

State-Led Extractivism and Environmental Degradation in the Arctic: A Political Ecology Analysis

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Abstract

This paper analyzes how state-led resource competition exacerbates environmental degradation in the Arctic through a political ecology framework. The Arctic has transformed from a peripheral frontier into a geopolitical contestation arena driven by climate change and natural resource abundance. Using qualitative research methods and secondary source analysis covering 2010-2024, this study reveals how Arctic states' extractivism: including Russia, the United States, Canada, Norway, Denmark/Greenland, Nordic states, and China results in environmental consequences through climate change acceleration, marine ecosystem disruption, permafrost degradation, and black carbon pollution. Findings demonstrate that environmental degradation is systematically shaped by power relations prioritizing state interests and corporate profits over Indigenous sovereignty and ecological sustainability, with the paradox of "green extractivism" legitimizing continued exploitation under climate mitigation rhetoric. The analysis exposes structural inequalities wherein Indigenous communities bear disproportionate environmental burdens while excluded from decision-making processes.

Keywords: *the Arctic; environmental degradation; political ecology; resource competition; indigenous rights*

Abstrak

Penelitian ini menganalisis bagaimana kompetisi sumber daya yang dipimpin negara memperburuk degradasi lingkungan di Arktik melalui kerangka ekologi politik. Arktik telah bertransformasi dari perbatasan terpencil menjadi arena kontestasi geopolitik yang dipicu oleh perubahan iklim dan kelimpahan sumber daya alam. Dengan menggunakan metode penelitian kualitatif dan analisis

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sumber sekunder periode 2010-2024, studi ini mengungkapkan bagaimana ekstraktivisme negara-negara Arktik: termasuk Rusia, Amerika Serikat, Kanada, Norwegia, Denmark/Greenland, negara-negara Nordik, dan Tiongkok yang menyebabkan konsekuensi lingkungan melalui percepatan perubahan iklim, gangguan ekosistem laut, degradasi permafrost, dan polusi karbon hitam. Studi menunjukkan bahwa degradasi lingkungan dibentuk secara sistematis oleh relasi kuasa yang memprioritaskan kepentingan negara dan keuntungan korporasi di atas kedaulatan masyarakat adat dan keberlanjutan ekologis, dengan paradoks "ekstraktivisme hijau" yang melegitimasi eksploitasi berkelanjutan.

Kata kunci: Arktik; degradasi lingkungan; ekologi politik; kompetisi sumber daya; hak masyarakat adat

Introduction

According to The Arctic Council, there are four million people living in the Arctic region, including more than a million members of over forty Indigenous communities ¹. Large areas of the Arctic have historically and currently had unfair international relations that are colonial in nature. Key global Nordic states, including Norway, Sweden, the United States, Canada, Finland, Denmark, and the Russian Federation, have made several Arctic regions important resource frontier locations for the extractive fossil fuel, metal mining, energy, and forestry economies ^{2,3}. Local populations, frequently Indigenous ones, have opposed these Arctic extractivist borders ^{4,5}. Driven by the convergence of natural resource abundance, climate change, and strategic imperatives, the Arctic area has quickly changed from an isolated, icy frontier to a center of fierce geopolitical rivalry. The Arctic is warming around four times faster than the rest of the earth due to rising global temperatures ^{6,7}. This has resulted in unprecedented ice melt, which is drastically changing the region's accessibility and strategic importance. The Arctic Ocean has been losing approximately 13 percent of its sea ice per decade, opening previously inaccessible shipping routes that has led to the emergence of new economic and geopolitical strategic for Nordic States; such as the Northern Sea Route (NSR) along Russia's Arctic coast and the Northwest Passage through Canadian waters, which could reduce transit times between Europe and Asia by up to 40 percent compared to traditional routes through the Suez or Panama Canals ⁸. The Arctic region has emerged as one of the most contested geopolitical zones of the twenty-first century, where intensifying state competition for natural resources intersects critically with accelerating environmental transformation. It is estimated to contain 30 percent of the world's natural gas resources and 13 percent of its undiscovered oil reserves, making it valuable resource for states seeking to expand economically and secure their energy supply ⁹, alongside numerous valuable deposits of rare earth elements, marine resources, and minerals.

The Arctic's geopolitical dynamics involve intricate, overlapping interests among the eight Arctic states (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and the United States). Each asserting sovereignty claims and achieving resource development strategies within their territorial boundaries and contested offshore zones. In addition to pursuing large-scale hydrocarbon projects such as Yamal LNG project, Russia, which owns over half of the Arctic coastline, has increased its military presence by reactivating Soviet-era outpost and constructing nuclear-powered icebreaker fleets¹⁰. In contrast, the United States has declared the Arctic to be crucial to national security in order to strengthen NATO ties and balance Alaskan extraction aspirations with legal frameworks. Meanwhile, non-Arctic states, most notably, China have established themselves as “near-Arctic” powers by making significant investments in research facilities, infrastructure, and alliances with projects such as the Polar Silk Road¹¹. These ambitions are reflected in legal frameworks such as United Nations Convention on the Law of the Sea (UNCLOS) and diplomatic organizations like the Arctic Council, but they also increasingly take the form of militarization, jurisdictional overlaps, and competing development plans that increase environmental pressures.

Substantial analytical gaps exist at the intersection of Arctic geopolitics and environmental change, since scholarly discourse on these topics remains largely fragmented within disciplinary boundaries. Environmental studies record biophysical effects like permafrost thawing and biodiversity decline¹², resource economics emphasizes extraction viability and market forces¹³, and geopolitical research stresses military tactics and territorial conflicts¹⁴. However, there are few integrated political ecology assessments that examine power dynamics, colonial histories, and political economy of extraction to connect state rivalry to socio-ecological deterioration¹⁵. Furthermore, dominant paradigms frequently prioritize corporate and state viewpoints, ignoring Indigenous groups whose territories suffer from the combined effects of militarization, extraction, and climate devastation¹⁶. The dearth of systematic inquiries connecting geopolitical rivalry to environmental outcomes via political ecology constitutes a critical oversight, especially amid the rise of “green” extractivism, where resource pursuits are framed as climate solutions¹⁷.

This paper aims to address these gaps by analyzing how state-led resource competition exacerbates environmental degradation in the Arctic through a political ecology theory that reveals the power structures, inequalities, and human-environment interactions underlying extractions regimes. Political ecology provides analytical tools for examining not merely the biophysical impacts of resource extraction, but the political-economic factors, historical trajectories, and discursive formations that enable and legitimize environmental degradation¹⁸. The main research question is: How does resource competition among Arctic states contribute to environmental degradation in the region,

viewed through the lens of political ecology? This study examines the mechanisms of state competition that produce environmental damage, power imbalances that enable extraction despite ecological risks, and socio-political structures that consistently prioritize resource accumulation over environmental protection. This study contributes to Arctic geopolitics and political ecology literature by systematically integrating the dynamics of geopolitical competition, state-led extractivism, securitization, and energy transition narratives within a single analytical framework. Unlike previous research that tends to separate geopolitical analysis, environmental policy, and social impacts sectorally, this research demonstrates how these four dimensions are interconnected and structurally shape patterns of environmental degradation and socio-ecological inequality in the Arctic.

Methodology

This study examines the connection between state-led extractivism and environmental degradation in the Arctic using a qualitative research design based on the theoretical framework of political ecology. Because it enables a multiscalar analysis that links regional ecological changes to state-level policies and international geopolitical conflict, political ecology is especially well-suited for this inquiry. This research deconstructs how political and economic power relations impact the distribution of environmental hazards and benefits throughout the Arctic ecosystem by going beyond classic realist or solely environmental perspectives¹⁹.

This study's time frame is established between 2010 and 2024, when Arctic cooperation gave way to a more fragmented, securitized environment. A methodical assessment of secondary sources provides the data, which is then subjected to qualitative content analysis. Scientific datasets, including the NOAA Arctic Report Cards and IPCC assessments, are triangulated with strategic state documents, such as national Arctic policies and military evaluations from organizations like the Center for Strategic and International Studies (CSIS). The analysis reveals how states define "environmental necessity" to justify extractivist expansion by contrasting scientific evidence of ecological degradation with state-led narratives of resource security.

This paper uses political ecology as its theoretical framework to understand how state-led competition for Arctic resources results in environmental degradation. The framework makes it possible to analyze a number of crucial aspects that are pertinent to the Arctic setting. It sheds light on how actors are forced to put short-term strategic gains ahead of long-term sustainability due to market and geopolitical competition, which forces extraction regardless of the effects on the environment. In particular, it looks at how companies and distant states profit from resource exploitation while marginalizing Indigenous peoples, revealing unequal power dynamics that dictate who gained from resource usage

and who pays environmental costs. It examines how environmental governance institutions and discourses define acceptable resource usage, frame issues, and determine whose knowledge is valued during decision-making.

Political ecology, as defined by Peet, Robbins, and Watts, integrates the concerns of ecology and a broadly defined political economy to examine three interconnected aspects: first, it examines how capitalist development impacts environments, revealing how the logics of accumulation, competition, and growth systematically generate degradation. Second, it scrutinizes environmental conservation and management initiatives themselves, demonstrating how protection efforts can serve as mechanisms for powerful actors to seize control over resources and landscapes. Third, it investigates how new natures are produced through human activity embedded within particular political-economic systems, with profound implications for livelihoods, biodiversity, and power relations²⁰. This multidisciplinary approach challenges the material systems and power dynamics that lead to ecological catastrophes, rejecting apolitical explanations that blame environmental issues on population expansion, inadequate technology, or poor management.

In the 1970s and 1980s, academics such as Blaikie, Watts, Neumann, and Robbins developed this theoretical framework in response to their dissatisfaction with apolitical explanations that attributed environmental problems mainly to population growth, inappropriate technology, or poor management. Two prevalent but insufficient viewpoints are fundamentally rejected by political ecology: first, the values-based environmentalist stance that improved environmental thinking would inevitably result in better environmental outcomes; and second, the market-enthusiast presumption that unrestricted capitalism can solve environmental issues despite the fact that these issues are precisely caused by processes of accumulation inherent in markets²¹.

Result and Discussion

The Arctic as a Climate-Driven Geopolitical and Extractive Frontier

The Arctic has undergone a major shift from a peripheral frozen frontier to a central area of geopolitical contestation. This transformation has been driven by the confluence of climate-induced accessibility and increasing competition over natural resources among both Arctic and non-Arctic states. According to Klimenko, “the strategic significance of the Arctic is growing in the face of the changing climate and environment”²², as new economic opportunities in maritime routes and extractive industries become more feasible due to sea ice melting. Given this rapidly changing environment, a thorough examination of the key states reveals the diverse approaches and conflicting interests shaping Arctic geopolitics. Hence, every state in this icy frontier has different goals, many

of which are essentially influenced by the Arctic's long history as a resource frontier.

The Arctic's extractive boom is rooted in a long history of colonial-driven resource grabs that have repeatedly reshaped its landscapes and peoples. From the 16th-century fur trade and later waves of gold, iron-ore, oil and gas extraction, the Arctic region has been turned into a "key resource frontier" for European and East Asian powers, most notably China²³. This legacy of "colonial extraction" now converges with climate-induced accessibility, creating what scholars describe as a "new extractive frontier" where melting sea ice opens previously untapped oil, gas, mineral and fisheries reserves. The World Economic Forum estimates that by 2030 cumulative mining, oil, natural-gas and infrastructure investments could reach US\$1 trillion, underscoring the scale of contemporary state-led and corporate-driven extractivism²⁴. Arctic extractivism now includes "green" projects such as wind farms, battery mining, LNG that replicate land seizure and displacement under climate-mitigation claims. This paradox shows how state security and economic imperatives override Indigenous rights^{25, 26}. Grasping this extraction continuum is vital for analyzing Arctic states' competing strategies.

State-Led Extractivism and National Strategies in the Arctic

Russia: Russia is the most dominant actor, controlling approximately 50% of the region's coastline with the largest population in the Arctic region. About 80% of the country's natural gas reserves are located in this region²⁷. Dependence on hydrocarbon exports makes Arctic development crucial. The Yamal LNG project produces approximately 16.5 million tons of LNG per year with a target increase of 40% by 2030. The Vostok Oil project is designed to produce up to 100 million tons of oil per year, accompanied by the construction of new cities, ports, airports, and major pipeline networks²⁸. Russia controls the Northern Sea Route (NSR), a shipping lane that shortens travel time between Europe and Asia by nearly 40%, by requiring vessels passing through to use icebreaker escort²⁹. Russia is also increasing its military presence by reopening old bases and upgrading nuclear assets on the Kola Peninsula, although these activities potentially add environmental risks³⁰.

Amerika Serikat: US Arctic policy fluctuates between resource extraction and environmental conservation, reflecting domestic political debates. The Arctic National Wildlife Refuge has become a symbol of conflict between energy exploitation and environmental protection. Climate change is driving commercial fish species such as cod, haddock, and mackerel northward, increasing fishing potential but potentially conflicting with conservation and Indigenous subsistence rights³¹. Increasing tensions with Russia have led to viewing the Arctic through a security framework, with a securitization approach that places strategic interests above environmental protection.

Canada: Canada's Arctic policy is shaped by the intersection of resource interests, sovereignty issues, and constitutional responsibilities toward Indigenous peoples. The European Union and the United States view the Northwest Passage as an international strait with transit passage rights, while Canada claims it as internal waters³². To assert sovereignty, Canada extended the Arctic Waters Pollution Prevention Act to 200 nautical miles in 2009 and implemented the mandatory NORDREG vessel reporting system in 2010, as well as planning the construction of a deep-sea port in Nanisivik and a military base in Resolute Bay³³.

Despite constitutional recognition of Indigenous rights, power imbalances remain evident. Indigenous communities bear the social and environmental impacts of extractive projects with limited economic benefits, often excluded from border demarcation that divides traditional lands³⁴. Resource exploitation continues, including the Mary River mine, which is considered to have not fully accounted for cumulative impacts.

Norway: Norway's economic interests in the Arctic focus on energy extraction and fisheries. The Barents Sea holds strategic value with approximately half of Norway's undiscovered oil and gas reserves. Fishery exports reached approximately 25 billion NOK in 2016. Warming in the Barents Sea expands space for hydrocarbon exploration. The discovery of a new oil field estimated to contain 3.66 billion barrels confirms Norway's economic priority on oil and gas³⁵. Norway strengthens surveillance infrastructure through Kongsberg Satellite Services (KSAT) in Svalbard, supporting environmental monitoring while serving military interests³⁶. The 2010 maritime boundary agreement with Russia demonstrates bilateral cooperation³⁷, but also facilitates resource exploitation in previously disputed areas. Russian criticism of dual-use satellite operations in Svalbard shows that civilian infrastructure can be read as a geopolitical instrument.

Denmark/Greenland: Denmark's relationship with the Arctic is mediated through Greenland, which has extensive autonomy. The U.S. military presence at Thule Air Base strengthens the security dimension. Estimates of significant oil reserves³⁸, initially drove intensive exploration in the 2000s, but drilling programs yielded no commercial discoveries. In 2021, the Greenland government imposed a moratorium on new oil and gas licenses³⁹, significant because Greenland's economy heavily depends on Danish transfer funds (60% of public expenditure). Rare earth mineral reserves attract China's attention, bringing great power competition dynamics. The construction of the Greenland Satellite Ground Station by China in 2017⁴⁰, potentially has strategic implications.

Nordic States: The involvement of Sweden, Finland, and Iceland demonstrates a shift from geographical determinism toward infrastructure and technological determinism. The expansion of Esrange Space Center in Kiruna reveals dual-use potential in surveillance and military interoperability, especially

post-Sweden's accession to NATO. In Finland, the development of the ICEYE radar system confirms that Arctic administration now heavily depends on remote sensing capabilities.

Strategic mineral mining in northern Sweden shows how the green transition agenda actually deepens pressure on Sámi indigenous territories. Criticism of large-scale wind energy projects in Sápmi as "green colonialism" reinforces the argument that sustainability often functions as moral legitimization for capital expansion⁴¹. Finland leverages its icebreaker shipbuilding industry as an instrument of economic geopolitics⁴². Iceland negotiates Arctic significance through its strategic location on North Atlantic air and shipping routes. Post-crisis economic vulnerability opens space for foreign investment, including from China, triggering U.S. concerns regarding potential dual-use infrastructure^{43, 44}.

Near-Arctic State: China: China's involvement in the Arctic represents a significant transformation in the regional power configuration. By identifying itself as a "near-Arctic state," China constructs a narrative that Arctic dynamics have global implications for trade, energy, and climate change. This position was formalized in the 2018 Arctic Policy Paper, which integrates the Arctic agenda into the Belt and Road Initiative through the Polar Silk Road concept. Maritime trade contributes approximately 46% to national GDP, making shipping route efficiency a strategic variable. The potential of the Northern Sea Route (NSR) to reduce shipping distance between China and Europe by approximately ±23% creates significant incentive for diversifying global distribution channels. COSCO's expansion of NSR transit from two ships in 2015 to fourteen in 2019 demonstrates the institutionalization process of China's maritime presence and integration with Russian infrastructure⁴⁵.

Environmental Degradation as a Consequence of Arctic Resource Competition

The escalation of geopolitical competition over hydrocarbons, critical minerals, and shipping routes has generated systemic ecological externalities. This environmental degradation is multidimensional as it encompasses marine, terrestrial, atmospheric, and cryospheric ecosystems. This condition creates a paradoxical feedback loop: climate change opens access to new extraction opportunities, while extractive activities themselves accelerate the pace of climate change.

Ekosistem Laut: The expansion of shipping routes introduces cumulative stressors to marine ecosystems. Noise pollution disrupts marine mammal communication, ballast water discharge facilitates the introduction of invasive species, and increased ship traffic raises the risk of oil spills⁴⁶. Warming waters significantly shift species distribution, with Atlantic cod, haddock, and mackerel expanding their range hundreds of kilometers northward^[ii], creating economic opportunities but triggering fisheries competition and pressure on fragile marine food webs.

Degradasi Terrestrial: Mining operations, infrastructure development, and hydrocarbon extraction fragment tundra landscapes, contaminating soil and water systems. The Yamal LNG complex produces approximately 16.5 million tons of LNG per year, with projections of a 40% increase by 2030. The Vostok Oil project targets production of up to 100 million tons of oil per year, accompanied by the construction of over 15 new cities, 800 kilometers of pipelines, ports, and airports⁴⁷. Permafrost thaw releases stored organic carbon and potentially accelerates global warming⁴⁸. Ground instability damages building foundations, pipeline networks, and transportation infrastructure, creating a paradox where extraction triggers conditions that threaten the sustainability of its own operations.

Black Carbon: Black carbon is a short-lived climate forcer (SLCF) that absorbs solar radiation and reduces albedo when deposited on snow and ice, accelerating melting⁴⁹. Its regional contribution is substantial: effective radiative forcing reaches 0.96 W/m², far above the global average of 0.08 W/m². Approximately 40% of black carbon emissions originate from forest fires, which are projected to increase under all climate scenarios. Military buildup adds emission sources while creating overlap between civilian and military infrastructure⁵⁰.

Paradoks Green Extractivism: The global energy transition introduces a paradox: minerals such as lithium and nickel required for batteries still necessitate destructive extraction methods including deforestation, water contamination, and landscape transformation⁵¹. Sámi activists call large-scale wind energy projects "green colonialism" because they appropriate traditional territories to supply energy to consumption centers in the south⁵², demonstrating the historical continuity of Indigenous marginalization. Land fragmentation and wildlife contamination disrupt hunting and subsistence practices, impacting food security and cultural identity.

Political Ecology of Arctic Resource Competition

The political ecology framework helps explain that environmental degradation in the Arctic is not merely a technical consequence of economic activity, but rather the result of structured power relations. Environmental change is shaped by capital accumulation, the distribution of political authority, and the accompanying social inequalities⁵³. States and corporations use legal instruments, infrastructure investment, and security legitimization to secure access to hydrocarbons, critical minerals, and shipping routes. In this process, state interests and corporate profits tend to be prioritized over Indigenous sovereignty and ecological sustainability.

Russia's Arctic Strategy demonstrates a pattern of state-led extractivism, where hydrocarbon exports form the primary foundation of national revenue⁵⁴. Financing schemes involving TotalEnergies, China National Petroleum Corporation, and the Silk Road Fund show that transnational capital circulation

concentrates economic benefits on states and investors, while ecological and social risks are borne by local communities. Environmental governance institutions are also not entirely neutral. The Northwest Passage dispute between Canada and the United States illustrates how the law of the sea is used to strengthen territorial control and economic access. The 2010 maritime delimitation agreement between Norway and Russia reduced political uncertainty while simultaneously opening opportunities for more intensive energy exploration⁵⁵. Legal stability in this context functions as a prerequisite for extractive expansion, not its limitation.

The concept of accumulation by dispossession helps explain how environmental costs are transferred from state and corporate actors to Indigenous communities. Historically, indigenous communities have been excluded from boundary-setting processes and resource-related decision-making, such that the fragmentation of traditional territories and disruption of subsistence practices become direct consequences⁵⁶. Sustainability narratives are often used to legitimize the continuation of extractivism. The concept of green extractivism demonstrates how climate change concerns are mobilized to justify lithium and nickel mining or the development of LNG facilities presented as energy transition solutions⁵⁷. Hydrocarbon exploration in the Barents Sea by Norway illustrates how claims of climate leadership can coexist with the expansion of fossil energy production⁵⁸.

The securitization process further reinforces the subordination of environmental interests to strategic imperatives. Russia's increased military presence in the Arctic adds ecological pressure while complicating environmental oversight. The dual-use nature of port infrastructure, airports, and surveillance systems blurs the boundaries between civilian and military functions, such that environmental regulations are often placed beneath security considerations⁵⁹. The inequality of impacts is clearly visible in Indigenous communities. Greenland's economic dependence on block grants from Denmark creates structural pressure to accept extractive projects despite environmental concerns⁶⁰.

Conclusion

Arctic resource competition fundamentally contributes to environmental degradation through interconnected mechanisms rooted in power structures that are best understood through the lens of political ecology. The transformation of the Arctic from a peripheral frozen frontier into a central arena of geopolitical contestation has generated cascading environmental consequences including climate change acceleration, marine ecosystem disruption, permafrost thaw, and black carbon pollution that are systematically produced by state-led extractivism prioritizing economic returns and strategic positioning over ecological integrity and environmental justice. The political ecology framework reveals that Arctic degradation is shaped by power relations

and institutional structures that privilege state interests, corporate profits, and security imperatives over Indigenous sovereignty and ecological sustainability. The convergence of colonial extraction legacies with climate-induced accessibility creates a "new extractive frontier" where historical exploitation intensifies into previously inaccessible regions. Phenomena such as "green extractivism" and securitization demonstrate how sustainability narratives and security concerns legitimize continued environmental destruction under the guise of climate mitigation and strategic necessity. Despite differing national strategies, Indigenous communities disproportionately bear the costs, indicating that addressing Arctic degradation requires structural changes to political and economic forces shaping resource competition, rather than solely technical or regulatory solutions.

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Endnote

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