region, Russia announced the first ever commercial fish auction for the Chukchi Sea last April.

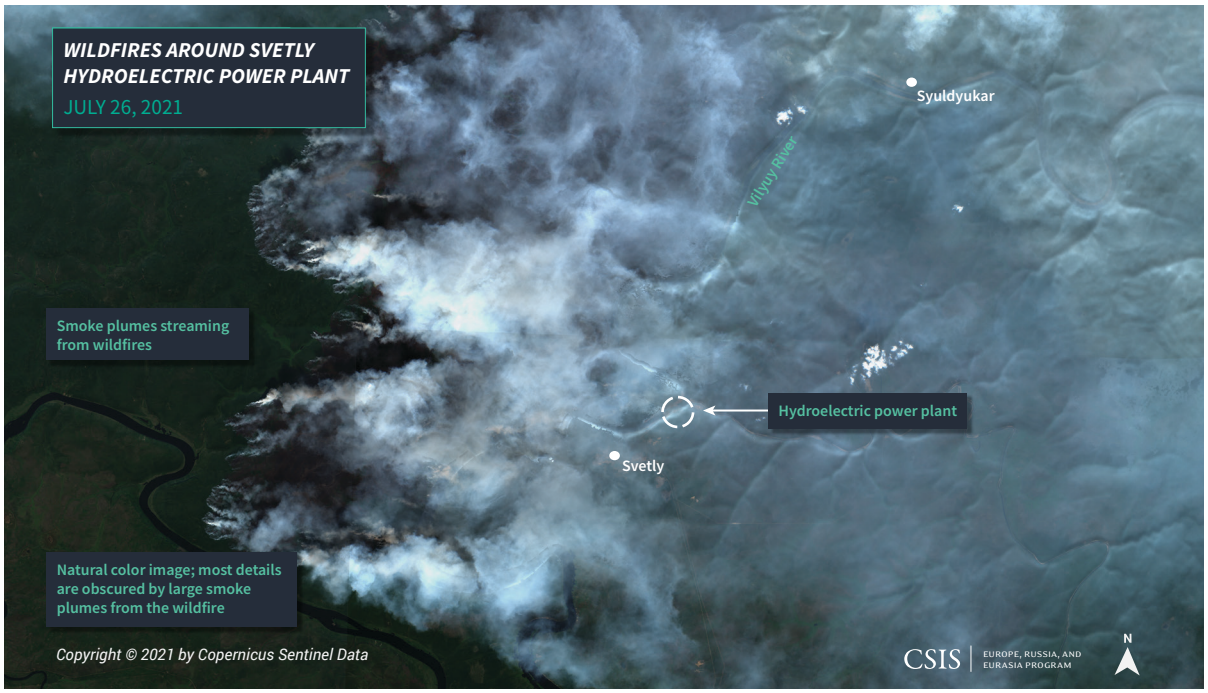
Though authorities in Russia view diminishment of the polar ice cap as a benefit, an increase in shipping traffic through the NSR will have wide-ranging, if poorly understood, environmental impacts. These include increases in noise and marine pollution (heavy fuel oils), maritime accidents, and oil spills, which all pose risks to sensitive marine ecosystems in the Arctic. These impacts may be particularly significant in the narrow Bering Strait, one of the world's most important migratory routes for marine animals.

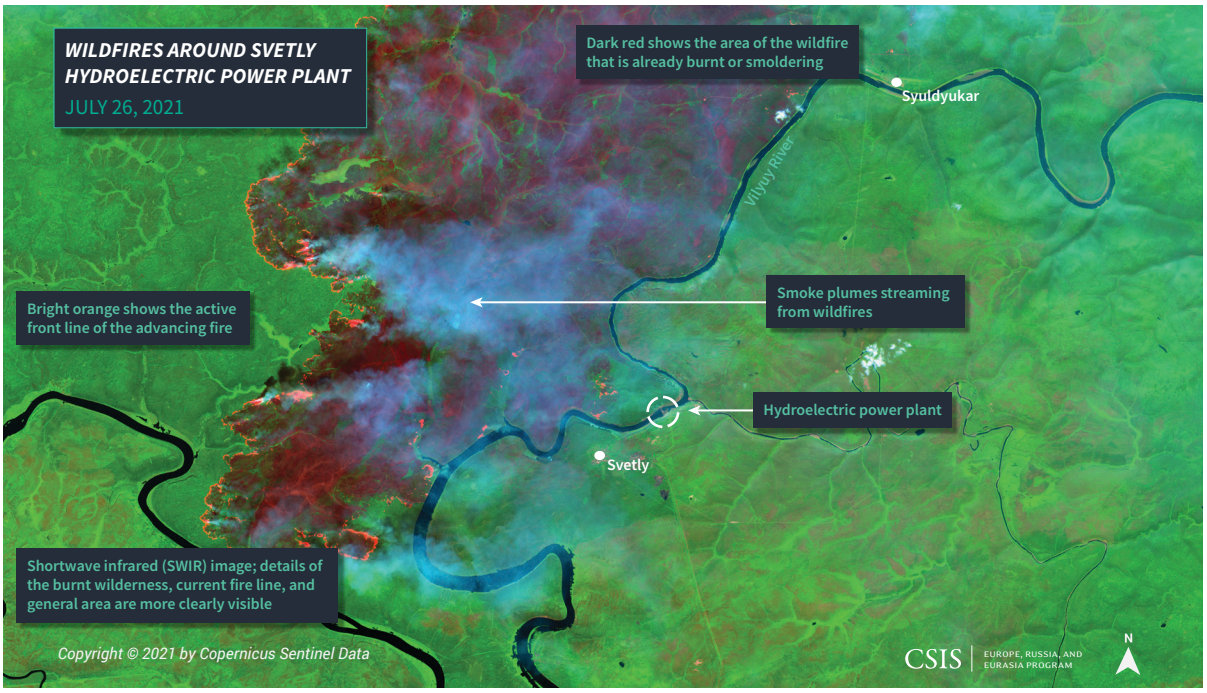
Wildfires

Longer periods of dry weather brought about by climate change have increased the probability and size of forest fires across Siberia—as noted earlier, even previously fire-resistant landscapes such as tundra are becoming more fire prone and the wildfire season is lasting longer.[32] In 2020, wildfires burned more than 60,000 square miles of forest in Russia, an area roughly the size of the U.S. state of Georgia. This year is on course to break that record: as of July 21, the total area burned across Russia was already more than half of the prior year's total, with the Republic of Sakha (Yakutia) having been particularly hard hit.[33] In June, an unusually early wildfire season prompted regional governor Aisen Nikolaev to declare a state of emergency for the region. By mid-July, the total area burned in Yakutia was nearly 20 percent higher than the same period in 2020.[34] By mid-August 2021, these summer wildfires had burned through 9.4 million hectares in Yakutia and set an annual record for carbon emissions with weeks still remaining in the fire season.[35] This led to Nikolaev bluntly telling the Russian media, "Obviously, there is only one reason: Global climate change. . . . We can see how it's getting hotter in Yakutia every year. We are living through the hottest, driest summer in the history of meteorological measurements since the end of the 19th century."[36]

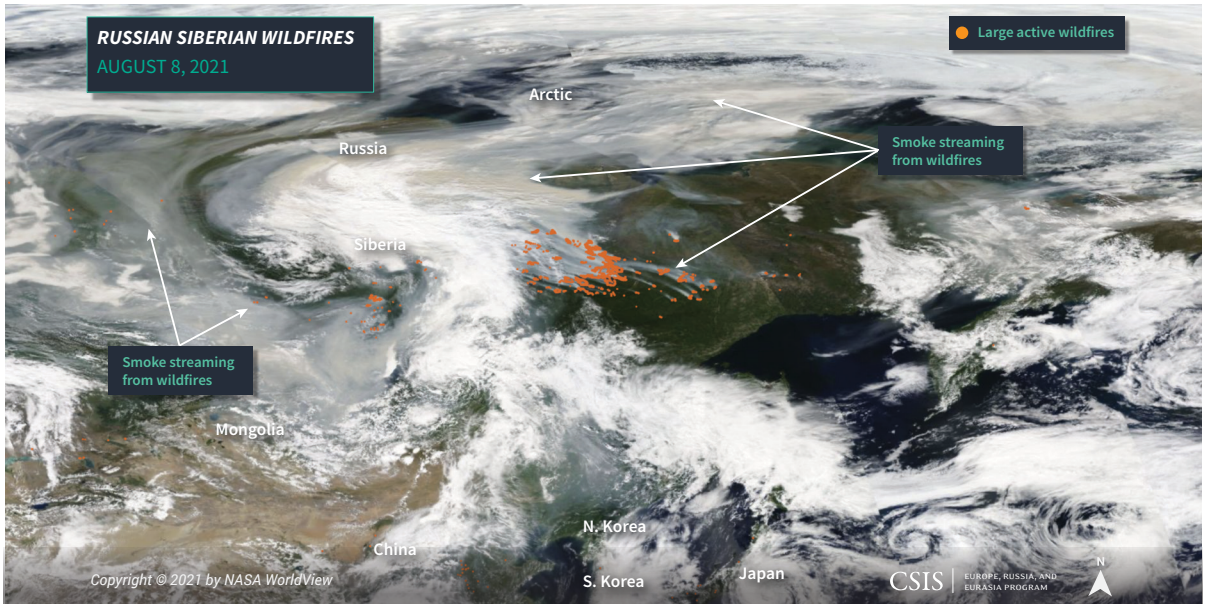
According to the IPCC, this more intense wildfire season may even be accelerating the rate of permafrost degradation by burning away some of the organic matter and vegetation that contributes to keeping permafrost cool.[37] This can set off a feedback loop: evaporating water from melting permafrost turns into clouds that produce more rain, more lightning, and, in turn, yet more wildfires.[38]

Though forest fires occur each year in Russia and historically have only a limited impact on human settlements, the sheer scale and duration of recent fires have forced authorities to contend with a new climate reality. Permafrost thaw, coastal erosion, and ocean acidification pose significant threats, but wildfires are the clearest manifestation of the dangerous and life-threatening consequences of climate change to Russia. In July, for example, a blaze came dangerously close to a hydroelectric power station outside the village of Syuldyukar in the Sakha Republic, underscoring the risks of future fires to critical infrastructure, including military installations.[39]





The costs to public health in Russia are also mounting each year. Siberia experienced record wildfires in 2020, but atmospheric circulation carried smoke northward into a sparsely populated corner of the Far East, north of Magadan. Russia has not been so lucky in 2021. Wind patterns have carried the smoke eastwards, enveloping dozens of cities and settlements in dangerous aerosols and particulate matter.[40] Overall, smoke from wildfires has blanketed huge swaths of Russia's Arctic and Far East regions.



The consequences extend beyond Russia. Siberia's fires accelerate climate change by releasing enormous quantities of greenhouse gases and destroying Russia's vast carbon-sequestering forests. Last year, fires in Yakutia released roughly as much carbon dioxide as did all the fuel consumption in Mexico in 2018.[41] As the frequency and severity of these climate change-related catastrophes continue to increase, Russia will be forced to contend with their economic ramifications.

3

Economic Consequences of Climate Change for Russia

Cost of Permafrost Degradation

Scientists in Russia have sought to quantify the economic cost of permafrost degradation to Russia. In May 2020, Russian environmental minister Alexander Kozlov estimated the economic cost of infrastructure damage from permafrost thaw at $67 billion by 2050.[42] In a 2019 interview with Bloomberg, deputy minister for Far East and Arctic development Alexander Krutikov put the economic loss at RUB 50–150 billion per year (approximately $695 million–$2.085 billion).

Other models suggest that permafrost degradation will carry an even heavier economic burden for regional budgets. Under an extremely dire RCP 8.5 warming scenario—in which no significant efforts are taken to cut greenhouse gas emissions—researchers estimate that 19 percent of infrastructure and 54 percent of buildings across Russia would be damaged by permafrost thaw by mid-century, with the total estimated cost associated with permafrost degradation to buildings reaching $105.07 billion by the mid-twenty-first century.[43] On paper, this cost appears manageable—roughly equivalent to the costs of two Olympic games in Sochi—but the picture changes when represented as a portion of regional budgets: by mid-century, the economic burden is roughly 5 percent of the gross regional product (GRP) in the Nenets AO and 3 to 4 percent of GRP in the Yamal-Nenets AO, Sakha (Yakutia), and the Chukotskiy AO.

In Russia, non-Western engineering approaches also increase the susceptibility of its Arctic cities to permafrost degradation. In part due to the scarcer availability of capital, Russian approaches to building emphasize low initial costs of construction, which raises the economic burden of maintenance (operating costs) over the building's lifetime and has implications for military installations as well. Though Russia has a much longer experience building on permafrost, its approach to engineering and construction in permafrost territories means that the cost of updating infrastructure in the Russian Arctic is likely to be much higher than in Canada or the United States.[44]

The costs to energy infrastructure are also substantial. Russia's permafrost area accounts for roughly 15 percent of Russia's oil production and 80 percent of Russia's gas operations.[45] The majority of Russia's energy infrastructure located in the Russian Arctic is aging and may not withstand changes to bearing capacity brought about by climate change. In May 2020, for example, an oil storage tank in Norilsk collapsed, spilling a reported 150,000 barrels of diesel into the Ambarnaya River and a nearby lake.[46] Greenpeace estimates that the Norilsk spill is only one of hundreds of oil accidents that occur each year across Russia and that at least 5 million tons of oil leak annually in Russia, a country that produces 500 million tons of oil per year.[47] Other researchers have corroborated these figures.

These images show the effects of the Norilsk spill and Russia's mitigation efforts.

More Land, More Drought: Climate Change and Agriculture

Russia's steppe, stretching from south of Moscow to the Black and Caspian Seas, makes up the country's traditional "breadbasket" and most productive agricultural regions, but longer growing seasons and changes in precipitation patterns as a result of climate change are expected to open up new arable land in more northern latitudes. A 2019 study estimated that approximately half of Siberia, over 2 million square miles, may become available for farming by 2080.[48]

A key question, however, is whether an increase in arable land translates into higher net yields, in particular as Russia's more productive southern agricultural region faces an expected uptick in droughts and extreme weather events. Soil in Russia's northern regions tends to be more acidic and less productive. Furthermore, the sparse newly arable regions of Siberia will require heavy capital investments into infrastructure and food transport. Meanwhile, agriculture in Russia's traditional breadbasket region will become more reliant on irrigation and pesticides and more vulnerable to droughts and other extreme weather events.

Northern Sea Route: An Exaggerated Economic Benefit?

The NSR is a waterway stretching from Kara Bay to the Bering Strait. Russia views the NSR as an internal passage, whereas the majority of the international community views it as an international passage. Global warming has reduced Arctic sea ice coverage and has extended passage for longer parts of the year. When global commodities and shipping prices are high, commercial interest is increased in the commercial use of this shipping corridor. Today, shipping volume along the NSR is growing modestly but remains nonconsequential for global trade. Traffic is dominated by destinational shipping serving Russian Arctic energy and mineral projects. This approach uses specialized vessels—such

as shuttle tankers, bulkers, and LNG carriers—for the shortest possible distance to carry LNG and minerals along the NSR and then transports cargo to more conventional vessels at suitable ports on the western and eastern periphery of Russia's Arctic coastline.

Northern Sea Route and Key Ports

The Kremlin prioritizes the development of the NSR and incentivizes the development of sea transport infrastructure, including ports, search and rescue centers, and floating storage units for LNG shipping along Russia's Arctic coast. Many of these ports are dual-use and may also be utilized by the Russian navy and the Federal Security Bureau's (FSB) coast guard service.

Transport volumes along the route reached 32 million tons in 2020—up from only 2 million in 2013.[49] This is expected to rise further as more LNG projects, including ones currently under construction, come online. By presidential decree, Putin has set a goal to increase cargo traffic volumes to 80 million tons by 2024.[50] Other ministries have laid out even more ambitious projections: the Ministry of the Far East and the Arctic, for example, projects an increase in cargo transport volume to 95 million tons, while Rosatom, the administrator of the NSR, envisions an increase to 92 million tons. In July 2021, First Deputy Prime Minister Andrei Belousov set a goal of reaching 150 million tons by 2030, a 400 percent increase over the next decade.[51] All of these goals are unlikely to be met.

Numerous obstacles stand between Russia and its lofty NSR ambitions. Despite the rapid warming of the Arctic Sea, scientists expect the NSR to remain fully or partially ice-covered six to nine months out of the year through the end of the century, meaning Russia will continue to rely on an expensive and small fleet of specialized shipping vessels, including icebreakers, to extend the navigation season for destinational shipping rather than transshipment.[52] Furthermore, climate change not only melts sea ice, it also leads to an increase in the intensity and frequency of extreme weather events, which may challenge shipping, and to coastal erosion and sea level rise, which may endanger critical ports. Moreover, demand for

Arctic shipping will be primarily determined by a vibrant global economy and the scale of resource development, including hydrocarbons and minerals, amid a global energy transition.

The Price of Global Decarbonization for Russia

Oil and gas remain the cornerstone of Russia's economy, contributing roughly a quarter of its consolidated budget revenue, over half of its export revenue, 40 percent of its industrial output, and an estimated 15 to 20 percent of GDP. A rapid global energy transition would reshape Russia's economy, potentially leading to substantial declines in Russian oil and gas output. In a scenario in which the world achieves net-zero emissions by 2050, as outlined in one roadmap from the International Energy Agency, Russian oil and gas production could decline precipitously by mid-century.[53]

Russia's government is skeptical that such rapid decarbonization is possible. The government claims that calls to stop investment in new oil and gas exploration and development are impractical and risk a supply shortfall and rapid price increases.[54] Russian oil and gas production will arguably be more resilient compared with other sources of supply, due to its relatively low break-even costs, continued investment, lenient tax regimes for state oil companies, and a supportive state financial sector. Still, Russia's government is arguably underplaying and underappreciating the longer-term risks to oil demand as well as the potential geopolitical implications of the shift away from fossil fuels.[55]

In the more immediate term, concerns related to the energy transition are already materializing. Environmental, social, and governance (ESG) pressures on oil and gas companies and the financial sector are making it increasingly difficult to finance fossil fuel projects, which will affect Russian state oil companies and their partners.[56] U.S. sanctions have also impacted Russia's ability to secure long-term financing to support Arctic energy projects. Natural gas buyers are also increasingly concerned over the emissions footprint of their gas supply and aware of the large methane emissions associated with Russian gas production and transport.[57] Russian national oil companies are sensitive to these demands and are making some efforts to improve their emissions disclosures, but to date their emissions targets have been modest.[58]

Russia is particularly vulnerable to policy changes in the EU market. By 2030, realization of the European Union's emissions targets could mean a 25 percent reduction in oil imports and a 15 percent reduction in gas imports, relative to 2015 levels, potentially eliminating a tenth of Russia oil and gas exports (worth $25 billion).[59] By 2050, the European Union meeting its climate targets could mean an 80 percent decrease in oil imports, relative to 2015, and a 58 to 67 percent decrease in gas imports. This is projected to reduce Russian oil and gas exports by 40 percent (roughly $100 billion in 2019 terms).[60] The final number may be even higher, as oil is the more valuable of the two and would be hit harder by the European Union's reduction. It is not surprising therefore that Putin has recently indicated that, as part of a grand bargain, Europe must not reduce its demand for Russian gas if it wishes Moscow to consider extending energy transit rights through Ukraine following the construction of the Nord Stream pipeline.[61]

Russia similarly faces headwinds in Asia as the region's major economies make stricter commitments toward carbon neutrality by 2050 or, in the case of China, 2060. Over half of the country's LNG exports in 2020 went to Asia, and the Power of Siberia pipeline to China will increase Russia's exposure to the Asian market. (The proposed Power of Siberia 2 pipeline, if it comes to fruition, will increase that

exposure further.[62]) For years, Russia has seen Asia as a counterbalance and hedge against possible declines in European energy demand. But even that hope might be dashed if the region's transition to a low-carbon economy proves faster than Russia anticipates. Rhetorically, Russia is planning to diversify its exports into lower-carbon gas or hydrogen—in reality, progress has been slow.

4

The Political Economy of Climate Change in Russia

Key Political and Private-Sector Climate Actors and Decisionmakers

Russian climate policy is influenced by a number of players advancing competing interests amid a global shift to limit carbon emissions. The hydrocarbon industry has considerable political influence, given its substantial contributions to the federal budget. Its goals align with the strategic outlook of the Putin government, which sees Russia's vast mineral wealth as a key source of power and influence relative to other countries and is threatened by the emergent global "climate consensus."[63] Military and national security leaders represent another powerful lobby. They acknowledge that climate change is a challenge as melting polar ice has increased the accessibility of the Arctic Ocean—which they have encouraged—and created strategic opportunities in a region where Russia believes it holds the advantage.[64] While these two lobbies are tied together by the 2035 Arctic Strategy and the dual-use nature of technology and infrastructure deployed in the Arctic, they compete for budget funds and political patronage.[65] Another group, part of Putin's inner circle, consisting of nationalist "protectors," uses the Russian Arctic as a vehicle for ideological mobilization by positioning the region as "integral to its overall confrontation with the West."[66] Membership in this group is not mutually exclusive, unlike the other two lobbies, and includes key members of Russia's national security apparatus.

GOVERNMENT OFFICIALS

Vladimir Putin: President Putin has shown an enduring interest in the Arctic due to its strategic importance and symbolic value and appears to play a direct role in key decisions regarding the development of the region.[67] As climate change creates opportunities for strategic competition in the Arctic, he has emphasized the importance of "reaffirming [Russia's] superiority" through securitization, industrial expansion, and the development of new technologies.[68]

Nikolai Patrushev, Secretary of the Security Council: A long-serving member of the "protectors" bloc under Putin, Patrushev sees climate change as an opportunity for competition and confrontation.[69] While he speaks of international cooperation in the Arctic, Patrushev has portrayed the scramble for resources there in zero-sum terms and advocates for further securitizing the region to protect Russia's national interests.[70] Patrushev, who traveled to the North Pole in 2003 as then-FSB director and planted a Russian flag, and other members of this ideological group may see climate change as a means to exert more influence over the development of the Arctic by presenting it as an anti-Western plot to contain Russia.[71] Following the spill at the Norilsk fuel reservoir in 2020, Patrushev assessed that such industrial accidents "play into the hands of the ones that intend to discredit Russia's policy on the Arctic" and stressed the importance of enhancing the safety and security of these facilities.[72] Curiously, Patrushev's son is also involved in Arctic affairs; in November 2019, an organization called the Arctic Initiatives Center was registered with the Russian authorities and named Andrei Patrushev as its founder and general director. The entity provides "consulting on commercial activities and management," according to its founding documents.[73]

Dmitry Medvedev, Deputy Secretary of the Security Council: During his presidency and premiership, Medvedev sought to put climate change on Russia's political agenda. In his current role on the Security Council, Medvedev chairs a special commission comprising senior government officials, lawmakers, and regional authorities to promote Russia's interests in the Arctic.[74] This new body might take over certain responsibilities of the State Commission on Arctic Development, chaired by Deputy Prime Minister Yury Trutnev.[75]

Sergei Shoigu, Defense Minister: Like Patrushev, Shoigu views climate change as opening the Arctic to strategic competition.[76] He has presided over an expansion of military forces and capabilities in the Russian Far North to counter threats to Russia's national interests that are perceived to be growing as global temperatures rise.[77] His personal proximity to Putin is believed to give him an advantage over other political elites vying for influence over the development of the Far North. His previous, long-serving experience as the minister of emergency situations (1991–2012) gives Shoigu greater authority in responding to Russia's intensified natural disasters due to climate change, such as wildfires. The elevation of the Northern Fleet to the status of a military district in January 2021 continues to illustrate a favorable shift in the vested interests of Shoigu and the military lobby.[78] Until 2018, Shoigu's daughter Ksenia was the sole owner of a company called Arctic Logistics, which controlled the port of Dikson on the NSR.[79]

Aleksandr Kozlov, Minister of Natural Resources and Environment: Previously the minister of development of the Far East and the Arctic, Kozlov assumed his current post in November 2020. Recently, he has warned about the risk that climate change poses to infrastructure and has sought to enhance the country's permafrost monitoring network, but his emphasis on forecasting and using early warning data to prevent accidents belies an approach that seeks to mitigate the consequences of climate change rather than address its root causes.[80] Kozlov remains a champion of hydrocarbon exploration in the Russian Arctic and has called for legislation to protect national industries from foreign carbon tariffs.[81]

Alexei Chekunkov, Minister of Development of the Far East and the Arctic: A former investment executive, Chekunkov has promoted the expansion of the hydrocarbon industry, along with shipping and tourism, as a way to increase jobs and attract investors to the far reaches of the country. He has a pessimistic view of decarbonization and views LNG, rather than renewables, as the most viable way to power Russia amid a changing climate.[82]

Yuri Trutnev, Deputy Prime Minister: As the deputy prime minister charged with coordinating executive bodies involved in the socioeconomic development of the Arctic Zone of the Russian Federation (AZRF), Trutnev heads the State Commission on the Development of the Arctic and is seen as a key figure promoting industrialization in the Far North. Together with the Ministry of Natural Resources and the Environment, Trutnev has promoted investment in the region through tax incentives for energy, petrochemicals, and plastics sector projects.

Viktoria Abramchenko, Deputy Prime Minister: Although her responsibilities do not explicitly include climate change, Abramchenko coordinates key policies regarding environmental protection and chairs a commission that includes heads of the leading resource-extracting companies and the governors of the regions where these companies reside.[83]

Ruslan Edelgeriev, Special Presidential Representative on Climate Issues: Nominated to his post in 2018, Edelgeriev previously served as head of the regional government in the Republic of Chechnya and spent 10 years in the security services. While Edelgeriev has acknowledged that climate change poses a critical threat to Russia's development and that Russia needs to reduce its dependence of fossil fuels, he has defended the interests of Russian carbon-emitting industries in recent statements criticizing the possible introduction of a European carbon border adjustment mechanism (CBAM).[84]

Anatoly Chubais, Special Presidential Representative on Relations with International Organizations to Achieve Sustainable Development Goals: An economist primarily known for his role in advancing privatization reforms in Russia in the 1990s, Chubais was appointed to his current role in December 2020 after a 10-year term at the helm of state technology firm Rusnano. While it remains to be seen how much authority Chubais will wield in his current capacity, he is one of the few voices in the Russian government that has emphasized the threat that climate change poses to the country's development. His alarm over climate change and calls to restructure the entire Russian economy as global energy consumption shifts away from oil and gas stand in stark contrast to the positions outlined by other government officials.[85]

Vyacheslav Ruksha, Director of Rosatom's Northern Sea Route Directorate: Appointed to his current position in 2018, Ruksha has been a long-time actor in Russia's Arctic policy. Prior to this role, he was director general of Atomflot, the Rosatom subsidiary that owns Russia's fleet of civilian nuclear-powered icebreakers, and also served as the deputy minister of transport.[86] When Rosatom was awarded administration over the NSR, Ruksha was chosen to lead the company's NSR directorate, putting him in a strong position to drive more business to the icebreaker fleet.

AGENCIES

State Commission on the Development of the Arctic: The commission (also referred to as the Russian Arctic Commission) was established in 2015 as a platform to coordinate the whole-of-government planning of Arctic projects. Currently chaired by Deputy Prime Minister Trutnev, its 36 members are mainly top officials from the federal government, although the Security Council, parliament, regional governments, and science and education institutions also have seats at the table. Since its inception, the

commission has prioritized issues related to the NSR, shipbuilding, and port infrastructure. However, the commission's rationale was undermined by a 2019 reform that expanded the purview of the Ministry for the Development of the Far East to also include the Arctic, along with the creation of a similar structure dedicated to Arctic issues within the Security Council.

Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet): Under the jurisdiction of the Ministry of Natural Resources and Environment, Roshydromet is responsible for conducting monitoring of environmental conditions and exercising government oversight of activities influencing hydrometeorological and other geophysical processes. In May 2021, Alexander Kozlov, minister of natural resources and environment, announced a plan to develop a permafrost monitoring network under the auspices of Roshydromet to track the dynamics of permafrost thaw and anticipate potential consequences. The network is expected to be launched in the Arctic zone by 2024 and extended to the rest of the country by 2030.[87]

Federal Service for Supervision of Natural Resources (Rosprirodnazdor): Russia's environmental regulator, which is under the jurisdiction of the Ministry of Natural Resources and Environment, claims to have increased its inspections and improved the efficiency of its enforcement actions in recent years.[88] The $2 billion fine it imposed on Nornickel in response to the 2020 oil spill was a powerful rebuke to the mining company and put other corporations on notice that they would bear severe consequences for negligence resulting in ecological harm.

Rosatom: A state-owned, multi-industry holding specializing in nuclear technology and energy production, Rosatom was designated the operator of the Northern Sea Route Administration in 2018 after a protracted struggle with the Ministry of Transport (although the ministry did retain some role in NSR administration).[89] With responsibilities to develop and maintain infrastructure, control access of Russian and foreign vessels, and safeguard shipping along the NSR, Rosatom is expected to modernize a shipping lane that had fallen into neglect since the Soviet era.[90] Rosatom's interests in the Arctic are closely aligned with those of domestic extractive industries, given the share of current and projected shipping volume along the NSR attributed to Russian oil and gas giants. It plans to develop an international container shipping business centered on the NSR that would help it meet a nearly impossible government target of ensuring 80 million tons of cargo volume through the NSR by 2024.[91]

Atomflot: The nuclear icebreakers belonging to Atomflot (a Rosatom company) are instrumental to expanding the throughput capacity of the NSR and assisting ships servicing oil and gas projects in the Arctic zone. Russia's 2035 Arctic Strategy foresees the construction of several new nuclear icebreakers that would open impassable areas of the Laptev, East Siberian, and Chukchi Seas to year-round shipping, enhancing both the economic potential of the region and Russia's power projection in the far-eastern stretches of the Arctic, which is far less militarized than the western zone. In the meantime, Atomflot has sought to protect its de facto monopoly on Arctic icebreaking by acquiring non-nuclear vessels to serve the port of Sabetta.[92]

Ministry of Economic Development: Ensuring Russia's economic development in the context of climate change is one of this ministry's stated focus areas. As a part of this effort, it is developing a system for the regulation of greenhouse gas emissions and is responsible for formulating legislation related to climate change.[93] The ministry's approach is guided by caution and the realpolitik of Russia's reliance on oil and gas revenues; while recognizing the risks that climate change poses to the Russian economy, its draft strategy for reducing greenhouse gas emissions by 2050 avoids ambitious targets on the grounds that they might jeopardize Russia's growth and macroeconomic stability.[94]

CORPORATIONS

Rosneft: The Russian state-owned oil company Rosneft was forced to moderate its offshore ambitions following the imposition of Western sanctions on the Russian energy industry and a crash in oil prices in 2014.[95] What appeared in its place, however, was the ambitious Vostok Oil Project: a 6-billion-ton resource base above the Arctic Circle stretching from the Yamalo-Nenets AO in the west to the eastern edge of the Taymir Peninsula. According to Rosneft, associated infrastructure development will include 7,000 km of infield pipelines and 50 shipping vessels, including 10 high ice-class tankers, for transporting oil along the NSR.[96]

Gazprom: The Russian state-owned gas company Gazprom has always been an Arctic company. In the past decade, it has reaffirmed and prolonged its Arctic identity with a slew of new gas fields along the northern and western edges of the Yamal Peninsula, including the Bovanenkovo gas field. Gazprom needs Yamal production in order to offset declines in its traditional fields in Eastern Siberia and the Far East.[97]

Novatek: Novatek and its Yamal LNG have been a surprising industry success story, responsible for turning Russia into a major LNG player in a short period of time, contrary to many energy experts' expectations. Novatek constitutes a keystone of Russia's Arctic ambitions.[98] While still under sanctions, Novatek has secured financing from international partners, including Total and China's National Petroleum Corporation (CNPC), to realize a project with 19 mtpa capacity. Like Gazprom and Rosneft, Novatek has an ambitious future agenda in the Arctic until 2030. Arctic LNG 2, with a 20 mtpa capacity, is expected to be online between 2023 and 2026, to be followed by Arctic LNG 1, also with a 20 mtpa by the end of the decade. In total, the company plans to produce 57 to 70 mtpa of LNG by 2030.[99] Novatek depends on the NSR to ship its LNG and seeks to increase traffic along the NSR. Novatek hopes to supplement destinational shipping with transshipping terminals on Kamchatka Peninsula in the east and Norway in the west. It is expected to soon have approximately 15 icebreaking LNG carriers of its own.[100]

At the same time, Novatek is among the growing ranks of significant Russian exporters that are acutely aware of the financial risks associated with climate inaction, driven in part by the rise of ESG metrics and the significant exposure of Russia's corporate giants to the international investor community.[101] It has made costly investments to improve its sustainability ranking, and some other corporations are following suit, including Lukoil and Polyus, Russia's largest gold producer.

Norilsk Nickel: Also known as Nornickel, the company is the world's largest producer of palladium and a leading producer of copper and nickel, making it a key supplier of metals used in green technologies such as electric vehicle batteries. The Talnakh and Norilsk ore clusters north of Norilsk city account for about half of the company's overall production volumes and are expected to remain viable for another 80 years at the current pace of exploitation.[102] Norilsk Nickel manages the Dudinka port and plans to increase its capacity by one-third as part of a major upgrade announced in July 2021.[103] The company's net profit fell roughly 40 percent year-on-year in early 2021 after it was forced to pay $2 billion in damages related to the May 2020 spill discussed above.[104]

BUSINESS COMMUNITY

Union of Industrialists and Entrepreneurs: This influential business lobby has been described as the "main opponent of the Paris Agreement" in Russia because of its opposition to enforceable domestic measures to reduce carbon emissions.[105] As with some corporations, the organization is also coming

around to the idea that Russian companies need to reduce emissions and improve their ESG metrics in order to remain competitive amid the "greening" of export markets, but it has yet to develop a consolidated position on the issue.[106] According to a top official at the lobby, the continuation of oil, gas, and coal projects is seen as a viable strategy to finance innovation and the transition to the green economy, which is perhaps unsurprising given the strong representation of the extractive industries in its membership base.[107] A more coherent stance regarding sustainable development may emerge as more of its members enact policies to reduce their own environmental impact.

Russia's Climate Policy Evolution: From Securitization to Greenwashing

Russia is the fifth-largest emitter of carbon dioxide globally, accounting for roughly 5 percent of total emissions—and yet it ranked just 52 out of 61 in the Climate Change Performance Index 2021.[108] Until recently, the Russian government has shown little interest in climate issues. As late as 2019, Putin cast doubt on the evidence of anthropogenic global warming. In recent months however, a global political and private sector movement toward net-zero emissions and the specter of foreign carbon emissions regulation of Russian oil and gas exports, in particular from the European Union, has forced Russia to begin to reposition itself on climate issues by increasingly using the language of climate change. And yet these words have not changed its actions. Moscow continues to subordinate climate policy to other more pressing economic goals, particularly the development of energy reserves in the Arctic.

For a brief moment, a focused discussion of climate change policy appeared on Russia's political agenda under then-president Dmitry Medvedev, who in 2009 commissioned a national Climate Doctrine and engaged with the issue in the spirit of international cooperation.[109] Although the document stopped short of proposing specific policy measures to address climate change, it nevertheless was an early attempt at establishing a climate framework and developing a path for Russia's involvement in global climate mitigation efforts. Although Medvedev remains involved in Arctic issues to this day, his early policy efforts on climate change rapidly diminished as he himself faded from the political stage.

The Russian climate agenda was effectively paused with Putin's return to the presidency in 2012. Putin, a self-proclaimed conservationist, has always been skeptical of Western-led multilateral efforts to counter global warming. It was hoped that U.S.-Russian engagement on Arctic climate issues in particular could have been possible. However, events during Putin's fourth term—Russia's annexation of Crimea and occupation of eastern Ukraine in 2014, its intervention in Syria in 2015, and its efforts to interfere in the 2016 U.S. presidential election—made dialogue related to international climate negotiations less tenable.

Russian leadership by and large views climate mitigation efforts through a securitized lens—as a Western attempt to undercut Russia's comparative economic advantage and to delay Russia's development. These suspicions fuel its regional security dilemma in the Arctic, as reflected in the 2019 statement by Anastasia Bondarenko, deputy minister of energy to the Russian parliament: "The Ministry of Energy of Russia considers it unacceptable to approach climate change and environmental protection issues from a biased point of view, infringe on the interests of states producing energy resources and deliberately ignore such aspects of sustainable development as ensuring universal access to energy and the development of clean hydrocarbon technologies."[110] Russia's late ratification of the Paris Agreement in 2019 was similarly cynical: Russia pledged to lower its emissions by 30 percent

compared to 1990 levels, which in reality would allow Russia's emissions to rise over the next decade and still remain below the target threshold.

Several developments have prompted Russia to alter its rhetoric on climate issues. First and most consequentially, the European Union announced a plan to levy a CBAM on imports of fossil fuels, metals, chemical fertilizers, and other products. This was a wakeup call from Russia's largest trading partner and a market that in 2020 accounted for 40 percent of Russian exports. The volume of carbon dioxide in Russian exports to the European Union, which accounted for 45 percent of total Russian exports in 2020, is over 1 billion tons per year, so a CBAM equivalent to those levied internally—€41 per ton of carbon dioxide—would equate to a $45 billion loss for Russian producers annually, or over 10 percent of total national export revenues.[111] Much to the Kremlin's consternation, climate policy is now an unavoidable dimension of Russia's relations with Europe. Second, the Biden administration is seeking to renew U.S. climate leadership globally (President Biden hosted a virtual Leaders' Climate Summit in April 2021 to which Putin was invited and gave unenthusiastic remarks) and raise the prominence of climate issues in multilateral fora, including the G7, G20, and Arctic Council, of which Russia assumed the chairmanship in 2021. Despite his lack of enthusiasm, the Kremlin wishes to avoid diplomatic isolation with the United States and Europe and, to do so, must be perceived as a participant in global climate discussions, if only to attempt to prevent or slow down negative climate policies that effect Russian energy exports. In July, the Kremlin hosted U.S. special envoy for climate John Kerry in Moscow to demonstrate continued channels of communication, but with very few concrete results. Third, in 2020 and 2021, Russia experienced devastating heatwaves and wildfires, making the impact of global warming on human systems in Russia impossible to ignore. As a result of these developments, official rhetoric around climate change was recalibrated to begrudgingly acknowledge the threat.

But is there anything more than a change of rhetoric? There may be early signs of a greener climate agenda with a recent flurry of activity in Moscow. In the spring of 2020, the Ministry of Economic Development presented a draft version of "The strategy of the long-term development of the Russian Federation with low level of GHG emissions until 2050." A pilot program for decarbonization is underway in the Sakhalin Oblast, with an ambitious regional target to achieve climate neutrality by 2025. Other similar programs are under discussion. In June 2021, Putin signed Russia's first-ever law mandating emissions reporting for Russia's largest companies, which improved on a previous bill that was stripped of regulatory mechanisms by lobbying from the Russian Union of Industrialists and Entrepreneurs.[112] In the same month, Deputy Prime Minister Alexander Novak said that Russia's aim was to become a global hydrogen superpower with 20 percent of the total market share.[113] Putin has also stated that Russia's forests neutralize as much as 2.5 billion tons of carbon per year, more than Russia's annual emissions, but this claim is not taken seriously in the scientific community.[114]

At the moment, these efforts are more of an attempt to greenwash Russia's climate image globally than a good-faith commitment to lower carbon emissions. Although rhetorical shifts and a slew of new "green" initiatives are designed to show that Russia is taking climate change seriously, in reality Russian leadership continues to regard climate change as a second-order issue to which Russia must not subordinate its strategic priorities, including the development of the Arctic energy resources.[115] This is most evident in Russia's Energy Strategy to 2035, which envisages a substantial increase of Russian fossil fuel production, combustion, and exports within the next 15 years, including a growth in natural gas production to 1 trillion tons annually (a 50 percent increase from 680 billion tons in 2019).[116] Renewables, meanwhile, continue to play a miniscule role in Russia's energy future and are forecast

to remain below 1 to 2.5 percent of Russia's energy mix through 2035. As presidential climate adviser Ruslan Edelgeriev noted, "Russia's climate policy is consistent and rational: it would be rash to abandon the experience and technologies in the oil and gas sector, which we have accumulated for decades, and switch to renewable energy sources in the current difficult economic situation. Our country must act in stages."[117] In the end, Russia's attempt to "play along to get along" may become more creative, but they are unlikely to reduce their emissions, which will only amplify tensions with the West.

Social Discontent and Regional Divisions

Russian public opinion around climate change is ambiguous and difficult to discern. On the one hand, environmental public activism is on the rise, though it remains highly localized in nature.[118] In a January 2020 survey by the Levada Center, Russians named environmental degradation as the biggest threat to humanity in the twenty-first century (48 percent), followed by international terrorism (42 percent), and wars (37 percent).[119] However, Russians do not clearly associate environmental degradation with climate change. Of Russia's environmental challenges, respondents viewed air pollution as the most important in a year that set new records for wildfires and hazardous air quality, followed by household waste management and nuclear waste. Climate change ranked seventh on the list. Nor do most Russians attribute global warming to human activity. A 2021 survey found that out of the 67 percent of respondents who believed global warming was occurring, only 28 percent agreed that it was the result of human activities, while an additional 27 percent believed it resulted from a combination of human activities and natural processes.[120] Russians are generally against tough measures to combat climate change. Though it is dated, a European Social Survey report from 2016 found that 42 percent of Russians are against increasing taxation on the fossil fuel industry, with 25 percent in favor, and 32 percent undecided. A more recent poll found that Russians are unwilling to make basic lifestyle changes to reduce their carbon footprint.[121]

Yet in spite of a seeming disconnect between environmental degradation and climate change, the mismanagement of environmental challenges across Russia risks becoming a new source of discontent. This year's wildfires in Yakutia have overwhelmed Russia's perpetually underfunded Aerial Forest Protection Service, opening a rift between local officials and teams of contractors fighting blazes on the ground.[122] Interviews with local residents in the Yakutia region revealed a "near-universal" sentiment that authorities were not doing enough to address the fires.[123] Apart from being its own source of discontent, environmental mismanagement amplifies existing issues such as corruption.

Social strife may be particularly acute in regions where historical mistrust of central authorities overlaps with the most acute climate impact, deepening center-region divisions as a result. Climate impacts across Russia's vast territory will be unevenly concentrated at the extremes: in the Arctic Northwest, which is warming at three times the global average and will experience dramatic permafrost thaw; in the Far East, where the bulk of Russia's wildfires are expected to occur; and south of the Volga, in the Caucasus regions and Kalmykia, where drought and desertification have created a raft of new socioeconomic problems.[124] Moreover, many of these regions have more independent political cultures and are less supportive of Kremlin-backed parties or initiatives. Interestingly, public support for a controversial constitutional referendum in 2020 which allowed Putin to reset his term limits was considerably lower in the Arctic regions of Komi, Arkhangelsk, NAO, and Murmansk and in the Far East regions comprising Yakutia, Khabarovsk Krai, Magadan Oblast, and Kamchatka Krai.[125] These same regions showed lower-than-average support for Putin in the 2018 presidential elections.

Russia's regions have seen an uptick in protests in recent years.[126] In late 2018, thousands took to the streets across Arkhangelsk Oblast to protest the construction of a massive landfill to be used for Moscow's ballooning waste. Likewise, in May 2021, hundreds of workers at Gazprom's Chanyanda field in Yakutia staged a rally to protest working conditions after an outbreak of Covid-19 at the complex. These events underscore how Russia's less developed and under-resourced peripheries may be most politically sensitive to climate and disaster-related mismanagement.

Although the Kremlin presides over a highly centralized and repressive political system, authorities in Moscow have long sought to distance themselves from regional crises in order to avoid political fallout, as was the case in 2020 when Putin withdrew from public view and abdicated crisis decisionmaking to regional governors in response to Covid-19. However, recent maneuvers by Prime Minister Mikhail Mishushtin to link the federal government more closely to the regions will enhance federal control over social and economic development in the regions. In July, the prime minister made each of his deputy prime ministers an envoy to one of Russia's federal districts, with responsibility for supervising its social development and monitoring its budget allocations.[127] However, this move could complicate Putin's desire to distance himself from responsibility for climate disasters—or he may be able to place all the blame on Mishushtin when aggrieved citizens direct some of their outrage toward the federal level after mismanaged environmental catastrophes.

5

Effects of Climate Change on Russia's Arctic Security Posture

Climate change impacts Russia's Arctic security posture from the broad strategic level down to the smallest logistical considerations. A warming and more accessible Arctic provided much of the original impetus to militarize the region. Russia's so-called protective dome is built through refurbishments of Cold War military installations, new bases, dual-use search and rescue centers, use of Russian special forces, and Arctic-specific kit. The Russian military—with Minister of Defense Sergei Shoigu and Secretary of the Security Council Nikolai Patrushev as its primary patrons—has continued to drive budget increases dedicated to the Arctic, reorganization of these forces (including the creation of an Arctic Strategic Command and the designation of the Northern Fleet as its own military district), and strategic and doctrinal developments. However, there has not been a discernible effort at better understanding climate-related impacts on Russia's military posture, especially with respect to infrastructure and military installations, where a culture of cost- and corner-cutting predominates, as does corruption. Once again, Russian decisionmakers prioritize the perceived benefits of climate change without acknowledging its future costs—especially as many military installations are located in vulnerable climate hot spots.

Climate Change at the Conceptual and Strategic Level

Similar to the Russian government's slow acknowledgement of the implications of climate change on its future economic prosperity, there has also been a slow recognition of the effects of climate change

in Moscow's security and defense policy. This evolution can be seen in the language in recent Russian security strategies referring to climate. The 2015 National Security Strategy only referenced climate change in passing and merely noted that it is "connected" to certain consequences such as natural disasters.[128] The July 2021 National Security Strategy, on the other hand, specifically discusses climate change as a security threat requiring prevention, adaptation, and international cooperation.[129] The shift appears to re-prioritize climate change as not merely a complicating variable, but as a higher-order challenge the national security apparatus must consider.[130] Notably, the document also pulls from the same language of Russian economic strategies that claim global (or Western) efforts to mitigate climate change are an excuse to contain the Russian energy industry, its exports, and its control over transport routes.[131] It also links the development of low-carbon economies to a race for resources that will fuel tensions and possibly even the emergence of conflict, providing justification for continued militarization of the Arctic.[132]

Climate change, the retreat of sea ice, and the prospect of a more readily navigable Arctic effectively creates a new coastal border that Russia must defend. Russia's defensive priorities are to protect its second-strike nuclear assets in the Kola Peninsula (in the western Arctic) and its critical economic interests, particularly the oil and gas projects on the Yamal Peninsula and the NSR (in the central to eastern Arctic).[133] The latter is notable due to the legal uncertainty around the route: Moscow asserts the NSR is an internal passageway and that the UN Convention on the Law of the Sea's requirements for international passages do not apply. It also uses Article 234 of the convention—which allows states to enhance their control of ice-covered waters in their exclusive economic zone—to require vessels passing through to have a Russian pilot, charge toll fees, and demand advanced warning for foreign vessels planning to use the route.[134] Moscow is concerned that the United States and NATO will use climate change to facilitate and justify increased Western presence in the region, which they could eventually use to challenge Russia's legal stance on the NSR.[135] The effects of climate change amplify this concern: as the NSR becomes increasingly ice-free, it is not clear how much longer Russia will be able to justify its restrictions under Article 234, which only applies to areas that are ice-covered for "most of the year."[136]

While these real and perceived threats drive much of Russia's military posture in the Arctic, its actual activity exceeds its defense mandate. Through the advancement and modernization of its ballistic missile submarine (SSBN) deterrent, testing of new hypersonic and nuclear-powered cruise missiles, and the likely development of the Poseidon nuclear undersea drone based in the Arctic, Russia's military posture in the Arctic also enhances its offensive capabilities.[137] Geographically, the Arctic (or the new "commanding heights," as the Chinese strategic community increasingly refers to the region) shortens the distance between Russian missiles and submarines in its Far North to European and North American targets.[138] Russia's modernized SSBNs more frequently traverse the Greenland-Iceland-United Kingdom (GIUK) Gap into the North Atlantic Ocean, which could challenge NATO's sea lines of communication (including economically vital transatlantic undersea cables) and prevent U.S. and Canadian reinforcement and resupply of European allies. Russia also exploits the blurred delineation between offensive and defensive capabilities.[139] For example, fighter jets are increasingly stationed at bases such as Russia's northernmost military installation: Nagurskoye air base on Franz Josef Land. They are ostensibly deployed to help the Northern Fleet intercept threats to Russia's Far North, but, especially when paired with air-to-air refueling capabilities (which Russia tests frequently) and new hypersonic cruise missiles, they may have sufficient range to threaten U.S. air bases in Greenland and North American targets.[140]

The prestige of the growing array of new Russian military capabilities on display in the Arctic may increase the leverage of the military-industrial complex in domestic competition for influence and favor and enhance its ability to request increased funding for new military capabilities.[141] This could challenge the Russian extractive industry lobby; as Russian expert Marlene Laruelle notes: "Tensions between economic and security considerations . . . are particularly visible for the Arctic region."[142] The central government has tried on occasion to split the difference between these camps and bridge together the regional military-industrial complex. Granting primary administration of the NSR to the state-owned corporation Rosatom can be viewed as an example of this: it allows a corporation to pursue economic gain while maintaining firm state control over the route for national security purposes.

Climate Change and the Militarization of the Russian Arctic

Russia's Far North military buildup centers primarily around the Northern Fleet and the refurbishment of Soviet-era military installations. Its militarization is quite different in its eastern Arctic, where it focuses primarily on situational awareness by deploying radar systems to its regional bases, such as the Sopka-2 radar systems on Wrangel Island and Cape Schmidt.[143] Showcasing Russia's dual-use approach to the region, these systems also provide meteorological data to civilian vessels traveling from the Asia-Pacific and entering the NSR through the Bering Strait. In the central Arctic, and even more so further west toward the highly militarized Kola Peninsula, Russia's capabilities become increasingly advanced, lethal, and offensive in nature. These include air defense systems such as the S-400 and S-300, Bastion-P, and Pantsir-S1 systems, as well as the Arctic Brigade, which was formed in 2015 with a mission to secure Russia's Arctic coastline and infrastructure and to assist with escorting ships along the NSR. It is housed on the Kola Peninsula.[144]

Russia's western Arctic is home to its Northern Fleet, the centerpiece of Moscow's regional force posture. Headquartered at Severomorsk, it was elevated to a joint strategic command in 2014. In January 2021, Putin upgraded it to one of five military districts, an unprecedented assignment for a fleet.[145] It retains its mission of guarding Russia's sea-based strategic nuclear deterrent, but its new status reflects the enhanced role it plays in patrolling Russia's northern coastline, safeguarding shipping on the NSR, and overseeing the refurbishment of Soviet-era military installations. It hosts a significant array of military assets: "nuclear-powered missile and torpedo submarines; missile-carrying and anti-submarine aircraft; surface ships with missiles, aircraft-carrying, and anti-submarine capabilities; coastal troops; combined independent force; the Russian Air Force and Air Defense Force; and the army corps of the Ground Forces."[146]

The Northern Fleet continues to substantially modernize, including with the launch of two of four Borei-class SSBNs.[147] Although it was originally planned that the next three Borei SSBNs would all go to the Pacific Fleet, the Ministry of Defence altered those plans to instead send one to the Northern Fleet.[148] This demonstrates the growing success of Arctic military commands in advocating for their needs. In June 2021, the Northern Fleet also received the first of the dangerous Yasen-M-class strategic guided-missile submarines (SSGNs); it will receive three more, as will the Pacific Fleet.[149] While this will improve the Northern Fleet's capability, it continues to struggle with aging capabilities, it lacks air mobility assets, and the majority of its current capabilities are not Arctic-specific. Russia's military icebreaking program has encountered substantial delays; the Northern Fleet has only one icebreaker and no other ice-class platforms.[150]

Russia is refurbishing or expanding Soviet-era military posts, including "13 air bases, 10 radar stations, 20 border outposts, and 10 integrated emergency rescue stations."[151] The air bases and radar installations are equipped with fighter jets, bombers, radar systems, missile defense systems, such as the S-400, and electronic warfare equipment, among other capabilities.[152] Russia also has launched remote sensing and communications satellites to cover its polar regions and plans to bring more online by 2024.[153] The radars and satellites increase capacity for early warning, monitoring, and operational awareness. The fighter jets, bombers, and missile systems boost interdiction capabilities and expand strategic depth by creating a dense, if not impenetrable, anti-access/area denial (A2/AD) bubble. The development of this strategic depth, the core of its bastion defense concept, has been a particular priority.[154] Most of these facilities are dual-use in nature and include coast guard units and search and rescue capabilities (Russia's coast guard service is part of its FSB).[155] In addition, Russia also has ambitious plans to build 10 integrated Emergency Rescue Centers along the NSR, though there have been delays in construction.[156]

It appears that Russia has decided to end constructing military infrastructure at new sites in the region in favor of strengthening and hardening what they have already built.[157] This may be to factor for cost and climate change implications, although the need for new infrastructure may become overwhelming as there are increasing indications that Russia could require more military and coast guard infrastructure in the eastern Arctic and near the Bering Strait to support new fishing areas in the Chukchi Sea.[158] This may also be needed to address increased shipping activity (particularly LNG carriers) into the NSR's eastern entry point in the Bering Strait. Both will necessitate an increased coast guard presence for search and rescue and to prevent illegal, unreported, and unregulated (IUU) fishing. It is important to note that Russian military activity in the Bering Sea is limited, but an unprecedented military exercise in the summer of 2020 may indicate a shift, suggesting these developments may presage additional military activity in Russia's eastern Arctic, which has been rare thus far.[159] It would, however, be consistent with an uptick in Russian long-range bombing flights near and around Alaska over the past several years.[160]

The Russian military also adjusts to a changing region by developing and procuring Arctic-specific capabilities, designed to withstand a harsh Arctic environment made even more unpredictable by climate change. Russian weapons and accompanying systems are either already hardened for Arctic use or are developed with extreme cold-weather conditions in mind. For example, the Northern Fleet has developed a new suite of drones designed and tested to survive extreme weather.[161] These include the Gorizont, Forpost, and Orlan-10 unmanned aerial vehicles (UAVs), as well as the new solar-powered Sova drone, which are primarily used for intelligence, surveillance, and reconnaissance (ISR) but may also assist with air guidance and artillery fire adjustments.[162] The Arctic Brigade has also procured armed personnel carriers and all-terrain vehicles adapted to cold-weather conditions.[163] What is not clear is how or if Russia is adjusting to address how warming, changing salinity, and acidification in Arctic waters could complicate undersea acoustics and therefore its submarine activity.[164]

Another feature of Russia's Arctic militarization is its constant testing and application of its new capabilities. This has included a substantial uptick in exercises, training, and missile tests. An illustrative list from just March to July 2021 alone includes: a large naval exercise led by the Northern Fleet; training for raiding operations near the Norwegian and Finnish border; artillery shelling in the Barents Sea; command and staff training at Northern Fleet Headquarters; and

submarine drills off Franz Josef Land Island.[165] The Northern Fleet is also participating in the Zapad 2021 exercise in September 2021.[166] Russia also increasingly tests its new hypersonic missiles in the Arctic, including the Tsirkon cruise missile and the Kinzhal ballistic missile.[167] Finally, long-range bomber flights of the region are also increasingly common.

Climate Impacts on Russian Military Installations

In addition to influencing Russia's Arctic force posture, mission set, and procurement plans, climate change has had and will continue to have a direct impact on Russia's new and Soviet-era Arctic military installations. This is a particular challenge for the Northern Fleet, which must cover a massive territory from its headquarters in Sevoromorsk. To begin to address this challenge, the Northern Fleet recently created a naval engineering brigade, an unorthodox unit that will tackle a broad array of missions, including bridge and pontoon laying, countermining, and assault on reinforced positions—but also construction and restoration of Arctic infrastructure facilities.[168] The creation of this unit, the competency of which was likely tested in Zapad 2021, demonstrates an understanding within the Russian Ministry of Defence of the potential impacts of climate change on Arctic installations.[169] This "climate change first responder unit" will hand yet another responsibility to an already overstretched Northern Fleet.[170] (The Northern Fleet already takes on responsibilities for what are normally civilian tasks, such as "protecting Russia's exclusive economic zone [EEZ] from illegal activities and environmental dangers, and ensuring safety of navigation."[171]) This expansion will also stretch the FSB's coast guard responsibilities to keep pace with more frequent and northerly commercial activity. Addressing the impacts of climate change will certainly add additional tasks for the Russian military in its Arctic region.

MILITARY INSTALLATIONS IN CLIMATE HOT SPOTS

An increasing number of environmental and climate-induced incidents occur near Russian military installations, including permafrost thaw, coastal erosion, wildfires, and extreme weather events. For example, the 22,000 tons of diesel oil spilled at Norilsk occurred not far from the Alykel airfield and Dudinka coast guard base.

The primary vulnerability to Russian military installations is permafrost thaw. Eighteen Russian Arctic military bases, ports, or search and rescue centers are situated in continuous, discontinuous, or sporadic permafrost zones.[172] There are five Russian military installations in or near permafrost hot spots—areas where infrastructure is at medium-high or high risk of significant degradation by 2050 because of permafrost thaw. Beginning in Russia's western Arctic and going east, they are as follows: Naryan-Mar air base, Rogachevo air base, Vorkuta air base, Provhideniya airfield, and Anadyr-Ugolny air base. Amderma airfield would be a sixth, but it has been abandoned and severely damaged by permafrost thaw already, and the Ministry of Defence's plans to rebuild it do not seem to have come to fruition.

Six more military and economically important locations appear to be at moderate risk: the port at Sabetta, critical for protecting Yamal energy infrastructure; the search and rescue center at Nadym; Alykel airfield, near the city of Norilsk, the site of the 2020 oil spill; Tiksi air base; Chokurdakh airfield; and Chersky airfield. (The heavily militarized Kola Peninsula, home of the Northern Fleet, Arctic Brigade, and Russia's strategic submarine fleet, is largely permafrost-free, as is Franz Josef Land Island, home of Nagurskoye air base.[173])

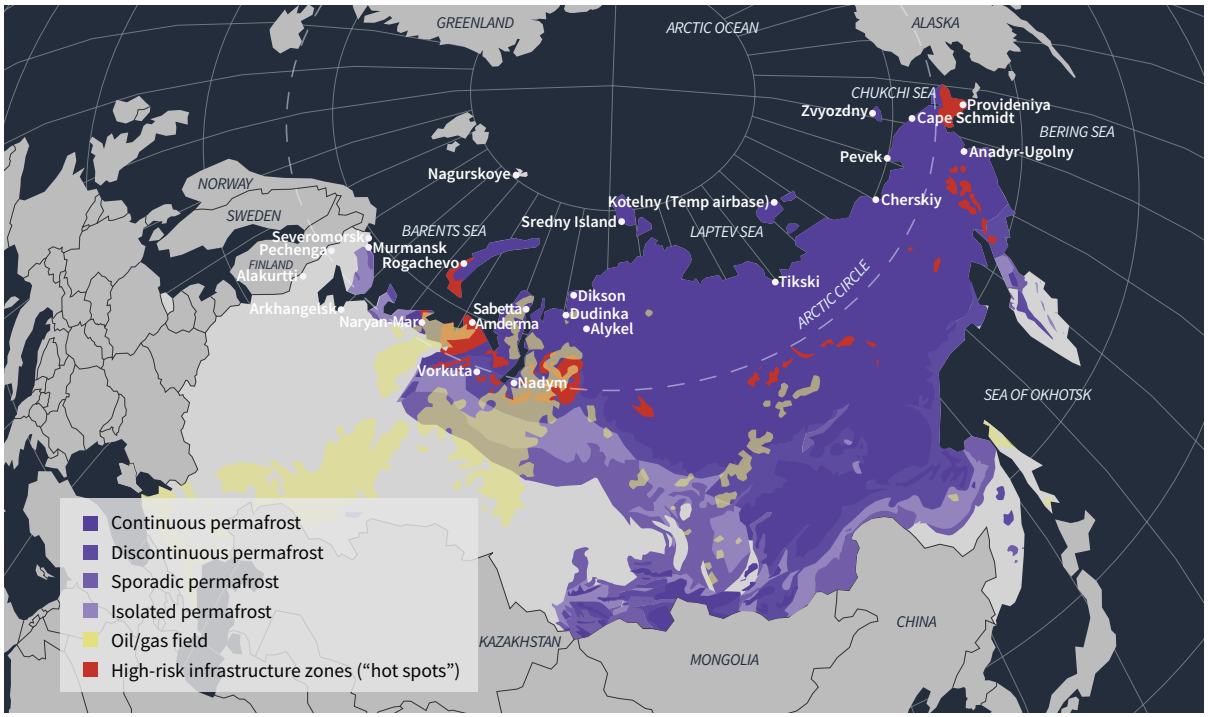
Permafrost Degradation at and near Abandoned Amderma Airfield

These images from July 2010 show the effects of permafrost deterioration on structures at Amderma airfield and ground collapse in the land nearby. Photos courtesy of Gerald V. Frost.

Some of these locations are more militarily significant than others. Of the five most endangered sites, two stand out. The first is Rogachevo, a significant air base on a southern island of the Novaya Zemlya archipelago that hosts crucial missile defense assets: S-400 and S-300 air defense systems, Pantsir-S1 anti-aircraft systems, Rubezh anti-ship coastal systems, and P-800 Oniks systems.[174] In 2018 and 2019, the air base was upgraded with "additional radar, electronic warfare (EW), signals intelligence forces, and related equipment."[175] Even more recently, at the air base east of the missile defense installation, Russia appeared to be deploying long-range MiG-31 BM interceptors. An adverse permafrost-related incident at Rogachevo, especially near the missile defense base, would have to be addressed quickly to ensure the strength of Russia's multilayered A2/AD strategy. Anadyr-Ugolny is notable as well. One of the few large installations in Russia's eastern Arctic, it supports a broad mission set: search and rescue, electronic warfare, drone operations, long-range patrols by Tu-22M3 strategic bombers, and satellite communications.[176] Should Anadyr-Ugolny require further development to support Russia's possible increased military activity in the Bering and Chukchi Seas, new construction could be hampered by climate change.

Of the moderately endangered sites, the port of Sabetta is of great interest as it has become the "nerve center" of three of Yamal's largest projects.[177] Construction on this dual-use port began in 2013; from the start, it was intended to serve Russia's Yamal oil and gas projects and be a major hub on the NSR.

Permafrost Hot Spots and Military Installations



Source: Map data comes from Bennett, “Norilsk oil spill: ‘There are rivers of fuel’”; and Hjort et al., “Degrading permafrost puts Arctic infrastructure at risk by mid-century.”

The Russian national guard (“Rosgvardia”), a military force established in 2016 directly answerable to Putin, was recently assigned responsibility for protecting the port.[178] While not at particularly high risk of permafrost-related degradation, there is an airfield at the site, and it is used for search and rescue as well. Given these multiple uses and the centrality of the Yamal projects in Russia’s regional development strategy, potential permafrost degradation or coastal erosion at the port of Sabetta is undoubtedly of high concern to the Russian Ministry of Defence. Tiksi air base in central-eastern Russia is also worth noting, though not because of its military significance per se. In fact, despite ambitious plans to upgrade the base with an S-400 system and port improvements, Russia has not yet delivered on these plans, although Tiksi does have the less advanced S-300 system.[179] This may indicate financial limitations, but it may also indicate reluctance to station essential air defense assets and NSR infrastructure on a permafrost hot spot, or some combination of the two.

Sea level rise and coastal erosion will continue to pose challenges to Russia’s military installations along its Arctic coasts. More than a decade ago, a 2009 report from the National Intelligence Council cited the port city of Murmansk as at elevated risk of flooding, but it is unlikely to affect the Northern Fleet naval stations as they are built 20 meters above sea level and inland on stable bedrock along the inlets, as opposed to in the more erodible dirt by the sea.[180] However, Russia’s shipbuilding yards near the city of Arkhangelsk may be at some risk, according to congressional testimony from a senior naval intelligence manager of the Office of Naval Intelligence.[181] The Sevmash shipyard at Severodvinsk is the only yard in Russia that builds nuclear submarines—such as the recent Yasen-M-class SSGN delivered to the Northern Fleet in June 2021, as well as the seven to follow—and could potentially be impacted, as could the 10 emergency search and rescue centers along the NSR.[182]

Quality of Russian Military Infrastructure

In addition to climate impacts, the quality and materials of Russian military infrastructure also affects the likelihood of degradation. A number of variables are germane: availability of financial resources, age of the infrastructure, engineering practices, building components, culture of reporting potential flaws, and corruption. Russia's relative deficiencies in these areas may increase the danger to its military installations.

Russia's new Arctic military infrastructure is largely built on former Soviet sites. Most have retained the original Soviet infrastructure but modernized, refurbished, or expanded upon it. Others use former Soviet-era sites but have built entirely new hangars, airstrips, and infrastructure, such as Nagurskoye air base, a facility which also received one of Russia's state-of-the-art Trefoil bases.[183] The reason behind this may be a cost-saving measure: it is cheaper to rebuild than to build anew.[184] However, the original Soviet sites were of course chosen before the extent of issues such as permafrost thaw and coastal erosion were understood.

Limits to Russian defense spending and the need to prioritize creates a hierarchy of sorts in the Russian Arctic. Nuclear and strategic facilities on the Kola Peninsula and in Arkhangelsk, as well as the Pacific Fleet at Kamchatka, are prioritized, followed by military installations near critical energy infrastructure, and then the remainder of the Russian Arctic Zone.[185] This final, disadvantaged category includes the vast majority of the bases highlighted in this section, which may help explain, for example, why construction at Tiksi air base has so lagged behind Russia's stated plans.

A culture of cutting corners and endemic corruption in the Russian military likely exacerbates the challenge of limited resources.[186] Arctic bases often receive substandard, "off-the-shelf" materials—even Nagurskoye, which the Russian government was eager to show to the world once construction concluded.[187] They likely make do with dual-use, "civilian-plus" materials that were not designed for use in the Arctic, much less to survive permafrost thaw, coastal erosion, sea level rise, and wildfires and extreme weather events that are becoming more common.[188] (This is consistent with the Russian engineering practice of prioritizing low initial capital expenditure initially while bearing the burden of operating costs latter. Those operating costs are now likely becoming burdensome.)

Russian structural engineers, who are very capable, may distribute quality specifications, and military leaders would like the best materials, but between the award of project funding and delivery, there may often be multiple rounds of kickbacks and bribes as vested interests and lobbying groups take their cut. By the time materials reach the ground at Arctic military installations, they may often be substandard.[189] This is not a unique phenomenon to the Arctic and is consistent with broader trends of corruption in the Russian armed forces.[190] While the scope of the problem in the Arctic is not clear, the margin of error and the consequences of failure are higher at remote bases, where conditions are harsh, supply lines are long, and senior officials may not frequently visit. The problem also goes the other direction: in Russia's vertical power structures, one is not incentivized to report potential structural vulnerabilities or incipient incidents up the chain.[191] While not a military installation, this issue may have played a role in the Norilsk storage tank spill: the facility had been in violation of regulations at least two years before the spill, so a lack of routine maintenance may have caused it—not permafrost thaw, as was initially suspected.[192]

U.S. Arctic Bases: Comparisons and Lessons Learned

There are many unknowns about climate impacts on Russian military installations. There is no incentive for the Russian government to be forthcoming about its weaknesses and mitigation efforts. But these challenges are not unique to Russia, and it is possible to draw lessons by comparing this experience with how the U.S. Department of Defense (DOD) addresses similar challenges in Alaska or at Thule Air Force Base in northern Greenland—although it is important to highlight that Alaskan and Russian permafrost conditions are not precisely the same (Russia is more ice-rich). However, there are enough similarities to make some tentative comparisons worthwhile.[193]

Four of Alaska's major military installations, two of which are located in discontinuous permafrost zones, also face challenges related to climate change. At Eielson Air Force Base, permafrost thaw caused the foundation of a munitions repair facility to gradually shift, cracks in the walls to appear, and heavy blast-proof doors containing a repair bay for missiles and explosives to become misaligned and dangerously unable to close—all before the facility itself began sliding slowly down the hill on which it was built.[194] After trying and failing to fill cracks in the melting ground, base personnel ultimately decided to demolish the building and build a new one using stabilizing, 100-foot-deep steel pilings at a price tag of $15.5 million.[195] Overall, the Air Force has had to spend $164 million for new construction on or around the permafrost, much of which is to prepare for the arrival of two F-35 squadrons. This represents a point of comparison with Russia, which also seeks to deploy fighter aircraft to Arctic military installations in permafrost zones. This includes Rogachevo air base, where, according to satellite imagery obtained by CSIS, the requisite facilities to host more fighter jets have not yet been constructed.[196] It is feasible that the Russian air force is staring down a similar price tag at this and other bases (Tiksi, for example).

The second is Clear Air Force Station, an early-warning radar site in a forested region of Alaska that is threatened by an increase in wildfires: the proximity of the forest allows fires to easily approach the installation.[197] There are many Russian Arctic and Siberian bases at similar risk, depending on whether they are surrounded primarily by brush or trees. These include the Kola Peninsula installations at Alakurtti (one of the two bases that host Russia's Arctic Brigade), Manchegorsk, and Olengorsk.[198] While most of the 2021 season of wildfires are burning in Siberia, fires in Kola are not unheard of, to include a 2018 fire just 75 kilometers west from Alakurtti.[199]

Two other endangered Alaskan bases are the Air Force and Army Joint Base Elmendorf-Richardson and Fort Greely, the Army's ground-based missile defense installation. The former is vulnerable to both wildfires and flooding and the latter to potential damage from thawing permafrost, which is endangering critical missile defense assets.[200] Moreover, the U.S. Air Force struggles to develop base designs, solve the problem of fuel supply chains, and find materials that can withstand high degrees of wind and cold in an increasingly harsh environment.[201] Although the Russian Ministry of Defence is not likely to be so transparent about its challenges, these examples illustrate that nearly every Arctic base is vulnerable to climate change–related difficulties and threats.

6

Concluding Analysis

As with Russia's ambitious vision for its Far North, this study was equally ambitious as it attempted to identify the most significant climate impacts across the Russian Arctic over the next 30 years to understand the broader implications for Russia's economy, politics, and security posture. The report sought to predict whether Russia's considerable economic and military ambitions in the Arctic would fail or succeed and, based on this analysis, to tease out meaningful regional and global implications.

Climate change has massively impacted the Arctic Zone of the Russian Federation and will continue to do so. Permafrost thaw, a drying tundra's susceptibility to wildfires, and coastal erosion will pose the greatest challenges to Russia's current and future economic infrastructure and military installations. Because roughly 60 percent of Russia's territory rests on permafrost and, in the last 30 years, average annual ground temperatures have increased 1 to 2 percent across the Russian Arctic, it is reasonable to assume that accelerating and widespread permafrost thaw will severely impact the region. It is notable that the effects may be the worst precisely where Russia's economic ambitions are the greatest, particularly in the Taymir and Yamal Peninsulas and cities and industrial centers such as Norilsk, Vorkuta, and Novy Urengoy.[202]

This research identified a number of specific permafrost hot spots where this destructive acceleration likely will occur, many of them near military and energy installations: the Taymir and Yamal

Peninsulas, as mentioned; the wider Nenets and Yamalo Nenets AOs; the southern tip of Novalya Zemlya; the northeastern region of Krasnoyarsk Krai near the city of Norilsk; the areas near the city of Yakutsk in the Siberian republic of Yakutia, which are also increasingly endangered by wildfires; and select areas in the far northwestern Chukotka AO. There is not a great deal of open-source information available—nor would Russian leaders openly discuss construction challenges or climate-related incidents at military sites. And yet, given that these installations are in endangered locations and likely use poor-quality materials, some of which date to the Soviet era, this report contends that Russian military authorities are likely already grappling with the same permafrost-related construction challenges that the United States faces for its military installations and energy infrastructure in Alaska. The considerable price tag of permafrost mitigation at Eielson Air Force Base, for example, is a likely parallel to what Russia is facing at its own installations.

For all the ferocity that climate change will inflict on Russia in the coming decades, this study assesses that decisionmakers will not be deterred in the pursuit of their bold economic vision for the Russian Arctic. Senior leaders will continue to publicly extol the benefits of rapid climate change even as its growing economic costs have forced them to modify their discourse to incorporate more "green language" to acknowledge its unprecedented impacts. Russian leaders have skillfully used this tactical shift to re-engage in international climate diplomacy, which serves several purposes: avoiding greater diplomatic isolation due to its other malign international behavior; securing a channel of communication between U.S. and European capitals, which have prioritized fighting climate change, and Moscow, the world's fifth-largest greenhouse gas emitter; and, perhaps most urgently, slowing down or diluting climate policies that directly challenge its economic model, such as a CBAM.

Russia remains undeterred from its Arctic ambitions in part because it has already had impressive success. The Yamal LNG megaproject is especially notable. When initial construction began in 2011, few energy experts gave it a chance of becoming commercially viable, let alone successful. Russia had arrived extremely late to the LNG market, and U.S. sanctions in 2014 imposed both direct costs on its Arctic energy development and diminished Moscow's ability to secure long-term financing, stymieing Arctic development further. And yet today, Yamal LNG represents an extraordinary energy and economic success for Russia (and for Novatek). Rosneft seeks to replicate this with the mega-Vostok Oil project, although it will not likely have the same success. Similarly, Russia will largely fail in its efforts to transform the NSR into an important global shipping route: it is unlikely that Russia will reach President Putin's goal of 80 million tons of shipping volume by 2024 unless it legally expands its definition of the NSR to capture additional volumes—and this would have the drawback of increasing legal uncertainty and potentially making international companies wary of future use of the route. Finally, even if other major global shipping lanes cease to function for extensive periods of time, this would not necessarily make the NSR a major shipping alternative route due to the high expense of shipping in a difficult region that climate change has made even more inhospitable. Despite Russia's ambitious plans, therefore, NSR development will be limited to a slow and steady increase in the destinational shipping of mineral and energy exports.

In many ways, however, Russia's economic success or failure in the Arctic is largely irrelevant because it will not change the thrust of its long-standing policy vision. Should its economic designs fail, the Kremlin will continue to securitize the Arctic, whether in an effort to provide dual-use military infrastructure and a security blanket that could incentivize future economic success or to prevent the West from taking advantage of its failings. Furthermore, the many key political players in the Kremlin

who have thoroughly attached themselves to Russia's Arctic policy will also ensure that economic failure does not derail that policy. The foremost among them is Putin, who views Arctic development as key for Russia's geopolitical future. This is why he is very strongly identified with its military development in particular. Understanding Putin's priorities, other key players, such as Rosneft CEO Igor Sechin, see Arctic development as a reliable method to secure the allocation of state resources toward the energy sector. His success in developing the region will advance his own economic and political aims as Russia enters a political transition period. Defense Minister Sergei Shoigu will benefit in the same way from increased defense budgets and acknowledgement of the Russian military's advances in the Arctic. For Nikolai Patrushev, secretary of the Security Council, a militarized Arctic also has important ideological and nationalistic purposes that can be usefully deployed when needed. Despite this high-level political competition, however, it is ultimately left to Russian technocrats and corporations to implement Arctic economic policies. It is they who will be conveniently blamed for failure, particularly the impacts of environmental catastrophes on the quality of life of Russian citizens. Overall, there is too much policy inertia and too many sunken costs pertaining to Arctic development for political forces in the Kremlin to be deterred.

The only development that could truly deter or upend Russia's Arctic economic plans are climate change mitigation policies implemented by other countries. Decisionmakers believe they can extract value from Russia's energy projects notwithstanding the forthcoming global energy transition, at least for the short term—this is why, for example, Russia's Energy Strategy to 2035 envisages a 50 percent increase in natural gas production in the coming years. Acknowledging the coming energy transition is an important first step, but the Russian government is unprepared for what it will mean for its economic model dependent on energy exports. Rather than pursue a proactive policy of adjustment and diversification, Moscow's foreign policy approach will seek to slow or dilute global decarbonization policies—or, in the case of European energy imports, even use threats to prevent reductions. At the same time, Moscow will highlight its limited advances related to blue (non-renewable) hydrogen, even if Europe will likely prefer green hydrogen from renewable sources.

The Russian government is equally unprepared for the economic and political costs of responding to climate change. In the near term, there will be few adjustments. For example, as apartment complexes in Arctic cities become uninhabitable due to collapses and structural weaknesses related to permafrost thaw, Russian families simply move to other Soviet-era apartment buildings, which are vacant due to the rapid depopulation of the region in the 1990s.[203] However, what happens when a substantial number of structures in urban environments become uninhabitable? How will this challenge be addressed? Who will be blamed for future climate-related incidents? Again, it will most likely be the technocrats and local administrators, whom the Kremlin can easily replace. And yet, this report contends that the federal government and perhaps even President Putin will increasingly absorb portions of public blame as well, exacerbating tensions between Moscow and Russia's Arctic and Far East regions and perhaps increasing protests.

In the earliest understanding of Russia's economic and security policies toward the Arctic, the authors described a dual or two-track nature.[204] Today, this duality has evolved into a high-stakes policy contradiction. The more external investment Russia chases in order to develop its Arctic energy resources and transform the NSR into a global shipping route, the more it must securitize the region—decreasing stability and eventually deterring the very foreign investment it seeks. The less economically successful the Russian Arctic becomes—the Yamal LNG project notwithstanding—the

more likely it is that Russia will force impractical infrastructure construction and military development to continue. The more infrastructure it builds, even if it uses modern geo-engineering, the more susceptible it will become to climate change. The more energy Moscow seeks to export, the more its economy will be impacted when carbon taxes and decarbonization become a reality. And, of course, the greatest contradiction is the Russian government's view that the country will only benefit from climate change, when in fact it will profoundly challenge Russia's economic and geopolitical prospects.

In other words, the more that Russia implements its near-term Arctic policies, the more damaging those policies become for the country's future. One can observe a similar reflexive approach in the regime's current domestic behavior: the near term is prioritized, but a sobering reality awaits in the long term.

About the Authors

Heather A. Conley is senior vice president for Europe, Eurasia, and the Arctic and director of the Europe, Russia, and Eurasia Program at the Center for Strategic and International Studies (CSIS). Prior to joining CSIS as a senior fellow and director for Europe in 2009, Conley served four years as executive director of the Office of the Chairman of the Board at the American National Red Cross. From 2001 to 2005, she was deputy assistant secretary of state in the Bureau of European and Eurasian Affairs with responsibilities for U.S. bilateral relations with the countries of Northern and Central Europe. From 1994 to 2001, she was a senior associate with an international consulting firm led by former U.S. deputy secretary of state Richard L. Armitage. Ms. Conley began her career in the Bureau of Political-Military Affairs at the U.S. Department of State. She was selected to serve as special assistant to the coordinator of U.S. assistance to the newly independent states of the former Soviet Union, and she has received two State Department Meritorious Honor Awards. Ms. Conley is frequently featured as a foreign policy analyst and Europe expert on CNN, MSNBC, BBC, NPR, and PBS, among other prominent media outlets. She received her BA in international studies from West Virginia Wesleyan College and her MA in international relations from the Johns Hopkins University School of Advanced International Studies.

Cyrus Newlin is a former associate fellow with the Russia and Eurasia Program at CSIS and a Master in International Affairs candidate at the School of International and Public Affairs at Columbia University.

Colin Wall is a research associate with the Europe, Russia, and Eurasia Program at CSIS, where he provides research and analysis on NATO, European security, and the Arctic. Prior to joining CSIS, he worked as a research assistant at the NATO Parliamentary Assembly and at the Harvard Kennedy School's Carr Center for Human Rights Policy. Previously, he interned at the European Parliament, Atlantic Council, and Stimson Center. He holds a BA in government and international studies from Franklin & Marshall College and an MA in transatlantic affairs from the College of Europe and the Fletcher School of Law and Diplomacy.

Andrew Lohsen is a fellow in the Europe, Russia, and Eurasia Program at CSIS. Prior to joining CSIS in August 2021, Lohsen served as a monitoring officer and political analyst with the Organization for Security and Co-operation in Europe (OSCE) Special Monitoring Mission to Ukraine, where he supported efforts to resolve Europe's only active armed conflict. Previously, he coordinated counter-nuclear-smuggling outreach and training engagements in the Caucasus, Eastern Europe, and Central Asia on behalf of the Bureau of International Security and Nonproliferation at the U.S. Department of State. As a specialist in the field of governance, Lohsen has worked with the Open Society Foundations, MacArthur Foundation, and Financial Services Volunteer Corps to develop civil society–led anti-corruption programs in fragile and transitioning states. He received his BA in Russian language and culture from Colby College and his Master of International Affairs from the School of International and Public Affairs at Columbia University.

Nikos Tsafos is the James R. Schlesinger Chair in Energy and Geopolitics with the Energy Security and Climate Change Program at CSIS. In this role, he oversees work on managing the geopolitics of energy and climate change, advancing industrial policies for clean energy, ensuring a just transition for workers and communities, and equipping U.S. foreign policy and the multilateral system to deal with climate change and the energy transition. Nikos has written extensively on the geopolitics of energy and natural gas; the political economy of hydrocarbon states; European climate policy; sustainable cities and mobility; the pace and trajectory of the energy transition; and the geopolitics of energy in the Arctic, Europe, the eastern Mediterranean, and Southeast Asia.

Ben Cahill is a senior fellow in the Energy Security and Climate Change Program at CSIS. He focuses on geopolitical risk and the oil market as well as the economics of oil-producing states. Ben was previously a director in Energy Intelligence's Research & Advisory group and led its country risk practice, advising oil and gas companies on politics, economics, and policy risks. He also wrote on corporate strategy and was the lead analyst for Saudi Aramco, Abu Dhabi National Oil Company, and the Southeast Asian national oil companies. He frequently led client briefings for supermajors, national oil companies, government agencies, and the financial sector. Ben formerly worked at PFC Energy (now part of IHS Markit) in Washington, D.C., and Kuala Lumpur, focusing on country risk and macro trends in the oil and gas industry. He has an MA in international affairs and economics from the Johns Hopkins School of Advanced International Studies and a BA in international relations and English from Boston University.

Endnotes

1 Yereth Rosen, "Arctic Council affirms it: the Arctic is warming at three times the global rate," Arctic Today, May 25, 2021, https://www.arctictoday.com/arctic-council-affirms-it-the-arctic-is-warming-at-three-times-the-global-rate/.

2 Melissa Denchak, "Permafrost: Everything You Need to Know," National Resources Defense Council, June 26, 2018, https://www.nrdc.org/stories/permafrost-everything-you-need-know.

3 Jan Hjort et al., "Degrading permafrost puts Arctic infrastructure at risk by mid-century," *Nature Communications* 9, no. 5147 (December 2018), https://www.nature.com/articles/s41467-018-07557-4.

4 "Russia ramps up Siberia blazes battle," MSN, August 13, 2021, https://www.msn.com/en-us/news/world/russia-ramps-up-siberia-blazes-battle/ar-AANhTFV?ocid=entnewsntp.

5 "The Ministry of Natural Resources estimates the damage from the degradation of permafrost in the Arctic at 5 trillion rubles," TASS, May 27, 2021, https://tass.ru/ekonomika/11490969.

6 Dmitry A. Streletskiy et al., "Assessment of climate change impacts on buildings, structures and infrastructure in the Russian regions on permafrost," *Environmental Research Letters* 14 (2019), https://iopscience.iop.org/article/10.1088/1748-9326/aaf5e6/pdf.

7 Russian Federation, *Energy Strategy of the Russian Federation until 2035* (Moscow: June 2020), https://minenergo.gov.ru/node/1026.

8 Tom Balmforth, "Vast wildfires in Russia's Yakutia have already set an emissions record," Arctic Today, August 4, 2021, https://www.arctictoday.com/vast-wildfires-in-russias-yakutia-have-already-set-an-emissions-record/; and "Putin Calls Siberian Wildfires 'Unprecedented,' Calls For Stronger Response," Radio Free Europe/ Radio Liberty, August 14, 2021, https://www.rferl.org/a/russia-putin-siberia-fires/31410681.html.

9 Laura Millan Bombrana, "Where Climate Scientists See Danger, Russia Sees an Opportunity," Bloomberg, March 15, 2021, https://www.bloomberg.com/news/articles/2021-03-15/where-climate-scientists-see-danger-russia-sees-an-opportunity.

10 Solveig Glomsrød, Gérard Duhaime, and Iulie Aslaksen, eds., "The Economy of the North – ECONOR 2020," Arctic Council Sustainable Development Working Group, May 2021, 17, https://oaarchive.arctic-council.org/handle/11374/2611.

11 Ibid., 85.

12 Roshydromet, *Report on Climate Risks on the Territory of the Russian Federation* (in Russian) (St. Petersburg: Russian Federal Service for Hydrometeorology and Environmental Monitoring, 2017), http://cc.voeikovmgo.ru/images/dokumenty/2017/riski.pdf.

13 Denchak, "Permafrost: Everything You Need to Know."

14 Roshydromet, *Report on Climate Features on the Territory of the Russian Federation in 2019* (Moscow: Russian Federal Service for Hydrometeorology and Environmental Monitoring, 2020); National Centers for Environmental Information, "Climate at a Glance: Global Mapping," NOAA, August 2021, last accessed August 30, 2021, https://www.ncdc.noaa.gov/cag/; and Alec Luhn, "Slow-motion wrecks: how thawing permafrost is destroying Arctic cities," *The Guardian*, October 14, 2016, https://www.theguardian.com/cities/2016/oct/14/thawing-permafrost-destroying-arctic-cities-norilsk-russia.

15 Nikolay I. Shiklomanov, Dmitry A. Streletskiy, Timothy B. Swales, and Vasily A. Kokorev, "Climate Change and Stability of Urban Infrastructure in Russian Permafrost Regions: Prognostic Assessment based on GCM Climate Projections," *Geographical Review* 107, no. 1 (2017): 125–142, doi:10.1111/gere.12214.

16 Presentation at CSIS workshop, May 27, 2021.

17 Grebenets, Streletskiy, and Shiklomanov, "Geotechnical safety issues in the cities of Polar Regions."

18 Glomsrød, Duhaime and Aslaksen, "ECONOR 2020," 87.

19 Jan Hjort et al., "Degrading permafrost puts Arctic infrastructure at risk by mid-century."

20 Atle Staalesen, "Environmentalists say oil spill in Nenets river was far more serious than claimed by authorities," Barents Observer, November 10, 2020, https://thebarentsobserver.com/en/2020/11/environmentalists-say-oil-spill-nenets-river-was-far-more-serious-claimed-authorities.

21 Henry Foy, "Russia's $55bn pipeline gamble on China's demand for gas," *Financial Times*, April 3, 2018, https://ig.ft.com/gazprom-pipeline-power-of-siberia/.

22 Vasiliy Bogoyavlensky et al., "Complex of Geophysical Studies of the Seyakha Catastrophic Gas Blowout Crater on the Yamal Peninsula, Russian Arctic," *Geosciences* 10, no. 6 (June 2020): https://www.mdpi.com/2076-3263/10/6/215/htm.

23 Simon Evans, Josh Gabbatiss, and Robert McSweeney, "In-depth Q&A: The IPCC's special report on the ocean and cryosphere," Carbon Brief, September 25, 2019, https://www.carbonbrief.org/in-depth-qa-the-ipccs-special-report-on-the-ocean-and-cryosphere.

24 H.-O. Pörtner et al., eds., *Summary for Policymakers: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate* (Paris: IPCC, 2019), 18, https://www.ipcc.ch/site/assets/uploads/sites/3/2019/11/03_SROCC_SPM_FINAL.pdf.

25 University of Copenhagen - Faculty of Science, "Arctic permafrost releases more CO2 than once believed," ScienceDaily, February 9, 2021, www.sciencedaily.com/releases/2021/02/210209113807.htm; and Christina Schädel, "Guest post: The irreversible emissions of a permafrost 'tipping point'," Carbon Brief, February 12, 2020, https://www.carbonbrief.org/guest-post-the-irreversible-emissions-of-a-permafrost-tipping-point.

26 Presentation at CSIS workshop, March 31, 2021.

27 Presentation at CSIS workshop, May 27, 2021.

28 Daisy Dunne, "Explainer: How 'Atlantification' is making the Arctic Ocean saltier and warmer," Carbon Brief, January 16, 2020, https://www.carbonbrief.org/explainer-how-atlantification-is-making-the-arctic-ocean-saltier-and-warmer.

29 Rebecca Lindsey, "Understanding the Arctic Polar Vortex," NOAA, March 5, 2021, https://www.climate.gov/news-features/understanding-climate/understanding-arctic-polar-vortex.

30 Presentation at CSIS workshop, March 31, 2021.

31 Duane Stevenson and Robert Lauth, "Bottom Trawl Surveys in the Northern Bering Sea Indicate Recent Shifts in Distribution of Marine Species," *Polar Biology* 42 (2019): 407–421, doi:10.1007/s00300-018-2431-1.

32 Madeleine Stone, "A heat wave thawed Siberia's tundra. Now, it's on fire.," *National Geographic*, July 6, 2020, https://www.nationalgeographic.com/science/article/heat-wave-thawed-siberia-now-on-fire; and presentation at CSIS workshop, August 12, 2021.

33 Anton Troianovski, "As Frozen Land Burns, Siberia Fears: 'If We Don't Have the Forest, We Don't Have Life'," *New York Times*, July 17, 2021, https://www.nytimes.com/2021/07/17/world/europe/siberia-fires.html.

34 "Analysis of the fire situation in the Republic of Sakha (Yakutia) based on satellite data for the period 2019-2021" (in Russian), Rosyhdromet, July 21, 2021, https://www.meteorf.ru/press/news/25276/.

35 Balmforth, "Vast wildfires in Russia's Yakutia"; and "Russia ramps up Siberia blazes battle," MSN.

36 "The head of Yakutia named the main cause of fires in the republic," RIA Novosti, July 20, 2021, https://ria.ru/20210720/pozhar-1742046378.html.

37 Evans, Gabbatiss, and McSweeney, "In-depth Q&A."

38 Sara Karlovitch et al., "Global warming is having a costly, and dangerous, impact on key military bases in Alaska," *Seattle Times*, August 9, 2020, https://www.seattletimes.com/seattle-news/environment/impact-of-melting-permafrost-on-three-military-installations-in-alaska/.

39 "Wildfires in Russia's Siberia could endanger a power plant," Associated Press, July 19, 2021, https://apnews.com/article/europe-business-russia-fires-environment-and-nature-dcbf460484a49eb437662dcaf80bf476.

40 Jonathan Watts, "'Airpocalypse' hits Siberian city as heatwave sparks forest fires," *The Guardian*, July 20, 2021, https://www.theguardian.com/environment/2021/jul/20/airpocalypse-hits-siberian-city-as-heatwave-sparks-forest-fires.

41 Troianovski, "As Frozen Land Burns, Siberia Fears,"

42 "The Ministry of Natural Resources estimates the damage from the degradation of permafrost in the Arctic at 5 trillion rubles," TASS.

43 Streletskiy et al., "Assessment of climate change impacts on buildings."

44 Presentation at CSIS workshop, May 27, 2021.

45 Streletskiy et al., "Assessment of climate change impacts on buildings."

46 Andrew E. Kramer, "Major Fuel Spill in Russia's North Spreads Toward Arctic Ocean," *New York Times*, June 9, 2020, https://www.nytimes.com/2020/06/09/world/europe/russia-arctic-oil-spill.html.

47 Nataliya Vasilyeva, "Constant oil spills devastate Russia," *Seattle Times*, December 24, 2014, https://www.seattletimes.com/nation-world/constant-oil-spills-devastate-russia/.

48 Abraham Lustgarten, "The Big Thaw: How Russia Could Dominate a Warming World," ProPublica, December 16, 2020, https://www.propublica.org/article/the-big-thaw-how-russia-could-dominate-a-warming-world.

49 Malte Humpert, "Cargo Volume on Northern Sea Route Remains Stable at 32m tons in 2020," High North News, September 30, 2020, https://www.highnorthnews.com/en/cargo-volume-northern-sea-route-remains-stable-32m-tons-2020.

50 President of Russia, "The President signed Executive Order On National Goals and Strategic Objectives of the Russian Federation through to 2024," Kremlin, May 7, 2018, http://en.kremlin.ru/events/president/news/57425.

51 Atle Staalesen, "Moscow's aims to grow trans-Arctic shipping by 2,000 percent in 10 years," Arctic Today, July 27, 2021, https://www.arctictoday.com/moscows-aims-to-grow-trans-arctic-shipping-by-2000-percent-in-10-years/.

52 Presentation at CSIS workshop, May 27, 2021.

53 International Energy Agency, *Net Zero by 2050: A Roadmap for the Global Energy Sector* (Paris: May 2021), https://www.iea.org/reports/net-zero-by-2050. Overall, the decline in oil production from Eurasia is 83 percent from 2020 to 2050, and the decline in gas production is 53 percent.

54 Dina Khrennikova and Olga Tanas, "Petrostates See Dire Consequences if World Rejects Oil Too Fast," Bloomberg, June 3, 2021, https://www.bloomberg.com/news/articles/2021-06-03/petrostates-see-dire-consequences-if-world-rejects-oil-too-fast?sref=B2BBHw9t.

55 Tatiana Mitrova, "The Geopolitics of Decarbonization: The Russian Case," Wilson Center, September 30, 2020, https://www.wilsoncenter.org/article/geopolitics-decarbonization-russian-case.

56 Taylor Kuykendall, Esther Whieldon, and Guarang Dholakla, "BlackRock Heading to Net-zero but Holds Large Fossil Fuel Investments for Now," S&P Global Market Intelligence, February 12, 2021, https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/blackrock-heading-to-net-zero-but-holds-large-fossil-fuel-investments-for-now-62628334.

57 "Methane Emissions from Russian Pipelines Up 40% in 2020," *Moscow Times,* March 9, 2021, https://www.themoscowtimes.com/2021/03/09/methane-emissions-from-russian-pipelines-up-40-in-2020-study-a73185.

58 Gazprom, *Methane Guiding Principles, Signatory Reporting* (Moscow: January 2021), https://methaneguidingprinciples.org/wp-content/uploads/2021/01/Methane-Guiding-Principles_Reporting-Gazprom.pdf.

59 Heli Simola and Laura Solanko, *Russia's oil & gas sector in global energy transition* (Helsinki: Bank of Finland, May 2021), https://helda.helsinki.fi/bof/handle/123456789/17970.

60 "Commission Staff Working Document, Impact Assessment, Stepping up Europe's 2030 climate ambition," European Commission, September 17, 2020, https://eur-lex.europa.eu/resource.html?uri=cellar:749e04bb-f8c5-11ea-991b-01aa75ed71a1.0001.02/DOC_1&format=PDF.

61 Daryna Krasnolutska and Patrick Donahue, "Merkel Vows Sanctions Against Russia If Pipeline Used as Weapon," Bloomberg Quint, August 22, 2021, https://www.bloombergquint.com/business/merkel-says-russia-ukraine-transit-accord-must-be-extended.

62 Anna Galtsova and Tianshi Huang, "'New' gas from Russia to China via Power of Siberia-2 pipeline: New route and new strategic opportunities," IHS Markit, July 16, 2020, https://ihsmarkit.com/research-analysis/new-gas-from-russia-to-china-via-power-of-siberia-2-pipeline.html.

63 Bobo Lo, *The Adaptation Game—Russia and Climate Change* (Paris: French Institute of International Relations, March 2021), Russie Nei Visions 121, https://www.ifri.org/sites/default/files/atoms/files/bobolo_russia_climate_change_2021.pdf.

64 Mathieu Boulègue, "Russia's Military Posture in the Arctic: Managing Hard Power in a 'Low Tension' Environment," Chatham House, June 28, 2019, https://www.chathamhouse.org/2019/06/russias-military-posture-arctic.

65 Mathieu Boulègue and Katarina Kertysova, "Arctic Development Reflects Russia's Thorny Civil-Military Relations," Wilson Center, May 6, 2020, https://www.wilsoncenter.org/blog-post/arctic-development-reflects-russias-thorny-civil-military-relations.

66 Tatiana Stanovaya, "Unconsolidated: The Five Russian Elites Shaping Putin's Transition," Carnegie Moscow Center, February 11, 2020, https://carnegie.ru/commentary/81037; and Eugene Rumer, Richard Sokolsky, and Paul Stronski, "Russia in the Arctic—A Critical Examination," Carnegie Endowment for International Peace, March 29, 2021, https://carnegieendowment.org/2021/03/29/russia-in-arctic-critical-examination-pub-84181.

67 Pavel Baev, "Russia and the Arctic: High Ambitions, Modernized Capabilities and Risky Setbacks," in *Russia's Global Reach: A Security and Statecraft Assessment*, edited by Graeme P. Herd (Garmisch-Partenkirchen, Germany: George C. Marshall European Center for Security Studies, 2021), https://www.marshallcenter.org/en/publications/marshall-center-books/russias-global-reach-security-and-statecraft-assessment/chapter-4-russia-and-arctic-high-ambitions-modernized; and intervention by participant in CSIS workshop, August 12, 2021.

68 "Putin Pledges Russian Superiority in the Arctic with New Icebreakers," Reuters, November 3, 2020, https://www.reuters.com/article/us-russia-putin/putin-pledges-russian-superiority-in-the-arctic-with-new-icebreakers-idUSKBN27J2AU.

69 Stanovaya, "Unconsolidated"; and "Patrushev warned of global crisis due to climate change" (in

Russian), RIA Novosti, June 24, 2021, https://ria.ru/20210624/klimat-1738369323.html.

70 "Russia Says It Must Stake Claim to Arctic Resources," Radio Free Europe/Radio Liberty, September 12, 2008, https://www.rferl.org/a/Russia_Says_It_Must_Stake_Claim_To_Arctic_Resources/1199594.html; and Atle Staalesen, "Russia's Security Strongmen Gather on Remotest Arctic Coast to Talk International Cooperation," Barents Observer, August 31, 2017, https://thebarentsobserver.com/en/arctic/2017/08/russias-security-strongmen-gather-remotest-arctic-coast-talk-international.

71 Victor Yasmann, "Russia: Rebranding the Nation," Radio Free Europe/ Radio Liberty, February 6, 2007, https://www.rferl.org/a/1074537.html.

72 Atle Staalesen, "National Security Chief Sounds the Alarm: Foreigners Might Use Tundra Oil Spill to Defame Russia," Barents Observer, June 11, 2020, https://thebarentsobserver.com/en/ecology/2020/06/national-security-chief-sounds-alarm-foreigners-might-use-tundra-oil-spill-defame.

73 Artem Filipenok, "Andrey Patrushev headed the Arctic Initiatives Center" (in Russian), RBC, November 27, 2019, https://www.rbc.ru/business/27/11/2019/5dde46379a79472d082f60d2.

74 Rumer, Sokolsky, and Stronski, "Russia in the Arctic—A Critical Examination."

75 Atle Staalesen, "Security Strongmen Take on Key Role in Russian Arctic Policy," Barents Observer, August 26, 2020, https://thebarentsobserver.com/en/2020/08/security-strongmen-take-key-role-russian-arctic-policy.

76 "Arctic Competition: Part Two: Military Buildup and Great Power Competition," *Foreign Policy*, Power Maps, December 14, 2020, https://foreignpolicy.com/2020/12/15/arctic-competition-defense-militarization-security-russia-nato-war-games-china-power-map/.

77 Rumer, Sokolsky, and Stronski, "Russia in the Arctic—A Critical Examination."

78 Intervention by participant in CSIS workshop, August 12, 2021.

79 "Another one of the Shoigu clan. How does the business that brings billions to the family of the new leader of United Russia work?" (in Russian), Open Media, June 25, 2021, https://openmedia.io/investigation/eshhyo-odna-iz-roda-shojgu-kak-ustroen-biznes-prinosyashhij-milliardy-seme-novogo-lidera-edinoj-rossii/#ch2.

80 Anna Kireeva and Charles Digges, "Permafrost Melt Caused by Climate Change Could Cost Russia Billions, Environmental Minister Says," Bellona, June 3, 2021, https://bellona.org/news/arctic/2021-06-permafrost-melt-caused-by-climate-change-could-cost-russia-billions-environmental-minister-says.

81 "Head of the Ministry of Environment to RPC: We Don't Have a KPI for the Number of Fines for Environmental Harm" (in Russian), RBC, May 11, 2021, https://www.rbc.ru/interview/business/11/05/2021/608bdd3d9a7947c17905ad99?from=column_2.

82 Laura Millan Lombrana, "Where Climate Scientists See Danger, Russia Sees an Opportunity," Bloomberg, March 15, 2021, https://www.bloomberg.com/news/articles/2021-03-15/where-climate-scientists-see-danger-russia-sees-an-opportunity.

83 Andrei Semenov, "Who Is Responsible for Mitigating the Effects of Climate Change in Russia?," CSIS, *Commentary*, January 14, 2021, https://www.csis.org/analysis/who-responsible-mitigating-effects-climate-change-russia.

84 Daniel Kozin, "Is Russia Finally Waking Up to Climate Change?," *Moscow Times*, March 9, 2020, https://www.themoscowtimes.com/2020/03/04/is-russia-finally-waking-up-to-climate-change-a69517.

85 "Chubais Called Climate Change the Main Challenge in the Next 10 Years," TASS, August 10, 2021, https://tass.ru/obschestvo/12096243; and "Chubais Called For Restructuring the Economy Due to Climate Change," RIA Novosti, June 3, 2021, https://ria.ru/20210603/klimat-1735378427.html.

86 Thomas Nilsen, "Vyacheslav Ruksha will lead the newly established Northern Sea Route Directorate," Barents Observer, July 24, 2018, https://thebarentsobserver.com/en/arctic/2018/07/vyasheslav-ruksha-will-lead-newly-established-northern-sea-route-directorate.

87 "Permafrost Monitoring, Air Pollution Control - At a Meeting under the President of Russia, Development of the Roshydromet System Was Discussed," Ministry of Natural Resources and Environment of the Russian Federation, Press release, August 5, 2021, https://www.mnr.gov.ru/press/news/monitoring_vechnoy_merzloty_kontrol_za_zagryazneniem_atmosfery_na_soveshchanii_pri_prezidente_rossii/.

88 Marc Bartholomy et al., "Environmental Law and Practice in the Russian Federation: Overview," Thomson Reuters Practical Law, 2020, https://uk.practicallaw.thomsonreuters.com/w-013-5609?transitionType=Default&contextData=(sc.Default)&firstPage=true.

89 Marlene Laruelle, *Russia's Arctic Policy: A Power Strategy and Its Limits* (Paris: IFRI, March 2020), Russie.Nei.Visions 117, 17, https://www.ifri.org/sites/default/files/atoms/files/laruelle_russia_arctic_policy_2020.pdf.

90 Nastassia Astrasheuskaya, "Russia Gives Nuclear Group Control of Arctic Sea Route," *Financial Times*, December 13, 2018, https://www.ft.com/content/b5dc9c38-fd56-11e8-aebf-99e208d3e521.

91 Arild Moe, "A New Russian Policy for the Northern Sea Route? State Interests, Key Stakeholders and Economic Opportunities in Changing Times," *Polar Journal* 10, no. (2021): 209–227, doi:10.1080/2154896X.2020.1799611.

92 Ibid.

93 Russian Federation, *Ensuring Economic Development in the Context of Climate Change* (in Russian) (Moscow: Ministry of Economic Development), https://www.economy.gov.ru/material/directions/investicionnaya_deyatelnost/obespechenie_razvitiya_ekonomiki_v_usloviyah_izmeneniya_klimata/.

94 "Russia runs economic risks with carbon footprint reduction - economy ministry," Thomson Reuters Foundation, August 25, 2021, https://news.trust.org/item/20210825132420-zxxco.

95 Presentation at CSIS workshop, May 27, 2021. This included the withdrawal of Exxon Mobil from a joint exploration project in the Pobeda oil field in the Kara Sea. Laruelle, *Russia's Arctic Policy*, 13.

96 Presentation at CSIS workshop, May 27, 2021.

97 Ibid.

98 Ibid.

99 "Unlocking Arctic Potential: Expanding Our Global LNG Footprint to 2030," Novatek, June 2020, novatek.ru/common/upload/doc/IR_June_2020_Investor_Meetings.pdf.

100 Laruelle, Russia's Arctic Policy, 14.

101 Heather A. Conley and Cyrus Newlin, "Climate Change Will Reshape Russia," CSIS, *Commentary*, January 13, 2021, https://www.csis.org/analysis/climate-change-will-reshape-russia.

102 "Taimyr," Norilsk Nickel, https://www.nornickel.com/business/assets/taimyr/.

103 "Nornickel Set to Expand and Upgrade Dudinka Port," Arctic Today, n.d., https://www.arctictoday.com/arctic_business/nornickel-set-to-expand-and-upgrade-dudinka-port/.

104 "Russia's Nornickel 2020 profit sinks 39% as sets aside cash for fuel-spill fine," Reuters, February 16, 2021, https://www.reuters.com/article/us-nornickel-results/russias-nornickel-2020-profit-sinks-39-as-sets-aside-cash-for-fuel-spill-fine-idUSKBN2AG1A8.

105 Sergey Satanovsky, "What Threatens Russia Due to the Imitation of Work Under The Paris Agreement" (in Russian), Deutsche Welle, December 12, 2020, https://www.dw.com/ru/chto-grozit-rossii-iz-za-imitacii-raboty-po-parizhskomu-soglasheniju/a-55912915.

106 Natasha Doff, Ilya Arkhipov, and Yuliya Fedorinova, "The Cold Calculus Behind Putin's Lukewarm Embrace of Paris Pact," *Moscow Times*, September 23, 2019, https://www.themoscowtimes.com/2019/09/23/the-cold-calculus-behind-putins-lukewarm-embrace-of-paris-pact-a67383.

107 Evan Gershkovich, "How Does a Powerful Russian Lobby Plan to Halt Climate Change? With Coal, Oil and Gas," *Moscow Times*, November 15, 2019, https://www.themoscowtimes.com/2019/11/15/how-does-a-powerful-russian-lobby-plan-to-halt-climate-change-with-coal-oil-and-gas-a68173.

108 Jan Burck et al., *The Climate Change Performance Index 2021* (Berlin: New Climate Institute, December 7, 2020), https://newclimate.org/2020/12/07/the-climate-change-performance-index-2021/.

109 President of Russia, "Climate Doctrine of the Russian Federation," Kremlin, December 17, 2009, http://en.kremlin.ru/supplement/4822.

110 "The Ministry of Energy warned of the risk of discrimination against fuel and energy companies under the pretext of environmental protection," TASS, September 26, 2019, https://tass.ru/ekonomika/6934837.

111 Georgy Safonov, "Back to the Future? Russia's Climate Policy Evolution," CSIS, *Commentary*, March 1, 2021, https://www.csis.org/analysis/back-future-russias-climate-policy-evolution.

112 "Russia's Putin signs law to curb greenhouse gas emissions," Reuters, July 2, 2021, https://www.reuters.com/business/environment/russias-putin-signs-law-curb-greenhouse-gas-emissions-2021-07-02/.

113 "Russia to take global de-carbonisation drive into account," Reuters, June 30, 2021, https://www.reuters.com/business/energy/russia-take-global-de-carbonisation-drive-into-account-2021-06-30/.

114 Felix Light, "Russia Says Its Forests Neutralize Billions of Tons of Greenhouse Gases. Scientists Have Their Doubts," *Moscow Times*, July 5, 2021, https://www.themoscowtimes.com/2021/07/05/russia-says-its-forests-neutralize-billions-of-tons-of-greenhouse-gases-scientists-have-their-doubts-a74428.

115 Lo, *The Adaptation Game*.

116 Russian Federation, *Energy Strategy of the Russian Federation until 2035*.

117 "Business is decarbonized on paper and in corporate reports" (in Russian), Kommersant, February 15, 2021, https://www.kommersant.ru/doc/4691458.

118 Angelina Davydova, "Environmental Activism in Russia: Strategies and Prospects," CSIS, *Commentary*, March 3, 2021, https://www.csis.org/analysis/environmental-activism-russia-strategies-and-prospects.

119 "Environmental Problems" (in Russian), Levada Center, January 23, 2020, https://www.levada.ru/2020/01/23/problemy-okruzhayushhej-sredy/.

120 "Ecology problems. Global warming" (in Russian), Public Opinion Foundation, March 26, 2021, https://fom.ru/Bezopasnost-i-pravo/14559.

121 "Life after Greta Thunberg, or Consumption and Global Warming," Public Opinion Research Center, August 18, 2020, https://wciom.com/index.php?id=61&uid=1792.

122 Evan Gershkovich, "'We Need More People': Exhausted Firefighters Battle Siberia Blazes," *Moscow Times*, July 29, 2021, https://www.themoscowtimes.com/2021/07/29/we-need-more-people-exhausted-firefighters-battle-siberia-blazes-a74643.

123 Troianovski, "As Frozen Land Burns, Siberia Fears."

124 Maxim Babenko, "Surviving in Isolation, Where the Steppe Has Turned to Sand," *New York Times*, May 10, 2021, https://www.nytimes.com/2021/05/10/travel/kalmykia-russia.html; E.B. Dedova, B.A. Goldvarg, and N.L. Tsagan-Mandzhiev, "Land Degradation of the Republic of Kalmykia: Problems and Reclamation Methods," Arid Ecosystems 10, (2020): 140–147, doi:10.1134/S2079096120020043.

125 Cyrus Newlin, "Patterns of Dissent in Russia's Regions," CSIS, *Commentary*, July 17, 2020, https://www.csis.org/analysis/patterns-dissent-russias-regions.

126 Ann M. Simmons, "In a Big Shift, Russians Take to the Streets Over Everyday Complaints," *Wall Street Journal*, December 24, 2019, https://www.wsj.com/articles/in-a-big-shift-russians-take-to-the-streets-over-everyday-complaints-11577203354.

127 Valery Dzutstati, "Russian Government Builds Novel Framework for Controlling Regions," *Eurasia Daily Monitor* 18, no. 120 (July 2021), https://jamestown.org/program/russian-government-builds-novel-framework-for-controlling-regions/.

128 Russian Federation, "Russian National Security Strategy, December 2015 – Full-text Translation," IEEE, December 2015, http://www.ieee.es/Galerias/fichero/OtrasPublicaciones/Internacional/2016/Russian-National-Security-Strategy-31Dec2015.pdf.

129 "Decree of the President of the Russian Federation of 02.07.2021 No. 400 'On the National Security Strategy of the Russian Federation'" (in Russian), Russian Federation, July 2021, http://publication.pravo.gov.ru/Document/View/0001202107030001.

130 Dmitri Trenin, "Russia's National Security Strategy: A Manifesto for a New Era," Carnegie Moscow Center, June 7, 2021, https://carnegie.ru/commentary/84893.

131 "On the National Security Strategy of the Russian Federation," Russian Federation, Section II, paragraph 16.

132 Ibid., Section IV, paragraph 80.

133 Matthew Melino and Heather A. Conley, "The Ice Curtain: Russia's Arctic Military Presence," CSIS, March 2020, https://www.csis.org/features/ice-curtain-russias-arctic-military-presence.

134 Elizabeth Buchanan and Bec Strating, "Why the Arctic is not the 'next' South China Sea?," War on the Rocks, November 5, 2020, https://warontherocks.com/2020/11/why-the-arctic-is-not-the-next-south-china-sea/.

135 Presentation at CSIS workshop, August 12, 2021.

136 Schreiber, "Russia and Canada may lose their legal claim to Arctic seaways"; "United Nations Convention on the Law of the Sea," United Nations, 1982, 115, https://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf.

137 Thomas Nilsen, "Is this Russia's new coastal base for the 'doomsday nuke' drones?," Barents Observer, January 26, 2021, https://thebarentsobserver.com/en/security/2021/01/russias-new-coastal-base-doomsday-nuke-drone.

138 Rush Doshi, Alexis Dale-Huang, and Gaoqi Zhang, *Northern Expedition: China's Arctic Activities and Ambitions* (Washington, DC: Brookings, April 2021), https://www.brookings.edu/wp-content/uploads/2021/04/FP_20210412_china_arctic.pdf.

139 Pierre Morcos and Colin Wall, "Invisible and Vital: Undersea Cables and Transatlantic Security," CSIS, *Commentary*, June 11, 2021, https://www.csis.org/analysis/invisible-and-vital-undersea-cables-and-transatlantic-security.

140 Four known tests from January to March 2021 alone. "Arctic Military Activity Tracker," CSIS, last accessed September 1, 2021, https://arcticmilitarytracker.csis.org/. Malte Humpert, "New Satellite Images Reveal Extent of Russia's Military and Economic Build-Up in the Arctic," High North News, May 3, 2019, https://www.highnorthnews.com/en/new-satellite-images-reveal-extent-russias-military-and-economic-build-arctic.

141 Presentation at CSIS workshop, August 12, 2021.

142 Laruelle, *Russia's Arctic Policy*, 16.

143 Melino and Conley, "The Ice Curtain."

144 Boulègue, "Russia's Military Posture in the Arctic," 16–18.

145 Thomas Nilsen, "Putin heightens the strategic role of the Northern Fleet," Barents Observer, June 8, 2020, https://thebarentsobserver.com/en/security/2020/06/putin-heightens-strategic-role-northern-fleet.

146 Melino and Conley, "The Ice Curtain."

147 Boulègue and Kertysova, "Arctic Development Reflects Russia's Thorny Civil-Military Relations."

148 Thomas Nilsen, "Northern Fleet gets priority in receiving new ballistic missile subs," Barents Observer, May 15, 2021, https://thebarentsobserver.com/en/security/2021/05/northern-fleet-gets-priority-receiving-new-ballistic-missile-subs.

149 Benjamin Brimelow, "Russia's powerful Northern Fleet just got the first of a new class of submarines that has the US Navy worried," Business Insider, June 8, 2021, https://www.businessinsider.com/russia-northern-fleet-new-class-of-subs-worry-us-navy-2021-6.

150 Boulègue, "Russia's Military Posture in the Arctic," 19–20.

151 Melino and Conley, "The Ice Curtain."

152 Ibid.; and Colin Wall, Matthew Funaiole, and Joe Bermudez, "Russia's Northern Fleet Deploys Long-Range Interceptors to Remote Arctic Base," CSIS, *Commentary*, April 14, 2021, https://www.csis.org/analysis/russias-northern-fleet-deploys-long-range-interceptors-remote-arctic-base.

153 Presentation at CSIS workshop, August 12, 2021.

154 Ibid.

155 Ernie Regehr, "Military Infrastructure and Strategic Capabilities: Russia's Arctic Defense Posture," in *The Arctic and World Order*, edited by Kristina Spohr and Daniel S. Hamilton (Washington, DC: Foreign Policy Institute/Henry A. Kissinger Center for Global Affairs, Johns Hopkins University SAIS, 2020), 195; and Laruelle, *Russia's Arctic Policy*, 11.

156 Malte Humpert, "Two new Arctic emergency centers to open along Northern Sea Route," Arctic Today, January 31, 2017, https://www.arctictoday.com/two-new-arctic-emergency-centers-to-open-along-northern-sea-route/.

157 Presentation at CSIS workshop, August 12, 2021.

158 "Study Shows Pollock Stocks are Mixing More Due to Changing Ocean Conditions and Weather Patterns," NOAA Fisheries, October 26, 2020, https://www.fisheries.noaa.gov/feature-story/study-shows-pollock-stocks-are-mixing-more-due-changing-ocean-conditions-and-weather; and Yereth Rosen, "Russia is poised to open the first-ever commercial pollock fishery in Chukchi Sea."

159 Vladimir Isachenkov, "Russian navy conducts major maneuvers near Alaska," Military Times, August 30, 2020, https://www.militarytimes.com/news/your-military/2020/08/30/russian-navy-conducts-major-maneuvers-near-alaska/; and participant intervention in CSIS workshop, August

12, 2021.

160 "Arctic Military Activity Tracker," CSIS.

161 Boulègue, "Russia's Military Posture in the Arctic," 22.

162 "The Russian Navy will form the regiments of unmanned aerial vehicles," RIA Fan, March 28, 2017, https://riafan.ru/686147-vmf-rf-sformiruet-polki-bespilotnyh-letatelnyh-apparatov; and "A solar-powered drone to be launched over the Arctic for the first time," The Arctic, December 25, 2020, https://arctic.ru/infrastructure/20201225/989775.html.

163 Boulègue, "Russia's Military Posture in the Arctic," 21.

164 Presentation at CSIS workshop, August 12, 2021.

165 "Arctic Military Activity Tracker," CSIS.

166 Thomas Nilsen, "Beefing up forces ahead of Zapad-2021, Northern Fleet kicks off large-scale exercise," Barents Observer, August 5, 2021, https://thebarentsobserver.com/en/security/2021/08/beefing-forces-ahead-zapad-2021-northern-fleet-kicks-large-scale-exercise-border.

167 "Arctic Military Activity Tracker," CSIS; Shaan Shaikh, "Russia Tests Kinzhal Missile in Arctic," Missile Threat, CSIS, December 2, 2019, https://missilethreat.csis.org/russia-tests-kinzhal-missile-in-arctic/; and Atle Staalesen, "Northern Fleet prepares deployment of hypersonic missile Kinzhal," Barents Observer, December 16, 2020, https://thebarentsobserver.com/en/security/2020/12/northern-fleet-prepares-deployment-hypersonic-missile-kinzhal.

168 Xavier Vavasseur, "Russia's Northern Fleet To Form Naval Engineering Unit," Naval News, November 18, 2019, https://www.navalnews.com/naval-news/2019/11/russias-northern-fleet-to-form-naval-engineering-unit/.

169 Presentation at CSIS workshop, August 12, 2021.

170 Pavel Baev, "Threat Assessments and Strategic Objectives in Russia's Arctic Policy," *Journal of Slavic Military Studies* 32, no. 1, (2019): 30, doi:10.1080/13518046.2019.1552662; and presentation at CSIS workshop, August 12, 2021.

171 Boulègue, "Russia's Military Posture in the Arctic," 19.

172 Ben Aris, "Russia's permafrost is melting," BNE Intellinews, September 2, 2020, https://www.intellinews.com/russia-s-permafrost-is-melting-190398/; Isabelle Khurshudyan and Andrew Freedman, "An oil spill in Russia's Arctic exposes risks for Moscow's Far North plans," *Washington Post*, July 28, 2020, https://www.washingtonpost.com/climate-environment/2020/07/28/an-oil-spill-russias-arctic-exposes-problems-moscows-big-plans-far-north/; and Toby Woodall, "Rising temperatures leave Russia's Arctic ambitions on thin ice," S&P Global, September 7, 2020, https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/rising-temperatures-leave-russia-s-arctic-ambitions-on-thin-ice-59646990.

173 The remaining six installations are at low risk: Sredny Ostrov, Taymylyr, Pevek, Mys Shmidta, Zvyozdny, and Temp.

174 Boulègue, "Russia's Military Posture in the Arctic," 19.

175 Heather A. Conley and Joe Bermudez, "Ice Curtain: S-400 Deployments and Enhanced Defense of Russia's Western Arctic (Rogachevo Air Base)," CSIS, *CSIS Briefs*, March 30, 2020, https://www.csis.org/analysis/ice-curtain-s-400-deployments-and-enhanced-defense-russias-western-arctic-rogachevo-air.

176 Boulègue, "Russia's Military Posture in the Arctic," 38.

177 Laruelle, Russia's Arctic Policy, 13–14.

178 Atle Staalesen, "National Guard becomes Arctic protector," Barents Observer, January 28, 2019, https://thebarentsobserver.com/en/security/2019/01/national-guard-becomes-arctic-protector.

179 Matthew Melino, Heather A. Conley, and Joseph S. Bermudez Jr, "Tiksi Airbase—Many Russian Announcements, Little Equipment," CSIS, *CSIS Briefs*, March 2020, https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/200326_Tiksi_WEB%20FINAL_UPDATE_1.pdf?VP1Cn6ImORkGdNR_5mTvSn.yHqzIUmBe; and Malte Humpert, "Russia activates a new S-300 air defense unit in the Arctic," Arctic Today, April 9, 2020, https://www.arctictoday.com/russia-activates-a-new-s-300-air-defense-unit-in-the-arctic/?wallit_nosession=1.

180 National Intelligence Council, *Russia: Impact of Climate Change to 2030: A Commissioned Research Report* (Washington, DC: April 2009), 31, https://www.dni.gov/files/documents/climate2030_russia.pdf; and Jeffrey Ringhausen, "Testimony before the House Permanent Select Committee on Intelligence's Open Hearing on National Security Implications of Climate Change," YouTube video, uploaded by House Intelligence, Jun 5, 2019, 1:39:30, https://youtu.be/bCheD2L-zDY?t=1629.

181 Ringhausen, "Testimony before the House Permanent Select Committee on Intelligence."

182 Thomas Nilsen, "Russia's most high-tech multi-purpose nuclear sub further delayed," Barents Observer, March 3, 2021, https://thebarentsobserver.com/en/security/2021/03/russias-most-high-tech-multi-purpose-nuclear-sub-further-delayed.

183 Matthew Melino, Heather A. Conley, and Joseph S. Bermudez Jr, "Hunting for Russia's Newest Military 'Treasures in the Far North'," CSIS, *CSIS Briefs,* March 27, 2020, https://www.csis.org/analysis/ice-curtain-hunting-russias-newest-military-treasures-far-north.

184 Presentation at CSIS workshop, August 12, 2021.

185 Ibid.

186 Interventions by multiple participants at CSIS workshop, August 12, 2021. Russia's own top military prosecutor estimated that corruption cost the armed forces over RUB 7 billion (roughly $97 million) in 2018 alone: "Corruption in Russia's Military Quadrupled in 2018, Prosecutors Say," *Moscow Times*, March 21, 2019, https://www.themoscowtimes.com/2019/03/21/corruption-in-russias-military-quadrupled-in-2018-prosecutors-say-a64907.

187 Melino, Conley, and Bermudez Jr, "Hunting for Russia's Newest Military 'Treasures in the Far North.'"

188 Presentation at CSIS workshop, August 12, 2021.

189 Interventions by multiple participants at CSIS workshop, August 12, 2021.

190 Polina Beliakova and Sam Perlo-Freeman, "Corruption in the Russian Defense Sector," World Peace Foundation at The Fletcher School, May 11, 2018, https://sites.tufts.edu/wpf/files/2018/05/Russian-Defense-Corruption-Report-Beliakova-Perlo-Freeman-20180502-final.pdf; and Isabel Gorst, "Russian military budget sapped by corruption," *Financial Times*, May 24, 2011, https://www.ft.com/content/961668be-8628-11e0-9e2c-00144feabdc0.

191 Intervention by participant at CSIS workshop, August 12, 2021.

192 "More Arrests Made In Connection With Russian Arctic Diesel Spill," Radio Free Europe/ Radio Liberty, June 10, 2020, https://www.rferl.org/a/more-arrests-made-in-connection-with-russian-arctic-oil-spill-/30663761.html; and intervention by participant at CSIS workshop, August 12, 2021.

193 Presentation at CSIS workshop, August 12, 2021.

194 Karlovitch et al., "Global warming is having a costly, and dangerous, impact on key military bases in Alaska."

195 Ibid.

196 Wall, Funaiole, and Bermudez, "Russia's Northern Fleet Deploys Long-Range Interceptors."

197 Karlovitch et al., "Global warming is having a costly, and dangerous, impact on key military bases in Alaska."

198 CSIS analysis of satellite imagery.

199 Thomas Nilsen, "Forest fire spreads across border from Russia to Lapland," Barents Observer, July 21, 2018, https://thebarentsobserver.com/ru/node/4187.

200 U.S. Department of Defense, *Report on Effects of a Changing Climate to the Department of Defense* (Washington, DC: Office of the Under Secretary of Defense for Acquisition and Sustainment, January 2019), https://media.defense.gov/2019/Jan/29/2002084200/-1/-1/1/CLIMATE-CHANGE-REPORT-2019.PDF; United States Government Accountability Office, *Climate Resilience: DOD Coordinates with Communities, but Needs to Assess the Performance of Related Grant Programs* (Washington, DC: December 2020), https://www.gao.gov/assets/gao-21-46.pdf; and participant intervention at CSIS workshop, August 12, 2021.

201 Participant intervention at CSIS workshop, August 12, 2021.

202 Roshydromet, *Report on Climate Features on the Territory of the Russian Federation in 2019*; and National Centers for Environmental Information, "Climate at a Glance: Global Mapping."

203 Presentation at CSIS workshop, May 27, 2021.

204 Heather A. Conley and Jamie Kraut, *U.S. Strategic Interests in the Arctic* (Washington, DC: CSIS, April 2010), https://www.csis.org/analysis/us-strategic-interests-arctic; and Heather A. Conley

and Caroline Rohloff, *The New Ice Curtain* (Washington, DC: CSIS, August 2015), 16, https://csis-website-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/publication/150826_Conley_NewIceCurtain_Web.pdf.

COVER PHOTO NATALIA KOLESNIKOVA/AFP/GETTY IMAGES

CSIS | CENTER FOR STRATEGIC & INTERNATIONAL STUDIES

1616 Rhode Island Avenue NW
Washington, DC 20036
202 887 0200 | **www.csis.org**

ROWMAN & LITTLEFIELD

4501 Forbes Boulevard
Lanham, MD 20706
301-459-3366 | **www.rowman.com**