

January 2024

## Climate Change in Arctic and Indigenous Peoples: Challenges and Solutions

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### Recommended Citation

Vera Solovyeva, *Climate Change in Arctic and Indigenous Peoples: Challenges and Solutions*, 29 Ocean & Coastal L.J. 317 (2024).

Available at: <https://digitalcommons.maine.maine.edu/oclj/vol29/iss2/8>

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# CLIMATE CHANGE IN ARCTIC AND INDIGENOUS PEOPLES. CHALLENGES AND SOLUTIONS.

*Vera Solovyeva\**

## ABSTRACT

### I. GLOBAL CLIMATE CHANGE IN THE ARCTIC

### II. CLIMATE CHANGE IMPACTS ON INDIGENOUS PEOPLES

#### *A. Medical Impacts*

#### *B. Socio-economic Impacts*

#### *C. Socio-cultural Impacts*

### III. IMPORTANCE OF INDIGENOUS KNOWLEDGE AND LOCAL KNOWLEDGE IN CLIMATE CHANGE ADAPTATION

### IV. INDIGENOUS PEOPLES MATTERS OF DEFINITION IN THE RUSSIAN FEDERATION

## CONCLUSION

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## ABSTRACT

*Climate change poses a serious threat to human well-being, negatively affecting health, traditional environmental management, water supply and food security. Changes in the environment are exacerbating indigenous peoples' problems. This is especially relevant to those who lead traditional lifestyles and whose well-being depends on agricultural and livestock production.*

*This Article addresses the challenges and potential solutions to climate change in the Arctic ecosystem, including the Sub-Arctic regions. Physical changes to the landscape are examined alongside impacts on Indigenous culture and identity. In addition, the Article explains the importance of Indigenous knowledge, values, and ethics in developing successful adaptation strategies. In the Russian Federation, however, not all Indigenous people are recognized as Indigenous. This Article advocates for changes to Russian law, along with a cultural shift to address climate change and its impacts.*

## I. GLOBAL CLIMATE CHANGE IN THE ARCTIC

The Arctic is a region with unique flora and fauna selectively shaped by extreme climatic and physical conditions such as permafrost, short growing seasons with low temperatures, extreme seasonality, and annual sea-ice cover. Over 21,000 species of animals, plants, and fungi have been recorded in the Arctic,<sup>1</sup> which are well adapted to the harsh conditions of the North. However, as many studies have predicted, the average global temperature will increase according to all scenarios,<sup>2</sup> and the temperature in the Arctic has already been increasing nearly four times faster than in the rest of the world since 1979.<sup>3</sup> The warming process in the Arctic has resulted in reducing Arctic Ocean ice coverage and thickness.<sup>4</sup> Thus, in July 2020, almost half of the intact ice shelf in the Canadian Arctic (at the fringe of Ellesmere Island) collapsed due to higher than normal air temperature, open water in front of the ice shelf, and offshore wind.<sup>5</sup> Diminishing sea ice in the Arctic Ocean also raises concerns about further warming because the ice reflects up to eighty percent of the sunlight, while open water absorbs sunlight energy.<sup>6</sup>

The average annual soil temperature with the subsequent intensification of *thermokarst* and coastal erosion has been increasing in the past years.<sup>7</sup> The rising permafrost temperature has led to the permafrost

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1. TOM BARRY ET AL., ARCTIC BIODIVERSITY ASSESSMENT: STATUS AND TRENDS IN ARCTIC BIODIVERSITY 68 (Hans Meltote et al. eds., 2013).

2. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2023 SYNTHESIS REPORT: SUMMARY FOR POLICYMAKERS 1-34 (Hoesung Lee et al. eds., 2023) [hereinafter IPCC 2023].

3. Mika Rantanen et al., *The Arctic has Warmed Nearly Four Times Faster than the Globe Since 1979*, 3 COMMC'NS EARTH & ENV'T 1, 2 (2022).

4. Rebecca Lindsey & Michon Scott, *Climate Change: Arctic Sea Ice Summer Minimum*, NAT'L OCEANIC ATMOSPHERIC ADMIN. (Oct. 18, 2022), <https://www.climate.gov/news-features/understanding-climate/climate-change-arctic-sea-ice-summer-minimum> [<https://perma.cc/ZM7M-KKUL>]; Grete K. Hovelsrud et al., *Arctic Societies, Cultures, and Peoples in a Changing Cryosphere*, 40 AMBIO 100, 102 (2011).

5. Moira Warburton, *Canada's Last Fully Intact Arctic Ice Shelf Collapses*, REUTERS (Aug. 6, 2020, 7:30 PM), <https://www.reuters.com/article/idUSKCN2523JG/> [<https://perma.cc/WP4M-CQU5>].

6. Mark Serreze, *Why is the Arctic So Sensitive to Climate Change and Why Do We Care?*, NAT'L OCEANIC ATMOSPHERIC ADMIN. (Aug. 28, 2008), [https://www.pmel.noaa.gov/arctic-zone/essay\\_serreze.html](https://www.pmel.noaa.gov/arctic-zone/essay_serreze.html) [<https://perma.cc/3UYJ-HGUE>].

7. Zhang Ting et al., *Warming-Driven Erosion and Sediment Transport in Cold Regions*, 3 NATURE REVS. EARTH & ENV'T 832, 833, 841 (2022); see also Kirillina Kyunney Svyatoslavovna, Pazrabortka Regional'noy Klimaticheskoy Programmy Dlya Respubliki Sakha (Yakutiya) (РАЗРАБОТКА РЕГИОНАЛЬНОЙ КЛИМАТИЧЕСКОЙ ПРОГРАММЫ

degradation like swelling and collapsing of the land surface, as seen in Figure 1.<sup>8</sup>



**Figure 1:** *Permafrost degradation.*<sup>9</sup>

One of the most striking examples of permafrost collapsing in Arctic region is the Kirgillyakh-Khatyngnansk ravine, which has an approximate depth of 70-100 meters.<sup>10</sup> The rate of destruction of the upper part of the permafrost zone can reach up to fifteen meters per year.<sup>11</sup> The formation of this ravine began in the 1960s from tin mining activities.<sup>12</sup> The ravine formation significantly accelerated from the beginning of 1990, coinciding

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для РЕСПУБЛИКИ САХА (ЯКУТИЯ)) [Development of a Regional Climate Program for the Republic of Sakha (Yakutia) (2017) (dissertation, Russian State Hydrometeorological University)]; Neil MacFarquhar, *Russian Land of Permafrost and Mammoths Is Thawing*, N.Y. TIMES (Aug. 4, 2019), <https://www.nytimes.com/2019/08/04/world/europe/russia-siberia-yakutia-permafrost-global-warming.html> [<https://perma.cc/3WQU-8BD8>].

8. Merritt R. Turetsky et al., *Permafrost Collapse is Accelerating Carbon Release*, 569 NATURE 32, 33 (2019); Vera Solovyeva, *Climate Change in Oymyakon: Perceptions, Responses, and How Local Knowledge May Inform Policy* (2021) (Ph.D. dissertation, George Mason University) (on file with author).

9. Vera Solovyeva, Photograph of Permafrost Degradation.

10. See Kseniia Ashastina et al., *Palaeoclimate Characteristics in Interior Siberia of MIS 6-2: First Insights from the Batagay Permafrost Mega-Thaw Slump in the Yana Highlands*, 13 CLIMATE OF THE PAST 795, 797 (2017).

11. Viktor V. Kunitsky (В.В. Куницкий) et al., *L'DISTYE PORODY I TERMODENUDACIJA V RAJONE POSELKA BATAGAJ (JaNSKOE PLOSKOGOR'E, VOSTOČNAJA SIBIR')* (ЛЪДИСТЫЕ ПОРОДЫ И ТЕРМОДЕНУДАЦИЯ В РАЙОНЕ ПОСЕЛКА БАТАГАЙ (ЯНСКОЕ ПЛОСКОГОРЬЕ, ВОСТОЧНАЯ СИБИРЬ)) [*Ice-rich Permafrost and Thermal Denudation in the Batagay Area (Yana Upland, East Siberia)*], KRIOSFERA ZEMLI (1 КРИОСФЕРА ЗЕМЛИ) [EARTH CRYOSPHERE] 56, 62 (2013).

12. *Id.*

with the time of a steady increase in winter and summer temperatures in Verkhoyansk territory.<sup>13</sup>

Consequences of the permafrost deterioration range from releasing of greenhouse gases (carbon dioxide and methane);<sup>14</sup> formation of new *taliks* (a layer of unfrozen ground in permafrost areas), and the deepening of existing ones;<sup>15</sup> the release of contaminants such as industrial contaminations stored in the Arctic permafrost,<sup>16</sup> and infection;<sup>17</sup> erosion activities, including on river and ocean banks;<sup>18</sup> appearing or disappearing of lakes<sup>19</sup> and late freezing of Arctic lakes;<sup>20</sup> bogging;<sup>21</sup> and damage to infrastructures and buildings.<sup>22</sup> Figure 2 below highlights an example of bank erosion in Republic of Sakha (Yakutia), as a consequence of permafrost deterioration.

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13. *Id.*

14. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SUMMARY FOR POLICYMAKERS: SPECIAL REPORT ON CLIMATE CHANGE AND LAND 14 (Priyadarshi R. Shukla, et al., eds., 2019) [hereinafter IPCC 2019]; Carolina Olid et al., *Groundwater Discharge as a Driver of Methane Emissions from Arctic Lakes*, NATURE COMM'NS, June 27, 2022, at 1, 5.

15. Katey Walter Anthony et al., *21st-Century Modeled Permafrost Carbon Emissions Accelerated by Abrupt Thaw Beneath Lakes*, NATURE COMM'NS, Aug. 15, 2018, at 1, 2; Wojciech Dobiński & Marek Kasprzak, *Permafrost Base Degradation: Characteristics and Unknown Threat with Specific Example from Hornsund, Svalbard*, FRONTIERS IN EARTH SCI., Feb. 16, 2022, at 1, 2.

16. Moritz Langer et al., *Thawing Permafrost Poses Environmental Threat to Thousands of Sites with Legacy Industrial Contamination*, NATURE COMM'NS, Mar. 28, 2023, at 1, 1.

17. *Permafrost Thaw Could Release Bacteria and Viruses*, EUR. SPACE AGENCY (Oct. 22, 2021), [https://www.esa.int/Applications/Observing\\_the\\_Earth/Permafrost\\_thaw\\_could\\_release\\_bacteria\\_and\\_viruses](https://www.esa.int/Applications/Observing_the_Earth/Permafrost_thaw_could_release_bacteria_and_viruses) [<https://perma.cc/B7JH-YYSU>].

18. See, e.g., Dimitrios Kostopoulos et al., *Coastal Erosion Due to Decreased Ice Coverage, Associated Increased Wave Action, and Permafrost Melting*, in ARCTIC STUDIES – A PROXY FOR CLIMATE CHANGE 1, 1 (Masaki Kanao et al. eds., 2018).

19. Mark Rowe, *The Big Thaw: Melting Permafrost is Causing a Global Problem*, GEOGRAPHICAL (Mar. 8, 2013), <https://geographical.co.uk/climate-change/the-big-thaw-melting-permafrost-is-causing-a-global-problem> [<https://perma.cc/8YYK-Y9Z9>].

20. J. E. Walsh et al., *Precipitation*, in NAT'L OCEANIC AND ATMOSPHERIC ADMIN., ARCTIC REPORT CARD 2022 23-31 (Matthew L. Druckenmiller et al. eds., 2022).

21. Ned Rozell, *Bogs, Permafrost and the Global Carbon Equation*, GEOPHYSICAL INST. (Mar. 27, 2003), <https://www.gi.alaska.edu/alaska-science-forum/bogs-permafrost-and-global-carbon-equation> [<https://perma.cc/GZ4E-PCSH>].

22. See Jan Hjort et al., *Impacts of Permafrost Degradation on Infrastructure*, 3 NATURE REV. EARTH & ENV'T 24, 24-28 (2022).



**Figure 2: Bank erosion.**<sup>23</sup>

The rising temperatures, deeper permafrost thawing, and changes in precipitation have already had significant impacts on the fragile Northern environment. For example, one of the consequences of climate change in the Arctic zone is the retreating tundra border.<sup>24</sup> There are also more wildfires across the Arctic—millions of hectares burned across Siberia, Alaska, Greenland, and Canada, setting one of the largest records of millions of hectares burned.<sup>25</sup> In Yakutia, the duration of spring and fall increased, and weather became unstable and unpredictable: heat waves have been suddenly replaced by cold weather and vice versa.<sup>26</sup> Floods are

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23. Semen Sivtsev, Photograph of Bank Erosion in the Republic of Sakha (Yakutia), Russia.

24. Julia Hager, *Taiga Could Displace Siberian Tundra Almost Completely*, POLAR J. (May 5, 2022), <https://polarjournal.ch/en/2022/05/25/taiga-could-displace-siberian-tundra-almost-completely/> [<https://perma.cc/YBG3-YWQP>]; Walsh et al., *supra* note 20.

25. Kate Wheeling, *The Rise of Zombie Fires*, EOS, (June 30, 2020), <https://eos.org/articles/the-rise-of-zombie-fires> [<https://perma.cc/U7Y3-P9ZT>]; Jessica L. McCarty et al., *Arctic Fires Re-Emerging*, 13 NATURE GEOSCIENCE 658, 659 (2020); Lilia Vinokurova et al., *When Ice Turns to Water: Forest Fires and Indigenous Settlements in the Republic of Sakha (Yakutia)*, SUSTAINABILITY, Apr. 15, 2022, at 1, 5.

26. O.A. Anisimov et al., *Obshchestvennoye Vospriyatiye Izmeneniya Klimata v Kholodnykh Regionakh Rossii: primer Yakutii* (Общественное восприятие изменения климата в холодных регионах России: пример Якутии) [*Public Perception of Climate Change in the Cold Regions of Russia: An Example of Yakutia*], 57 ICE AND SNOW 565, 572 (2017); Solovyeva, *supra* note 8.

happening more often.<sup>27</sup> Thus, due to changes in climatic conditions, the Lena River and other Arctic rivers in the Sakha Republic have become more abundant.<sup>28</sup> For instance, over thirty-five years of observations from 1966 to 2017 on the river Berezovka, the level of water reached a critical level of 950 centimeters once, in 1985, but between 1990 and 2017 the water level exceeded a meter five distinct times.<sup>29</sup>

With increasing temperatures, more extreme events registered in the Arctic region. Thus, the icy crust that forms due to unusually warm days with wet snowfall or even rain with negative temperatures following, which prevents animals from reaching fodder beneath, is occurring more often.<sup>30</sup> In recent years, “dry thunderstorms,” weather events occurring when discharges of atmospheric electricity between clouds and the earth are not accompanied by rainfall, are more often observed over the Yakutia territory.<sup>31</sup> In combination with hot, dry weather and gusts of wind up to thirty meters per second, these dry thunderstorms are often responsible for forest fires.<sup>32</sup>

These changes in the environment and weather are affecting the availability of traditional sources of food and medicinal plants,<sup>33</sup> creating

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27. See Alexander Suleymanov, *Permafrost Degradation and Devastating Floods of the 20th – 21st Centuries for the Livelihoods of Yakut Arctic Villages*, 378 E3S WEB OF CONFS., Apr. 7, 2023, at 1, 4.

28. See Viktoriia Filippova, *Adaptation of the Indigenous Peoples to Climate Change Effects in Yakutia: Gender Aspects*, 26 POLAR SCI. Dec. 2020, at 1, 2.

29. See Viktoriia Filippova, *Èveni Berezovki v usloviyakh navodneniya: iz opita sednterizatsii* (Эвены Березовки в условиях наводнения: из опыта седентеризации, Серия: Гуманитарные науки) [The Evens of Berezovka in Flood Conditions: on the Experience of Sedentarization], 12 SERIES ON THE HUMANITIES, 84-88 (2017); Vera Solovyeva et al., *Fire and Water: Indigenous Ecological Knowledge and Climate Challenges in the Republic of Sakha (Yakutia)*, 59 ANTHROPOLOGY & ARCHEOLOGY OF EURASIA, 242, 244-45 (2020).

30. J. E. Walsh et al., *supra* note 20.

31. Lilia Vinokurova et al., *supra* note 25, at 9; Daiju Narita et al., *Impacts and Management of Forest Fires in the Republic of Sakha, Russia: A Local Perspective for a Global Problem*, 27 POLAR SCI. Mar. 2021, at 1, 3.

32. A. Salva et al., *Navodneniya, lesniye pozhari, a takzhe drugiye technogenniye opasnosti v Kobyayskom uluse Respubliki Sakha (Yakutia)*, Internet-zhurnal “Mir Nauki”, [Internet journal, EARTH SCIENCE] (2015) // Сальва А.М., Макаров В.В., Киприянова, Кириллина, А. (2015) Наводнения, лесные пожары, а также жругие техногенные опасности в Кобяйском улусе Республики Саха (Якутия) [Floods, forest fires, and similar man-made hazards in the ulus of Kobyaiska, Republic of Sakha (Yakutia)].

33. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 2, at 5.



a serious threat for Indigenous peoples that affects all sides of their life—economic, cultural, social, and health.<sup>34</sup>

## II. CLIMATE CHANGE IMPACTS ON INDIGENOUS PEOPLES

Environmental changes are putting a strain on society, especially for those who still maintain a traditional lifestyle and depend on agricultural and livestock production, even though those same people have contributed very little to climate change.<sup>35</sup> For many Arctic Indigenous people, hunting, fishing, reindeer herding, and gathering are not only the basis of their livelihood, but are also sources of their cultural and social identities.<sup>36</sup> Indigenous peoples can lose their cultural identity due to losing heritage sites from flooding or relocation and ways of life as a result of climate change.<sup>37</sup> Increasing vulnerability of Arctic Indigenous communities was projected,<sup>38</sup> as early as the nineteenth century, and climate change is

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34. IGOR KRUPNIK & DYANNA JOLLY, *THE EARTH IS FASTER NOW: INDIGENOUS OBSERVATIONS OF ARCTIC ENVIRONMENTAL CHANGE* 284 (2002); Solovyeva, *supra* note 8, at 25-35.

35. See TRAVIS J. LYBBERT & DANIEL A. SUMNER, *AGRICULTURAL TECHNOLOGIES FOR CLIMATE CHANGE MITIGATION AND ADAPTATION IN DEVELOPING COUNTRIES: POLICY OPTIONS FOR INNOVATION AND TECHNOLOGY DIFFUSION* 12 (2010); Gleb Rayogorodetsky, *Why Traditional Knowledge Holds the Key to Climate Change*, WORLD ASS'N FOR CHRISTIAN COMM'N GLOBAL (May 17, 2020), <https://waccglobal.org/why-traditional-knowledge-holds-the-key-to-climate-change/> [<https://perma.cc/D6LY-MSQF>]; INT'L LAB. OFF., *INDIGENOUS PEOPLES AND CLIMATE CHANGE: FROM VICTIMS TO CHANGE AGENTS THROUGH DECENT WORK* 9-10 (2017); INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY: SUMMARY FOR POLICYMAKERS* 1-32 (Christopher B. Field et al. eds., 2014); INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *GLOBAL WARMING OF 1.5° C SPECIAL REPORT: SUMMARY FOR POLICYMAKERS* (Valérie Masson-Delmotte et al. eds., 2018) [hereinafter IPCC 2018]; IPCC 2019, *supra* note 14, at 10; INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 2, at 5.

36. GERMAN ARCTIC OFF. & SAAMI COUNCIL, *Arctic Indigenous Peoples*, Sept. 2021, at 1, 4.

37. Dave Ranney, *Alaska Native Sees Culture, Heritage Endangered Through Climate Change*, LAWRENCE JOURNAL-WORLD (June 20, 2006, 12:00 AM), [https://www2.ljworld.com/news/2006/jun/20/alaska\\_native\\_sees\\_culture\\_heritage\\_endangered\\_thr/](https://www2.ljworld.com/news/2006/jun/20/alaska_native_sees_culture_heritage_endangered_thr/) [<https://perma.cc/4DWY-HTDG>]; Kathryn Norton-Smith et al., U.S. DEP'T AGRIC., *CLIMATE CHANGE AND INDIGENOUS PEOPLES: A SYNTHESIS OF CURRENT IMPACTS AND EXPERIENCES* 1-133 (2016).

38. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY* 133-71 (Martin Parry et al. eds., 2007).

already altering their physical, biological, and social systems.<sup>39</sup> Climate change first affects those who are already economically challenged—for example, Native people’s houses on Indian reservations in the United States are ten times more likely to be without electricity compared to the national average.<sup>40</sup> Many homes do not have adequate electricity.<sup>41</sup> Therefore, the houses do not provide effective protection from environmental changes and makes these communities more vulnerable.<sup>42</sup> In Kamchatka, the Russian Federation, inhabitants of settlements have experienced an increased quantity of storms, strengthening winds, sudden changes in temperature, and higher humidity. Participants reported seeing new species of sparrows that they had not noticed earlier in these regions.<sup>43</sup> The tundra is gradually starting to be covered by young wood and shrubs.<sup>44</sup> Évenki people reported extinction of some plant species and fish, as well as the appearance of new species of birds and insects that originally inhabited warmer regions.<sup>45</sup> They also have linked climate change to unexplained changes affecting domesticated reindeer. Some reindeer can suddenly die during very hot weather or unexpectedly develop illnesses when organs, including the brain, as well as blood and urine are invaded by parasites.<sup>46</sup> Sakha and Évenki people in Oymyakon (Sakha Republic)

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39. Clarence Alexander et al., *Linking Indigenous and Scientific Knowledge of Climate Change*, 61 *BIOSCIENCE* 477, 477-84 (2011); Jouni J. K. Jaakkola et al., *The Holistic Effects of Climate Change on the Culture, Well-Being, and Health of the Saami, the Only Indigenous People in the European Union*, 5 *CURRENT ENV’T HEALTH REPS.* 401, 401-17, (2018).

40. *The Future of Tribal Energy Development: Implementation of the Inflation Reduction Act and the Bipartisan Infrastructure Law Before the S. Comm. on Indian Affrs.*, 118th Cong. 2 (2023) (statement of Bryan Newland, Assistant Sec’y for Indian Affrs., U.S. Dep’t of the Interior).

41. Joseph Lee, *Living in the Dark: Native Reservations Struggle with Power Shortages in Pandemic*, *THE GUARDIAN* (Aug. 12, 2020, 6:00 AM), <https://www.theguardian.com/environment/2020/aug/12/native-americans-energy-inequality-electricity> [https://perma.cc/RU2N-6QAG].

42. NAT’L ASSESSMENT SYNTHESIS TEAM, *CLIMATE CHANGE IMPACTS IN THE UNITED STATES: POTENTIAL CONSEQUENCES OF CLIMATE CHANGE AND VARIABILITY AND CHANGE* 351-77 (2001).

43. Drew Gerkey & Victoria. N. Sharakhmatova, *Local Observations of Climate Change by Kamchatka Indigenous Peoples*, in *ROUTLEDGE HANDBOOK OF CLIMATE CHANGE IMPACTS ON INDIGENOUS PEOPLES AND LOCAL COMMUNITIES* 45-60 (Victoria Reyes-Garcia et al. eds., 2024).

44. Isla H. Myers-Smith et al., *Shrub Expansion in Tundra Ecosystems: Dynamics, Impacts and Research Priorities*, *ENV’T RSCH. LETTERS*, Dec. 20, 2011, at 1, 2.

45. Alexandra Lavrillier, *An Emic Science of Climate: Reindeer Evenki, Environmental Knowledge and the Notion of an “Extreme Process,”* 49 *ÉTUDES MONGOLES ET SIBÉRIENNES, CENTASIATIQUES ET TIBÉTAINES*, 1, 18 (2018).

46. *Id.*

shared that weather has become unpredictable, summers are colder, winters are milder, and that the land constantly changes now.<sup>47</sup>

Overall, climate change impacts can be grouped in the following categories: medical, socio-economic, and socio-cultural.

#### A. Medical Impacts

*Direct impact.* Climate change can directly impact peoples' health—in summer, heatwaves can happen more often and can trigger heat-related illnesses such as heat stroke, and respiratory and cardiovascular problems.<sup>48</sup> Heatwaves also “exacerbate all sorts of chronic disease issues.”<sup>49</sup> In winter, sudden changes in temperature can lead to different health problems, including sudden changes in blood pressure, and increased injuries from falls and freezes as reported by Indigenous people.<sup>50</sup>

*Indirect impact.* Climate change also is expected to impact people indirectly by bringing new bacteria, insects, and other organisms to the region, as well as vector-borne disease outbreaks.<sup>51</sup> As mentioned earlier, there previously were no reported tick bites in Yakutsk, but now the number of tick bites is increasing every year.<sup>52</sup> There is also a possibility

47. Solovyeva, *supra* note 8, at 240-60.

48. E. Akentyeva, et al., *Doklad o klimaticheskikh riskah na territorii Rossiyskoy Federatsii, Federalnaya sluzhba po gydrometeorologii i monitoring okruzhayushey sredi* (Roshidromet) (Федеральная служба по гидрометеорологии и мониторингу окружающей среды (Росгидромет)) [Report on the Climate Risks to the Territory of the Russian Federation, Federal Service for Hydrometeorology and Environmental Monitoring (Rosgidromet)] (2017); *Climate Effects on Health*, CTRS. FOR DISEASE CONTROL AND PREVENTION, <https://www.cdc.gov/climateandhealth/effects/default.htm> (last visited Mar. 19, 2024) [<https://perma.cc/5PSB-U8F4>].

49. Nate Seltenrich, *Between Extremes: Health Effects of Heat and Cold*, 123 ENV'L HEALTH PERSPECTIVES, A275, A275-79 (2015) (quoting Jeremy Hess, emergency medicine physician and associate professor, Univ. of Washington).

50. Solovyeva, *supra* note 8, at 240-60.

51. See generally Paul Epstein, *Profound Consequences: Climate Disruption, Contagious Disease and Public Health*, □VI NATIVE AMS. 64 (1999); Jim Berner et al., *HUMAN HEALTH, in ARCTIC CLIMATE IMPACT ASSESSMENT* 863-906 (Carol Symon et al. eds. 2005); O. A. Anisimov et al., *supra* note 26, at 566; CTRS. FOR DISEASE CONTROL AND PREVENTION, *supra* note 48.

52. Leonid N. Vladimirov et al., *Quantifying the Northward Spread of Ticks (Ixodida) as Climate Warms in Northern Russia*, 12 ATMOSPHERE 233, 233 (2021); Boyakova et al., Якутия в условиях глобальных климатических изменений: уязвимость, риски, социальная адаптация [*Yakutia in the Context of Global Climate Change: Vulnerability, Risks, Social Adaptation*], INST. HUMANITIES RSCH. & INDIGENOUS STUD. N., 22-26 (2010);

of emerging or re-emerging climate-sensitive infectious diseases in the Arctic that could arise from the damage of sanitation infrastructure due to permafrost thawing and water contamination from repetitive flooding, causing vector-borne infectious diseases.<sup>53</sup> Further, climate change has been associated with outbreaks of infectious and parasitic diseases that are carried by mouse rodents, and their areal distribution is likely to expand.<sup>54</sup> Frequent forest fires due to global warming decrease air quality locally and downwind caused by the release of combustion products into the atmosphere.<sup>55</sup>

### B. Socio-economic Impacts

*Damage of infrastructures and buildings.* One of the most worrying problems in the Sakha Republic is the decrease of permafrost bearing capacity due to the deepening of seasonal thawing, as mentioned. This consequence of climate change can damage the foundations of buildings, including polar and high-altitude infrastructure and more.<sup>56</sup> For example, the world's largest city built on permafrost is Yakutsk, the capital of the Republic of Sakha.<sup>57</sup> Many buildings in the city of Yakutsk were built during the Soviet era.<sup>58</sup> These buildings are made of concrete panels and stand on support beams to have an insulation air gap and prevent permafrost beneath the building from heating.<sup>59</sup> During the Soviet era

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ИНТЕРВЬЮ | Как изменение климата сказывается на жизни в Сибири [*How Climate Change Affects Life in Serbia*], U.N. NEWS (June 11, 2023), <https://news.un.org/ru/interview/2023/06/1441837> [<https://perma.cc/5UVW-H8QD>].

53. Boyakova, *supra* note 52; Caminade et al., *Impact of Recent and Future Climate Change on Vector-Borne Diseases*, 1436 ANNALS N.Y. ACAD. SCI. 157, 158 (2019).

54. Svyatoslavovna, *supra* note 7.

55. CTRS. FOR DISEASE CONTROL AND PREVENTION, *supra* note 48.

56. Svyatoslavovna, *supra* note 7; Schneider von Deimling et al., *Consequences of Permafrost Degradation for Arctic Infrastructure – Bridging the Model Gap Between Regional and Engineering Scales*, 15 CRYOSPHERE 2451, 2452 (2021); Hjort et al., *supra* note 22, at 24.

57. *Yakutsk: City Context and History*, URB. RESILIENCE HUB, <https://urbanresiliencehub.org/city-context/yakutsk/> (last visited Mar. 10, 2024) [<https://perma.cc/PZ4Y-WVK3>].

58. See Nikolay I. Shiklomanov & Dmitriy A. Streletskiy, *Effect of Climate Change on Siberian Infrastructure*, in REGIONAL ENVIRONMENTAL CHANGES IN SIBERIA AND THEIR GLOBAL CONSEQUENCES 155 (Pavel Ya. Groisman & Garik Gutman ed., 2013); Maria Antonova, *Siberian Region Fights to Preserve Permafrost as Planet Warms*, YAHOO! NEWS (Dec. 6, 2018), <https://sg.news.yahoo.com/siberian-region-fights-preserve-permafrost-planet-warms-041714963.html?guccounter=1> [<https://perma.cc/6GWR-2TBD>].

59. Antonova, *supra* note 58.

construction, when climate change was not in mind, support piles were driven to a depth of twenty feet (about six meters);<sup>60</sup> these support piles are no longer sufficient in the wake of climate change.<sup>61</sup> Shiklomanov and his colleagues have estimated the impact of climate change on the stability of Russian urban infrastructure, noting particularly changes in bearing capacity and the ability of the frozen ground to support buildings.<sup>62</sup> They suggest that critical climate-induced decreases in bearing capacity in the area of Yakutsk city can be expected around the 2040s.<sup>63</sup> According to Svyatoslavovna, these problems have already started.<sup>64</sup> She noted that more than 300 buildings in the city of Yakutsk already have serious damage due to the subsidence of frozen soils.<sup>65</sup> Emergencies have already arisen due to destruction of building foundations caused by permafrost melting.<sup>66</sup> This has led to demolishing several buildings after residents' resettlement.<sup>67</sup> A recent example of such destruction happened in June 2020, in the city of Yakutsk; a huge crack formed on the wall of a residential building from 1983, posing a threat of the building's collapse (Figure 3).<sup>68</sup> Structural destructions are happening across the Arctic

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60. *Id.*

61. *Id.*

62. Nikolay I. Shiklomanov et al., *Climate Change and Stability of Urban Infrastructure in Russian Permafrost Regions: Prognostic Assessment Based on GCM Climate Projections*, 107 GEOGRAPHICAL R. 125, 126 (2016).

63. *Id.* at 136.

64. Svyatoslavovna, *supra* note 7.

65. *Id.*

66. Anisimov et al., *supra* note 26, at 565-74.

67. *Id.*

68. Melody Schreiber, *Melting Permafrost and the Housing Crisis in the Arctic*, BLOOMBERG (May 10, 2018, 1:41 PM), <https://www.bloomberg.com/news/articles/2018-05-10/melting-permafrost-and-the-housing-crisis-in-the-arctic> [https://perma.cc/P5ZD-F□HT].

region. For example, in Cherskiy city by the Arctic Ocean, the multitenant house “smiled” due to the collapse of the permafrost under it.<sup>69</sup>



**Figure 3:** *A crack on the wall of the residential building in Yakutsk.*<sup>70</sup>

69. *Skorotečnaya merzlota: kak Yakutija vozvrašaetsja v èpohu plejstocena* (Скоротечная мерзлота: как Якутия возвращается в эпоху плейстоцена) [Permanent Permafrost: How Yakutia is Returning to the Pleistocene Era], IZVESTIA (Nov. 8, 2021, 12:02 AM), <https://iz.ru/1246181/gallery/vechnaia-merzlota#> [https://perma.cc/M6ZS-6GYP].

70. *NTD: tajanie večnoj merzloty v Jakutske grozit obrnut'sja katastrofoj* (NTD: таяние вечной мерзлоты в Якутске грозит обернуться катастрофой) [NTD: Melting Permafrost in Yakutsk Threatens to Turn into a Disaster], RTTV (June 9, 2021), <https://russian.rt.com/inotv/2021-06-09/NTD-tayanie-vechnoj-merzloti-v> [https://perma.cc/ZFM3-AZB3].



**Figure 4:** A “smiled” house in the city of Cherskiy.<sup>71</sup>

Another problem in these examples is that building support piles are sagging and cracking; some require emergency repairing.<sup>72</sup> Generally, scientists have argued that climate-induced reduction in bearing capacity of standard foundations in Yakutsk is in progress. See Figures 5 and 6.

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71. *Skorotečnaja merzlota: kak Jakutija vozvrašaetsja v èpohu plejstocena* (Скоротечная мерзлота: как Якутия возвращается в эпоху плейстоцена) [*Permanent Permafrost: How Yakutia is Returning to the Pleistocene Era*], *supra* note 69.

72. AFP, *Siberian City Fights Melting Permafrost*, RADIOFREEEUROPE (Dec. 17, 2018, 4:51 PM), <https://www.rferl.org/a/russia-yakutsk-warming/29661282.html> [<https://perma.cc/VF75-LCGS>].



**Figure 5:** *Repaired damaged piles supporting a residential building in Yakutsk.*<sup>73</sup>

There is a need for new construction standards, norms, and risk assessment that consider climate change impacts.<sup>74</sup>

In rural areas, buildings also can be destroyed, as has happened in the village of Yuchugey, Oymyakon ulus; the waterlogged soil froze and swelled right under the house, loosening its walls and breaking its joints.<sup>75</sup> People were forced to abandon the house.<sup>76</sup>

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73. Деградация вечной мерзлоты идет быстрыми темпами в Якутии [*Permafrost Degradation is Proceeding at a Rapid Pace in Yakutia*], PRIMAMEDIA (March 29, 2017, 10:25 AM), <https://primamedia.ru/news/578763/> [<https://perma.cc/JBR9-EE92>].

74. *Id.*; Hjort, *supra* note 22, at 24-38.

75. Solovyeva, *supra* note 8, at 28.

76. *Id.*





**Figure 6:** *Destroyed and abandon house in the village of Yuchugey, Oymyakon ulus, the Republic of Sakha.*<sup>77</sup>

As indicated, melting permafrost can also form cavities—tunnels and air pockets when permafrost’s ice melts and water drains.<sup>78</sup> These cavities can form in any place—under the school or under the asphalt of busy roads or other permafrost zones’ infrastructure.<sup>79</sup> Among infrastructures located on permafrost are the Kola and Bilibino Nuclear Power Plants, eighty percent of the Amur railroad, and an extensive network of fuel and energy pipelines.<sup>80</sup> Damage to industrial infrastructure could lead to devastating environmental pollution.<sup>81</sup> Due to permafrost degradation Yakutia was forced to adopt “the law about permafrost protection and rational use” in 2018.<sup>82</sup> According to this law, any anthropogenic impact on permafrost

77. *Id.* at 29.

78. Craig Welch, *Arctic Permafrost is Thawing Fast. That Affects Us All*, NAT’L GEOGRAPHIC (Sept. 2019), <https://www.nationalgeographic.com/environment/article/arctic-permafrost-is-thawing-it-could-speed-up-climate-change-feature> [<https://perma.cc/SEK7-CUF3>].

79. В Якутске под школой провалился асфальт [*In Yakutsk, Asphalt Collapsed Under a School*], SAKHADAY (May 11, 2017, 8:45 PM), <http://sakhaday.ru/news/pod-shkoloy-v-yakutске-provalilsya-asfalt/> [<https://perma.cc/23NP-4F□2>].

80. *Global’noe poteplenie grozit Rossii masštabnymi bedstvijami* (Глобальное потепление грозит России масштабными бедствиями) [*Global Warming Threatens Russia with Large-Scale Disasters*], RIA NEWS (May 14, 2014, 6:00 PM), <https://ria.ru/20140514/1007771088.html> [<https://perma.cc/5CR3-R6RE>].

81. See generally Hjort et al., *supra* note 22.

82. T. Vasilyeva, *V Jakutii prinjat regional’nyj zakon ob ohrane večnoj merzloty, oficial’nyj sajt Gosudarstvennogo Sobraniya (Il Tumèn) Respubliki Saha (Jakutija)* (В

landscapes must occur under the control of both public organizations and government agencies.<sup>83</sup>

In the north-eastern part of the Sakha Republic, the risk of flooding has increased in almost all lowland areas of rivers, especially in the Indighir area.<sup>84</sup> Rural residents of the Sakha Republic who live near lakes and rivers have noted that increased water levels have become common due to rain and permafrost melting, leading to collapse of the shores, the onset of swamps, and water on residential and farm building areas.<sup>85</sup> More frequent and large floods cause damage to roads.<sup>86</sup> For example, in Srednekolymsk, in 2018, the local airdrome was closed because its airstrip flooded;<sup>87</sup> a bridge to Sordognookh was damaged several years in a row (field research observation); and, in 2019, three large ravines formed on the roads in the Oymyakon ulus, because of large spills of water, leaving Oymyakon in transport isolation until the road workers repaired the roads, highlighted in Figures 7 and 8.<sup>88</sup>

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*Якутии принят региональный закон об охране вечной мерзлоты, официальный сайт Государственного Собрания (Ил Тумэн) Республики Саха (Якутия)* [A Regional Law on the Protection of Permafrost has been Adopted in Yakutia], IL TUMEN (2018), <http://old.iltumen.ru/content/v-yakutii-prinyat-regionalnyi-zakon-ob-okhrane-vechnoi-merzloty> [https://perma.cc/WUG9-TM□4].

83. *Id.*

84. *Republic of Sakha (Yakutia), Russian Federation: Flood Relief and Rehabilitation Situation Report No. 2*, RELIEFWEB (July 28, 1998), <https://reliefweb.int/report/russian-federation/republic-sakha-yakutia-russian-federation-flood-relief-and-rehabilitation-1> [https://perma.cc/ZE7A-FKP□].

85. S. I. Boyakova et al., *Social'nye posledstviya i adaptacija naselenija Respubliki Saha (Jakutija) k črezvyčajnym situacijam prirodnogo haraktera (po materialam sociologičeskikh issledovanij 2009-2010 gg.)* (Социальные последствия и адаптация населения Республики Саха (Якутия) к чрезвычайным ситуациям природного характера (по материалам социологических исследований 2009-2010 гг.)) [The Social Consequences and Adaptation of the Republic of Sakha (Yakutia) to Natural Emergencies (based on material from 2009-2010 sociological studies)], 2 NE. HUMANITARIAN BULL. 37, 37-40 (2011); See Vinokurova et al., *supra* note 25, at 3.

86. MacFarquhar, *supra* note 7.

87. *Id.*

88. *Oymyakonskiy rayon okazalsya v transportnoj izolyacii iz-za prirodnoy stuxuu* (Оймяконский район оказался в транспортной изоляции из-за природной стухуу) [Oymyakonsky District Found Itself in Transport Isolation Because of Natural Disasters], YAKUTIA.INFO (July 23, 2019), <http://yakutia.info/article/189835> [hereinafter Oymyakonsky District] [https://perma.cc/QS4Q-JDY9].



**Figure 7:** *A road in Oymyakon damaged by flood in 2014.*<sup>89</sup>



**Figure 8:** *A road damaged in Oymyakon due to flood in 2019.*<sup>90</sup>

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89. Spiridon Sleptsov, *SOS: Kubyuma-Tomtor Highway*, LIVEJOURNAL (Aug. 5, 2014), <https://sachaja.livejournal.com/587921.html> [<https://perma.cc/AJS3-PP6N>].

90. Oymyakonsky District, *supra* note 88.

About 14.9% of all settlements in Yakutia have had to relocate due to constant threats of flooding.<sup>91</sup> However, the relocation process is very expensive, long, and complicated, and has yet to be completed.<sup>92</sup> In addition to the direct damage caused by floods, there is indirect damage that is rarely determined and assessed. “These indirect damages constitute financial losses due to an increased amount of firewood needed to warm houses after the flood, loss of hay and stored food supplies, a decline in production, and much more.”<sup>93</sup>

There have been more forest and tundra wildfires in Arctic and Subarctic zones in recent years.<sup>94</sup> In 2019, wildfire covered a vast area across the Arctic zone, including Alaska, Siberia, Greenland, and Canada, as a record-setting event.<sup>95</sup> In the Russian Arctic in 2020, a devastating fire happened in an area where large wildfires previously had not occurred.<sup>96</sup>

*Pollution.* Frequent forest fires decrease air quality locally and downwind due to the release of combustion products into the atmosphere. On July 13, 2021, toxic smoke from forest fires caused one of the world’s worst ever air pollution events, occurring in the city of Yakutsk, and local administration recommended citizens to stay indoors.<sup>97</sup>

Thawing permafrost threatens more than buildings and roads. It also destabilizes water, sewage, fuel reservoirs, and oil pipes.<sup>98</sup> An example is a recent fuel leak of 17,000 tons of diesel that contaminated rivers near the Arctic city of Norilsk in Russia.<sup>99</sup> It was reported as directly tied to climate change—depressurization of the fuel reservoir occurred due to subsidence of the foundation piles because of thawing permafrost.<sup>100</sup> *When pollution*

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91. Boyakova et al., *supra* note 85, at 37-40.

92. See Filippova, *supra* note 28, at 5, 7.

93. Solovyeva, *supra* note 8, at 98.

94. *Arctic Connected | Wildfires are Devastating the Arctic*, WWF GLOBAL ARCTIC PROGRAMME: NEWSROOM (July 24, 2023), <https://www.arcticwwf.org/newsroom/features/arctic-connected-wildfires-are-devastating-the-arctic/> [<https://perma.cc/6WBL-6CYU>].

95. Wheeling, *supra* note 25.

96. McCarty et al., *supra* note 25, at 659.

97. Lilia Vinokurova et al., *supra* note 25, at 5.

98. Nikk Ogasa, *Thawing Permafrost May Unleash Industrial Pollution Across the Arctic*, SCI.NEWS (Apr. 26, 2023), <https://www.sciencenews.org/article/permafrost-thawing-pollution-arctic-climate-change> [<https://perma.cc/PYS8-2YRK>].

99. Langer et al., *supra* note 16, at 1.

100. Yuliya Fedorinova, *Huge Spill Stains Arctic and Climate Change Could Be the Cause*, BLOOMBERG (June 4, 2020, 3:29 AM), <https://www.bloomberg.com/news/articles/2020-06-04/russia-declares-state-of-emergency-over-arctic-city-fuel-spill> [<https://perma.cc/TMH2-852>]; Andrey Gurkov, *Kommentariy: Izmeneniye klimata privelo k ChS v Norilске* (Комментарий: Изменения климата привело к ЧС в Норильске)

*happens, pollutants can spread more widely and faster through the ground than through the solid permafrost.*<sup>101</sup> When the ice in the permafrost melts, the ground sinks and releases buried hazardous chemicals and biological contaminants, including a variety of viruses and bacteria trapped in the ice for a very long time.<sup>102</sup> For example, in the Yamal-Nenets region in 2016, anthrax bacteria (*Bacillus anthracis*) released from the permafrost in an unusually hot summer that caused 2,650 reindeer and thirty-six people to be infected and led to the death of 2,350 reindeer and one reindeer herder.<sup>103</sup> While some sources indicate that there are about 8,000 anthrax cattle burial grounds in Russia and a significant number of unregistered anthrax burials,<sup>104</sup> other sources estimate about 13,885 cattle burial grounds, many of them located in the Sakha Republic.<sup>105</sup> Anthrax and other types of bacteria can survive frozen for more than a century because they form spores.<sup>106</sup> For example, tetanus and botulism pathogens and other viruses can survive for thousands of years.<sup>107</sup> Thus, the probability is high that vectors of deadly infections of the eighteenth and nineteenth centuries may come back.<sup>108</sup> The risk of infection in the Arctic is greater during dry, hot years due to climate change when the upper layer of permafrost is dry

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[*Comment: Climate Change Led to an Emergency in Norilsk*], TIME.NEWS (May 25, 2021), <https://www.dw.com/ru/izmenenie-klimata-privelo-k-chs-v-norilске/a-53680508> [<https://perma.cc/L88A-SMJV>].

101. See Valery I. Grebenets et al., *The Problem of Storage of Solid Waste in Permafrost*, 16 ENV'T RSCH. LETTERS, Apr. 28, 2021, at 1, 1-8, 11, 14.

102. Wasim Sajjad et al., *Resurrection of Inactive Microbes and Resistome Present in the Natural Frozen World: Reality or Myth?*, 735 SCI. OF THE TOTAL ENV'T, May 13, 2020, at 1, 1-4.

103. Aleksandr Nikolaevich Kulichenko et al., *Vspyška sibirskoj jazvy v Jamalo-Neneckom avtonomnom okruge v 2016 godu, èpidemiologičeskie osobennosti* (Вспышка сибирской язвы в Ямало-Ненецком автономном округе в 2016 году, эпидемиологические особенности) [*Outbreak of Anthrax in the Yamalo-Nenets Autonomous District in 2016, Epidemiological Peculiarities*], 4 Probl. Osobo Opasnyh Inf (Пробл. особо опасных инф) [PROBS. OF PARTICULARLY DANGEROUS INFECTIONS] 42, 42 (2016).

104. *Id.*

105. Boris A. Revich & Marina A. Podolnaya, *Thawing of Permafrost May Disturb Historic Cattle Burial Grounds in East Siberia*, GLOB. HEALTH ACTION, Nov. 21, 2011, at 1, 2.

106. John Vidal, *Fevered Planet: How a Shifting Climate is Catalysing Infectious Disease*, BBC (Dec. 2, 2023), <https://www.bbc.com/future/article/20231201-fevered-planet-how-climate-change-spreads-infectious-disease> [<https://perma.cc/D8M2-DA2Z>].

107. *Id.*; Boyakova et al., *supra* note 85, at 37-40.

108. See Boris Revich et al., *Climate Change and Zoonotic Infections in the Russian Arctic*, 71 INT. J. CIRCUMPOLAR HEALTH, July 23, 2012, at 1, 1, 6; Revich & Podolnaya, *supra* note 105, at 2.

and weather is abnormal.<sup>109</sup> Mining, construction, and agricultural activities around people and cattle burials may spread the infection to people and animals.<sup>110</sup> Unfortunately, harmful bacteria can likely survive for long periods not only in permafrost but also in oceans. Researchers have connected the re-emergence of the water-born pathogen *Vibrio cholera* in Southeast Asia, Central America, South America, and West Africa to the warming oceans due to climate change.<sup>111</sup>

*Food security.* Reindeer husbandry is directly affected by cryosphere changes, increased snowfall, and winter temperatures.<sup>112</sup> Light snow offers ready forage for horses, elks, reindeer, and other herbivores. With increased precipitation in winter, it is more difficult for animals to get to the grass under the snowpack.<sup>113</sup> With deeper snow, reindeer spend more energy digging through the snow to reach lichen.<sup>114</sup> Also, because of more frequent thawing and freezing during winter, an ice layer forms on the ground that has altered reindeer, horses, and other animals' ability to access lichens under the ice crust.<sup>115</sup> Difficulty in accessing food results in higher mortality rates of animals.<sup>116</sup> The does and calves are especially vulnerable.<sup>117</sup> For instance, in Yamal-Nenets autonomous okrug (Russian Federation), thousands of reindeer died due to hunger: during the winters

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109. Alan J. Parkinson & Birgitta Evengård, *Climate Change, its Impact on Human Health in the Arctic and the Public Health Response to Threats of Emerging Infectious Diseases*, 2 GLOB. HEALTH ACTION, Nov. 11, 2009, at 1, 2.

110. Revich & Podolnaya, *supra* note 105, at 1.

111. Xavier Rodo et al., *ENSO and Cholera: a Nonstationary Link Related to Climate Change?*, 99 PROC. OF THE NAT'L ACAD. OF SCI. 12901, 12905 (2002); Guillaume Constantin de Magny et al., *Regional-scale Climate-Variability Synchrony of Cholera Epidemics in West Africa*, 7 BMC INFECTIOUS DISEASE, Mar. 19, 2007, at 1, 1; Robin Kundis Craig, *Warming Oceans, Coastal Diseases, and Climate Change Public Health Adaptation*, 10 SEA GRANT L. & POL. J. 3, 8 (2020).

112. Gunhild C. Rosqvist et al., *Impacts of Climate Warming on Reindeer Herding Require New Land-use Strategies*, 51 AMBIO 1247, 1258 (2022).

113. *Id.*

114. WWF-NORWAY, WWF INTERNATIONAL ARCTIC PROGRAMME, FACTSHEET: EFFECTS OF CLIMATE CHANGE ON REINDEER 2 (2008).

115. *Id.*

116. *Id.*

117. *Id.*

of 2013 to 2014, 70,000 reindeer died; in 2016, 2,500 died; and in 2018, 1,500 died;<sup>118</sup> and hundreds of reindeer died in Kamchatka in 2021.<sup>119</sup>



**Figure 9:** Up to 80,000 reindeer died in the Yamalo-Nenets region due to a weather anomaly in 2021: freezing rains occurred in November, and then record cold with strong winds hit, forming a thick crust of ice through which reindeer were unable to break through to graze and died of starvation.<sup>120</sup>

118. Elena Matsiong, *V yamalskoy tundra bolee tisyachi oleney pogibli ot goloda* (*B yamalskoy tundra bolee tisyachi oleney pogibli ot goloda*) [*In the Yamal Tundra, More than a Thousand Deer Have Died of Starvation*], RGRU (Apr. 4, 2018), <https://rg.ru/2018/04/04/reg-urfo/bolee-tysiachi-olenej-pogibli-ot-goloda.html> [<https://perma.cc/DE8F-SRLE>]; Priemskaya, *Po zakonam tundra. Pochemu na Yamale nachali massovo gibnut oleni* (*По законам тундры. Почему на Ямале начали массово гибнуть олени*) [*According to the Laws of the Tundra Why Did Deer Begin to Die en masse in Yamal?*], IZVESTIYA (Apr. 4, 2018), <https://iz.ru/727800/evgeniia-priemskaya/po-zakonam-tundry> [<https://perma.cc/E8F7-KKZA>].

119. *Rosselkhoz nadzor: golod stal prichinoy massovoy gibeli oleney v Kamchatskoy tundre* (*Россельхознадзор: голод стал причиной массовой гибели оленей в камчатской тундре*) [*Rosselkhoz nadzor: Famine Cause the Mass Death of Deer in the Kamchatka Tundra*], INTERFAX-RUSSIA (May 28, 2021, 02:35AM), <https://www.interfax-russia.ru/index.php/far-east/main/golod-stal-prichinoy-massovoy-gibeli-oleney-v-kamchatskoy-tundre-rosselkhoz-nadzor> [<https://perma.cc/PL2R-Q9LH>].

120. *Golod oleney v Yamalo-Nenetskom, avtonomnom okruge mozhetsya sledstviye raboty ledokolov dumayut zhiteli tundry* (*Голод оленей в Ямало-Ненетском, автономном округе может стать следствием работы ледоколов, думают жители*

In some areas of Nizhnekolymsk ulus (Sakha Republic), climate change is negatively impacting reindeer herding due to unusually heavy snow.<sup>121</sup> Nizhnekolymsk ulus has seen snow as deep as 1.5 to 2.0 meters every year since 2016.<sup>122</sup> Many reindeer have died of starvation, and the number of herds has been halved compared to previous years—from 22,000 to 10,900 herds.<sup>123</sup> Similar problems have been experienced by other Indigenous reindeer herders in other parts of the Arctic, for example, in the area where the Saami live, a rain-on-snow event and rapid change in temperature above and below the freezing point forms an ice crust seriously challenging reindeer.<sup>124</sup> For example, sudden temperature changes in 2018 to 2019, which caused the grass to freeze over, resulted in the death of horses belonging to residents of Gorniy ulus.<sup>125</sup> A third of the Delta Junction bison herd and many moose starved to death in Alaska in 2022.<sup>126</sup>

Due to changing seasonality, lakes and rivers are thawing and freezing at different times with tendency to freeze later and thaw earlier than they

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тундры) [*The Reindeer Famine in the Yamal-Nenets Autonomous Okrug Could Have Been a Consequence of the Work of Icebreakers, Tundra Dwellers Believe*], PRO-URENGOY (Apr. 6, 2021), [https://www.pro-urengoy.ru/news/incidents/golodomor\\_oleney\\_v\\_yanao\\_mog\\_stat\\_sledstviem\\_raboty\\_ledokolov\\_schitayut\\_tundroviki/](https://www.pro-urengoy.ru/news/incidents/golodomor_oleney_v_yanao_mog_stat_sledstviem_raboty_ledokolov_schitayut_tundroviki/) [https://perma.cc/YJ7H-MBDB].

121. Arkady Vasiliev, V Yakutii potepleniye klimata mozhnet skazatsya na zhizni severyan [*In Yakutia, a Warming Climate May Affect the Lives of Northerners*], JAKUTSKOE-SAHA INFORMACIONNOE AGENTSTVO (June 4, 2018, 11:15 PM), <http://ysia.ru/v-yakutii-poteplenie-klimata-mozhet-skazatsya-na-zhizni-severyan/> [https://perma.cc/86NF-C2ZK].

122. *Id.*

123. *Id.*

124. Stefan Kirchner & Vanessa M. Frese, *Sustainable Indigenous Reindeer Herding as a Human Right*, 5 LAWS, May 25, 2016, at 1, 2.

125. Svetlana Ivanova, *Izmeneniye klimata seryeznim obrazom menyaet zhizn yakutyan, osobenno v sele* [*Scientist: “Climate Change Is Seriously Changing the Lives of Yakut Residents, Especially Those in the Village”*], JAKUTSKOE-SAHA INFORMACIONNOE AGENTSTVO (Mar. 19, 2023, 3:58 PM), <https://ysia.ru/uchenyj-izmenenie-klimata-sereznyim-obrazom-menyaet-zhizn-yakutyan-osobenno-v-sele/> [https://perma.cc/6G7D-AGJ4].

126. Tim Ellis, *State Downsizes Bison Hunt After a Third of Delta Herd Starves to Death*, ALA. PUB. MEDIA (Dec. 6, 2022), <https://alaskapublic.org/2022/12/06/state-downsizes-bison-hunt-after-a-third-of-delta-herd-starves-to-death/> [https://perma.cc/□G98-5UZP].



did in the past.<sup>127</sup> This in turn impacts ice roads and water transportation.<sup>128</sup> Due to temperature increases, ice on the rivers does not reach the necessary thickness to withstand heavy, multi-ton trucks for prolonged periods.<sup>129</sup> As a result, it is challenging to supply remote settlements with food products and industrial goods, which leads to higher prices and higher costs of living.<sup>130</sup> For example, abnormally warm weather and heavy snowfalls in the fall-winter period in the Arctic regions in 2017, which caused slow freezing of ice and the subsequent late opening of ice roads, led to a backlog in the transportation of goods in the Arctic regions of the Sakha Republic.<sup>131</sup> In April 2017, with the shipment plan of 203,500 tons of life-supporting products, only 132,900 tons were delivered.<sup>132</sup> In December 2022, the Yakutsk State Hydrometeorological Service reported that ice covers on the rivers of the Sakha Republic of Yakutia were established six to eighteen days later than usual.<sup>133</sup> For instance, on the river Lena near Yakutsk city, the ice thickness was thirty-one centimeters, compared with the norm of forty-seven centimeters.<sup>134</sup>

The number of mosquitoes and insects, including newly introduced, increased because of higher temperatures and longer warm seasons in the

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127. See generally A. N. Gorokhov et al., *Current Trends in Climate Change in Yakutia*, 2 GEOGRAFIJA I PRIRODNYE RESURSY (ГЕОГРАФИЯ И ПРИРОДНЫЕ РЕСУРСЫ) [GEOGRAPHY AND NAT. RES.] 111, 111 (2018); ENV'T PROT. AGENCY, CLIMATE CHANGE INDICATORS: LAKE ICE (2021), <https://www.epa.gov/climate-indicators/climate-change-indicators-lake-ice> [<https://perma.cc/469J-AA9V>].

128. When transporting goods to remote settlements, especially in the Arctic, it is common to do so via ice roads in winter and water bodies in summer. Therefore, the changing level of precipitation and the ice period's duration has a significant effect on everyday life in this region.

129. The Canadian Press, *Climate Changed: Limited Transportation Infrastructure Facing Threats in the North*, APTN NAT'L NEWS (Nov. 17, 2022), <https://www.aptnnews.ca/national-news/climate-changed-limited-transportation-infrastructure-facing-threats-in-the-north/> [<https://perma.cc/6933-KZ3U>].

130. *Id.*

131. *Teplaya pogoda i snegopadi stali prichinoy otstavaniya ot grafika perevozki грузов v Yakutii* (Теплая погода и снегопады стали причиной отставания от графика перевозки грузов в Якутии Подробнее) [*Warm Weather and Snowfall Delayed Cargo Transportation Schedules in Yakutia*], YAKUTIAMEDIA (Apr. 5, 2017, 5:30 PM), <https://yakutiamedia.ru/news/580588/?from=70> [<https://perma.cc/T5FB-BJZT>].

132. *Id.*

133. *V Yakutii otkrili ledovuyu dorogu cherez Lenu* (В Якутии открыли ледовую дорогу через Лену) [*An Ice Road Across the Lena River was Opened in Yakutia*], RZHD-PARTNER (Dec. 15, 2022, 9:52 AM), <https://www.rzd-partner.ru/auto/news/v-yakutii-otkryli-ledovuyu-dorogu-cherez-lenu/> [<https://perma.cc/2BZK-YFKG>].

134. *Id.*

Arctic region.<sup>135</sup> This negatively impacts not only the quality of peoples' lives but also livestock production—especially reindeer, which are very sensitive to the mosquitoes, warble, and nose bot flies.<sup>136</sup> Vinokurova and Prokhorova quoted reindeer herders in their article:

The climate in the Arctic changed dramatically during the past decades. In the north-western part of Yakutia, the summer is hot now. Due to hot weather, there are a lot of mosquitoes and nose bot flies. So, we got good calving of tuguts [calves], but we lost many newborns due to the huge number of insects.<sup>137</sup>

### *C. Socio-cultural Impacts*

Socio-cultural values and practices rooted in the local environment are the pillars of sustainable Indigenous communities. Strong connections to place manifest in many ways—the traditional activities they follow to support their livelihoods determine Indigenous people's identity, the food they eat, the clothes they wear, the traditional activities they follow to support their livelihoods. Climate change not only affects those connections but also impacts self-identity and culture, since cultural symbols, and the worldviews of Indigenous people in the Arctic are based on human-environment relationships.<sup>138</sup> Negative changes have forced Indigenous people to migrate to other places and contribute to urbanization.<sup>139</sup> Indigenous peoples are concerned about social and

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135. See Svyatoslavovna, *supra* note 7; Kyle Joly et al., *Behavioral, Physiological, Demographic and Ecological Impacts of Hematophagous and Endoparasitic Insects on an Arctic Ungulate*, 12 TOPIINS, May 20, 2020, at 1, 5; *Kak izmeneniye klimata skazivaetsya na zhizni v Sibiri (Как изменение климата сказывается на жизни в Сибири)* [How Climate Change Is Affecting Life in Siberia], UN NEWS (June 11, 2023), <https://news.un.org/ru/interview/2023/06/1441837> [<https://perma.cc/YE4J-Q273>]; see also Vladimirov et al., *supra* note 52.

136. WWF-NORWAY & WWF INT'L ARCTIC PROGRAMME, *supra* note 114.

137. D. E. Vinokurova & M. N. Prokhorova, *Osobennosti olenevodstva i tendentsii v izmenenii pogolovya domashnikh oleney v Resoublike Sakha (Yakutia) (Особенности оленеводства и тенденции в изменении поголовья домашних оленей в Республике Саха (Якутия))* [Features of Reindeer and Trends in Domestic Reindeer Population in the Republic of Sakha (Yakutia)], YAKUTSK STATE AGRIC. ACAD. 126, 128 (2013).

138. Joydeb Garai et al., *Climate Change and Cultural Responses of Indigenous People: A Case from Bangladesh*, 4 CURRENT RSCH. IN ENV'T SUSTAINABILITY, Feb. 16, 2022, at 1, 4; Nazune Menka, *Embracing an Indigenous Worldview of Climate Change*, UUNWORLD (Oct. 5, 2022), <https://www.uunworld.org/articles/righting-relationships> [<https://perma.cc/8TS-U3FK>].

139. Celia McMichael et al., *An Ill Wind? Climate Change, Migration, and Health*, 120 ENV'T HEALTH PERSPS. 646, 648 (2012).

environmental tensions, possible changes in traditional lifestyles, the prospects of forced migration or relocation due to climate change, and changes in the environment due to natural disasters.<sup>140</sup> To adapt to changing conditions, Sakha farmers have replaced thousands of cows with native horses that need less hay during winter.<sup>141</sup> However, the horses produce much less milk, and the market for their meat is limited.<sup>142</sup>

In sum, as many studies have predicted, the average global temperature will increase according to all scenarios.<sup>143</sup> The temperature in the Arctic is increasing more than twice as fast as the rest of the world.<sup>144</sup> The rising temperature will have significant impacts on the environment, and the majority of these impacts are likely to be negative. Global warming impacts ice cover and glaciers, making them melt faster. The Arctic Sea summer ice cover was retreating rapidly over the period 1980 to 2022.<sup>145</sup> The warming process in the Arctic will also result in increased temperature in the permafrost, influencing the depths of seasonal thawing of the permafrost's upper level.<sup>146</sup> The changes in the environment are already happening, creating serious effects for Indigenous peoples in the Arctic region across all aspects of their lives including economic, cultural, social, and health.

However, Indigenous people are not passive victims of climate change.<sup>147</sup> They have successfully adapted to changing conditions using

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140. Menka, *supra* note 138.

141. Fyodor Shomoev, *V Yakutii pomenyalis prioritety v zhivotnovodstve (В Якутии поменялись приоритеты в животноводстве)* [In Yakutia, Priorities in Livestock Farming Have Changed], JAKUTSKOE-SAHA INFORMACIONNOE AGENTSTVO (ЯКУТСКОЕ-САХА ИНФОРМАЦИОННОЕ АГЕНТСТВО) (Oct. 7, 2021, 6:56 AM), <https://rg.ru/2021/10/07/reg-dfo/v-iakutii-pomenialis-prioritety-v-zhivotnovodstve.html> [https://perma.cc/6T2Y-SPKN].

142. MacFarquhar, *supra* note 7.

143. See generally IPCC 2019, *supra* note 14; INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, 2021: *Summary for Policymakers*, in CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS 3-31 (Valérie Masson-Delmotte et al., eds., 2021) [hereinafter IPCC 2021].

144. O. A. Anisimov et al., *supra* note 26; IPCC 2018, *supra* note 35; see generally A. N. Gorokhov et al., *supra* note 127.

145. NAT'L AERONAUTICS & SPACE ADMIN., ARCTIC SEA ICE MINIMUM EXTENT (2024), <https://climate.nasa.gov/vital-signs/arctic-sea-ice/> [https://perma.cc/5KAL-239H].

146. M. C. Serreze et al., *Observational Evidence of Recent Change in the Northern High-Latitude Environment*, 46 CLIMATIC CHANGE 159, 189-193 (2000); Svyatoslavovna, *supra* note 7; Myers-Smith, *supra* note 44, at 2.

147. Marie Roué & Douglas Nakashima, *Co-production Between Indigenous Knowledge and Science: Introducing a Decolonized Approach*, in RESILIENCE THROUGH KNOWLEDGE CO-PRODUCTION 3, 3 (Marie Roué et al. eds., 1st ed., 2022).

their Indigenous knowledge, cultural values, and community networks.<sup>148</sup> Indigenous knowledge also provides valuable information for scientists to better understand changes in the environment.<sup>149</sup> There is constant monitoring by Indigenous communities of climate change's impacts on the primary sources of local food, such as fish, caribou, ice seals, whales, birds, and others.<sup>150</sup>

### III. IMPORTANCE OF INDIGENOUS KNOWLEDGE AND LOCAL KNOWLEDGE IN CLIMATE CHANGE ADAPTATION

Adequate responses to climate change's local effects require interdisciplinary dialogue<sup>151</sup> and a study of Indigenous knowledge.<sup>152</sup> Nature is a living system—all its elements are interconnected and depend on each other. Indigenous knowledge develops from, and intertwines with, the surrounding environment. Indigenous peoples superimpose day-to-day observations of periodically occurring natural events on economic and

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148. DOUGLAS NAKASHIMA ET AL., *Executive Summary*, in WEATHERING UNCERTAINTY: TRADITIONAL KNOWLEDGE FOR CLIMATE CHANGE ASSESSMENT AND ADAPTATION 6, 6 (David McDonald ed., 1st ed. 2012); Solovyeva, *supra* note 8, at 19; Matthew L. Druckenmiller et al., *New Arctic Report Warns of Disturbances for People, Plants and Animals*, SCI. AM. (Dec. 13, 2022), <https://www.scientificamerican.com/article/new-arctic-report-warns-of-disturbances-for-people-plants-and-animals/> [<https://perma.cc/WN87-D4KG>].

149. Henry P. Huntington et al., *Climate Change in Context: Putting People First in the Arctic*, 19 REG'L ENV'T CHANGE 1217, 1218 (2019).

150. NAT'L PARK SERV., *2019 Seabird Die-Off* (2021), <https://www.nps.gov/subjects/aknatureandscience/seabird2019.htm> [<https://perma.cc/NBE7-P5C>]; Kristen M. Green et al., *Climate Change Stressors and Social-Ecological Factors Mediating Access to Subsistence Resources in Arctic Alaska*, 26 ECOLOGY & SOC'Y, Dec. 2021, at 1, 12; Krista B. Oke et al., *Recent Declines in Salmon Body Size Impact Ecosystems and Fisheries*, 11 NATURE COMM'NS, Aug. 19, 2020, at 1, 2; *see generally* Eric C. Palm et al., *Increasing Fire Frequency and Severity Will Increase Habitat Loss for a Boreal Forest Indicator Species*, 32 ECOLOGICAL APPLICATIONS, Jan. 30, 2022, at 1, 14 (discussing the indigenous monitoring of caribou populations).

151. Noel Castree et al., *Changing the Intellectual Climate*, NATURE CLIMATE CHANGE 1, 4 (2014); *see* IPCC 2023, *supra* note 2, at 15; Sarah Kehler & S. Jeff Birchall, *Adaptation Planning: An Interdisciplinary Approach to Climate Change Risk Reduction*, CANADIAN METEOROLOGICAL & OCEANOGRAPHIC SOC. (Feb. 28, 2023), <https://bulletin.cmos.ca/adaptation-planning-an-interdisciplinary-approach-to-climate-change-risk-reduction/> [<https://perma.cc/NT66-F2KQ>].

152. E. Lisa F. Schipper et al., *Climate Change Research and the Search for Solutions: Rethinking Interdisciplinarity*, 168 CLIMATIC CHANGE, Oct. 18, 2021, at 1, 6; Sébastien Boilat & Fikret Berkes, *Perception and Interpretation of Climate Change Among Quechua Farmers of Bolivia: Indigenous Knowledge as a Resource for Adaptive Capacity*, 18 ECOLOGY & SOC'Y, Dec. 2013, at 1, 1.

cultural activities they undertake within the surrounding environment.<sup>153</sup> These events are explained through the lens of Indigenous peoples' worldviews, creating symbolic meaning. This knowledge co-evolves with the environment, is accumulated across generations, critically analyzed, and adjusted to changes or renewed if needed by each generation.<sup>154</sup> It has produced in-depth knowledge of places and environments, sometimes allowing Indigenous groups to develop predictive tools for future events, even in radically changing times.<sup>155</sup> Thus, Indigenous knowledge embodies adaptive management at the local level, allowing Indigenous peoples to adjust to uncertainty and changes.<sup>156</sup> Successful climate change adaptation requires ecosystem knowledge that extends across time incorporating the experience of the multiple generations. Failure to consider these components may lead to adaptation failure. Including Indigenous voices and supporting their place-linked adaptation strategies across all governmental levels is necessary for successful resilience-building and adaptation to changing conditions.<sup>157</sup>

The international community is recognizing the importance of Indigenous knowledge in climate change adaptation because Indigenous knowledge and science are different angles of the same reality. Indeed, Traditional Ecological Knowledge complements scientific research or suggests new directions for research.<sup>158</sup> It provides unique insights for many branches of knowledge including medicine, agriculture, and

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153. Mamaweswen Niigaaniin & Timothy MacNeill, *Indigenous Culture and Nature Relatedness: Results from a Collaborative Study*, 44 ENV'T DEV., Sept. 6, 2022, at 1, 2-3.

154. Fulvio Mazocchi, *Western Science and Traditional Knowledge: Despite Their Variations, Different Forms of Knowledge Can Learn From Each Other*, 7 EMBO REPORTS, 463, 463-64 (2006); NAKASHIMA et al., *supra* note 148, at 7.

155. Nancy Turner & Pamela R. Spalding, "We Might Go Back to This"; *Drawing on the Past to Meet the Future in Northwestern North American Indigenous Communities*, 18 ECOLOGY AND SOC'Y, Dec. 2013, at 1, 5.

156. Firket Berkes et al., *Rediscovery of Traditional Ecological Knowledge as Adaptive Management*, 10 ECOLOGICAL APPLICATIONS 1251, 1260 (2000); Arry Retnowati et al., *Environmental Ethics in Local Knowledge Responding to Climate Change: An Understanding of Seasonal Traditional Calendar PranotoMongso and Its Phenology in Karst Area of GunungKidul, Yogyakarta, Indonesia* 20 PROCEEDIA ENV'T SCI. 785, 792 (2014).

157. Zerihun Yohannes Amare, *Indigenous Knowledge of Rural Communities for Combating Climate Change Impacts in West Central Ethiopia*, 22 J. OF AGRIC. EXTENSION 181, 182 (2018); Solovyeva, *supra* note 8; Seghan MacDonald & S. Jeff Birchall, *Climate Change Resilience in the Canadian Arctic: The Need for Collaboration in the Face of a Changing Landscape*, 64 THE CANADIAN GEOGRAPHER 530, 531 (2019).

158. Solovyeva, *supra* note 8.

environmental studies, particularly climate change phenomena.<sup>159</sup> Science and technology have contributed tremendously to understanding natural processes. However, most technological development answers market needs that do not respond to people's needs.<sup>160</sup> In order to serve people better and solve the many challenges that communities face now, especially under climate change pressure, rational, systematic, and objective modern science (western science)<sup>161</sup> needs to evolve to include the human aspects such as Indigenous ethics and spirituality together with Indigenous knowledge. It is also equally important to consider human rights to life, health, family life and property, and Indigenous rights<sup>162</sup> in developing climate change adaptation strategies.<sup>163</sup> However, in some countries, including Russia, not all Indigenous people are recognized as Indigenous even if they are within the scope of the United Nations' accepted description of Indigenous peoples.<sup>164</sup>

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159. Victoria Rawan Wyllie de Echeverria & Thomas F. Thornton, *Using Traditional Knowledge to Understand and Adapt to Climate and Biodiversity Change on the Pacific Coast of North America*, 48 BIODIVERSITY CHANGE AND HUM. ADAPTATION 1447, 1449 (2019); see generally Shivani Rawat et al., *Wound Healing Agents from Medicinal Plants: A Review*, 2 ASIAN PACIFIC J. OF TROPICAL BIOMEDICINE S1910 (2012) (showing an example of traditional ecological knowledge providing insight into medicine through the use of healing wounds using medicinal plants).

160. INTERNATIONAL ENVIRONMENT FORUM, *Statement to the United Nations Conference on Sustainable Development Brazil* (June 9, 2012), <https://iefworld.org/iefRio20science> [<https://perma.cc/4367-CG6W>].

161. *Indigenous Knowledge and Traditional Ecological Knowledge*, NAT'L PARKS SERV., (June 29, 2023), <https://www.nps.gov/subjects/tek/description.htm> [<https://perma.cc/T2LM-J34P>].

162. Indigenous people have specific rights because of their unique position as first peoples of their nations. Thus, Indigenous peoples are free and equal to all others and have the right to be free from any kind of discrimination, including discrimination based on their Indigenous origin or identity. They have the right to practice and revitalize their cultural traditions and customs. Indigenous peoples shall not be removed from their land by force. Governments shall consult properly with Indigenous peoples before adopting laws and policies that may affect them. They must use the principles of free, prior and informed consent—which means giving Indigenous peoples all the facts needed to make decisions. Indigenous peoples have the right to own, use and control their lands, waters and other resources. Governments shall recognize and protect these lands, waters and resources. Amnesty International definition of Indigenous rights; AMNESTY INT'L *The Rights of Indigenous Peoples*, <https://www.amnesty.org.au/how-it-works/what-are-indigenous-rights/> (last visited Mar. 23, 2024) [<https://perma.cc/8T4-KQZQ>].

163. Lisa Mardikian & Sofia Galani, *Protecting the Arctic Indigenous Peoples' Livelihoods in the Face of Climate Change: The Potential of Regional Human Rights Law and the Law of the Sea*, 23 HUM. RIGHTS L. REV. 1, 13 (2023).

164. U.N. PERMANENT F. ON INDIGENOUS ISSUE: WHO ARE INDIGENOUS PEOPLES? FACT SHEET.

IV. INDIGENOUS PEOPLES MATTERS OF DEFINITION IN THE RUSSIAN  
FEDERATION

According to Russian legislation, the term “Indigenous” appears only together with quantitative limitation and referral to place.<sup>165</sup> Therefore, the term “Indigenous” refers only to the small-numbered Indigenous peoples of the north, Siberia, and the far-east of the Russian Federation. It is notably different from the United Nations working definition of “Indigenous peoples,” which does not mention administrative criteria, but instead emphasizes the historical aspects of colonization and discrimination, and the cultural distinctiveness of ethnic characteristics together with self-identification.<sup>166</sup>

*Small-numbered Indigenous peoples of the north, Siberia, and the far-east of the Russian Federation.* The Russian federal law “On the Basis of State Regulation of the Socio-Economic Development in the North of the Russian Federation” (1996) defined “Small Numbered Indigenous Peoples” (SNIP) as “distinct ethnic groups, who live on their ancestral land within a certain geographic territory, follow their traditional way of life, recognize themselves as independent ethnic communities and whose population was less than 50,000 people.”<sup>167</sup> The rights of these groups are protected by various decrees and laws. During the Soviet Union’s era “Small Peoples of the North” were granted many state privileges such as stipends for higher education, reductions in income tax, and other benefits.<sup>168</sup> In contemporary time, the Decree of the President of the

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165. JOHANNES ROHR, INDIGENOUS PEOPLES IN THE RUSSIAN FEDERATION, INTERNATIONAL WORK GROUP FOR INDIGENOUS AFFAIRS (IWGIA) REPORT 18 9 (Diana Vinding & Kathrin Wessendorfs eds., 2014); Vera Solovyeva, *Ecology Activism in the Sakha Republic, Russia’s “Large Numbered” Indigenous Peoples and the United Nations Declaration of the Rights of Indigenous Peoples*, in WALKING AND LEARNING WITH INDIGENOUS PEOPLES 119, 119 (Pamela Calla & Elsa Stamatopoulou eds., 2018).

166. G.A. Res 61/295, United Nations Declaration on the Rights of Indigenous People, at 2 (Sept. 13, 2007) [hereinafter UNDRIP].

167. Federal’nyj zakon “Ob osnovah gosudarstvennogo regulirovanija social’no – èkonomičeskogo razvitija Severa Rossijskoj Federacii” ot 19.06.1996 N 78-FZ (poslednjaja redakcija) (utratil silu v 2005 godu) (Федеральный закон “Об основах государственного регулирования социально – экономического развития Севера Российской Федерации” от 19.06.1996 N 78-ФЗ (последняя редакция) (утратил силу в 2005 году)) [Federal Law of the Russian Federation on the Fundamental of State Regulation of Socio-Economic Development in the North of the Russian Federation] No. 78-FZ (June, 19, 1996) (losing effect in 2005).

168. See Anna N. Agalarkhanova, *National Policy of the Russian Empire and Soviet Union Towards Indigenous Peoples of the North, Siberia and the Far East*, 6 HUMANITARIAN STUD. IN E. SIBERIA & THE FAR E. (2013).

Russian Federation (1992) “[o]n urgent measures for the protection of the places of residence and traditional economic activities of Indigenous Peoples of the North” outlined territories of traditional resource management occupied by SNIP under their lifetime ownership.<sup>169</sup> SNIP can use these territories for hunting, reindeer herding, fishing, and other traditional activities.<sup>170</sup> There are three important federal laws which are aimed to protect the rights of SNIP, and accord with international laws:

- (1) “About guarantees of the rights of [SNIP] of Russian Federation” (from 1999);<sup>171</sup>
- (2) “About general principles of organization of the [SNIP] communities of the North, Siberia and the Far East of Russian Federation” (from 2000);<sup>172</sup> and
- (3) “About territories of the traditional use of the [SNIP] of the North, Siberia and the Far East of Russian Federation” (2001).<sup>173</sup>

Unfortunately, as many sources note, protection measures toward the rights of SNIP are inconsistent, and are often stated with no corresponding action.<sup>174</sup> To some extent, the assertions in federal laws and acts can

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169. Ukaz Prezidenta Rossijskoj Federacii ot 22.04.1992 g. № 397 O neotložnyh merah po zaštite mest proživaniya i hozjajstvennoj dejatel'nosti maločislennyh narodov Severa (Указ Президента Российской Федерации от 22.04.1992 г. № 397 О неотложных мерах по защите мест проживания и хозяйственной деятельности малочисленных народов Севера) [Decree of the President of the Russian Federation On Urgent Measures for the Protection of the Places of Residence and Traditional Economic Activities of Indigenous Peoples of the North] (1992).

170. *Id.*

171. *Indigenous Peoples in Russia*, INT’L WORK GROUP FOR INDIGENOUS AFFAIRS, <https://www.iwgia.org/en/russia.html> (last visited Mar. 25, 2024) [<https://perma.cc/B24L-6R29>].

172. Об Общих Принципах Организации Общин Коренных Малочисленных Народов Севера, Сибири И Дальнего Востока Российской Федерации [On General Principles of Organization of Indigenous Scanty People of the North, Siberia and of the Far East of the Russian Federation], PARLAMENTSKAIA GAZETA [PARL. GAZ.] July 20, 2000.

173. О Территориях Традиционного Природопользования Коренных Малочисленных Народов Севера, Сибири И Дальнего Востока Российской Федерации [About the Territories of Traditional Natural Management of Indigenous Small Peoples of the North, Siberia and the Far East Russian Federation], ROSSIJSKAIA GAZETA [ROS. GAZ.] May 7, 2021.

174. Ruslan Garipov, *Indigenous Peoples’ Protection in International Law; Indigenous Peoples’ Rights Protection in Russia and the US*, WILSON CTR.: ALUMNI SPOTLIGHT (Oct. 11, 2019), <https://www.wilsoncenter.org/blog-post/ruslan-garipov-indigenous-peoples-protection-international-law-indigenous-peoples-rights> [<https://perma.cc/V7RT-MK23>].



protect governmental interests.<sup>175</sup> As a result, the purpose behind the adoption of these laws is not achieved since these laws have not ensured full and effective protections of the rights of SNIPs.<sup>176</sup> Still, due to the presence of these laws, there are some federal programs aimed to support SNIP by building schools, supporting language programs, purchasing high-grade sanitary vehicles and satellite phones in some areas, and more.<sup>177</sup>

*“Large numbered” or “titular” Indigenous peoples.* The larger ethnic groups whose population exceed 50,000 people are not considered “Indigenous” under the Russian legislation, despite possessing characteristics of “Indigenous peoples” outlined by two international human rights documents: Convention 169 of the International Labor Organization (1989), and the United Nations Declaration on the Rights of Indigenous Peoples (2007):

- Self-identification as Indigenous peoples at the individual level and accepted by the community as their member;
- Historical continuity with pre-colonial and/or pre-settler societies;
- Strong link to territories and surrounding natural resources;
- Distinct social, economic, or political systems;
- Distinct language, culture, and beliefs;
- Forms non-dominant groups of society; and
- Resolves to maintain and reproduce their ancestral environments and systems as distinctive peoples and communities.<sup>178</sup>

The matter of definition is very important. First, the Russian legal definition of “Indigenous people” blurs the self-identification of large-numbered Indigenous peoples,<sup>179</sup> and many of them are not aware of their Indigenous rights and cannot protect them. Also, by not being recognized

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175. ROHR, *supra* note 165, at 13.

176. See Human Rights Council, Rep. of the Special Rapporteur on the Situation of Human Rights and Fundamental Freedoms of Indigenous People, James Anaya, 5/3 U.N. Doc A/HRC/15/37 (July 19, 2010).

177. Daria Khanolainen et al., *Indigenous Education in Russia: Opportunities for Healing and Revival of the Mari and Karelian Indigenous Groups?*, 52 COMPARE 768, 772 (2020).

178. See generally International Labour Organization, Indigenous and Tribal Peoples Convention, adopted on June 7, 1989, Convention No. 169; UNDRIP, *supra* note 166, at 5.

179. Marjorie Balzer, *Indigeneity, Land and Activism in Siberia*, in LAND, INDIGENOUS PEOPLE AND CONFLICT 2-3 (Alan Tidwell & Barry Zellen eds., 1st ed. 2017).

as “Indigenous,” large-numbered Indigenous peoples of the Russian Federation are excluded from the federal programs aimed to support Indigenous culture, language, and traditional ways of life.<sup>180</sup> Moreover, practically all international tools and mechanisms, including international assessments and programs developed to better defend the rights of Indigenous peoples, overlook problems of the “large numbered” Indigenous peoples in the Russian Federation, including those, associated with climate change, leaving them invisible.<sup>181</sup>

### CONCLUSION

The 2030 Agenda for Sustainable Development, adopted in 2015, is the most ambitious agenda proclaiming human rights and social justice for all.<sup>182</sup> It is a call to end hunger and malnutrition, promote sustainable agriculture, and achieve other goals necessary for sustainable life.<sup>183</sup> However, climate change is already threatening the possibility of achieving sustainability goals due to the increasing intensity and frequency of extreme weather events. While some reports estimate that direct economic losses from natural disasters attributable to climate change reached almost \$3 trillion over 20 years (1998 to 2017), and about 1.3 million people died due to those disasters, others argue that those economic costs are underestimated and reach \$143 billion per year, where sixty-three percent is due to loss of human life.<sup>184</sup> Other global warming consequences are the loss of biodiversity, rising inequality, and hunger among people, especially in developing countries.<sup>185</sup> The Paris Agreement under the United Nations Framework Convention on Climate Change

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180. E. FILIPPOVA & M. SOKOLOVSKIY, THE DEATH OF A LANGUAGE IS THE DEATH OF A PEOPLE? SITUATIONS OF MOTHER TONGUES IN RUSSIA AND NEIGHBORING COUNTRIES 260 (2019); Diana Shanava, *Fiktivnyj zakon o jazyke: kak v respublikah v sostave RF idet rusifikacija* (Фиктивный закон о языке: как в республиках в составе РФ идет русификация) [A Fictitious Law on Language: How Russification Is Taking Place in the Republics Within the Russian Federation], SOVA (Jan. 31, 2024) <https://sova.news/2024/01/31/fiktivnyj-zakon-o-yazyke-kak-v-respublikah-v-sostave-rf-idet-rusifikacziya/> [https://perma.cc/2LM7-UKLE].

181. Solovyeva, *supra* note 165, at 136.

182. See G.A. Res. 70/1, ¶ 2 (Sept. 25, 2015).

183. INT’L LAB. OFF., *supra* note 35, at 36.

184. Rebecca Newman & Ilan Noy, *The Global Costs of Extreme Weather That Are Attributable to Climate Change* 14 NATURE COMM’N, 2023, at 1, 1; UNITED NATIONS, THE SUSTAINABLE DEVELOPMENT GOALS REPORT 2019 16 (2019); U.N. Secretary-General, *Special Edition: Progress Toward the Sustainable Development Goals*, U.N. Doc. E/2019/68 (May 8, 2019).

185. G.A. Res. 70/1, *supra* note 182, at ¶ 14; see IPCC 2019, *supra* note 14.

(2015),<sup>186</sup> the Sendai Framework for Disaster Risk Reduction (2015),<sup>187</sup> and the International Science Council (2023)<sup>188</sup> highlighted the necessity of addressing climate change and putting the human dimension at the center of attention for actions aimed to mitigate and adapt to climate change. Among important actions to combat climate change, organized by the Arctic countries, are the Arctic Resilience Report (2016),<sup>189</sup> the Arctic Resilience Action Framework (2017 to 2019),<sup>190</sup> the Arctic Resilience Forum (2020),<sup>191</sup> Arctic Report Card (2022),<sup>192</sup> the Fifth National Climate Assessment, NCA5 (2023),<sup>193</sup> and academic collaborative efforts within the International Arctic Science Committee and International Arctic Social Sciences Association.

As it is already admitted on the high level, Indigenous communities are one of the most vulnerable groups to climate change.<sup>194</sup> Climate change impacts the Arctic in different ways, affecting the health, food security, livelihoods, and shelter of Indigenous peoples.<sup>195</sup> Arctic Indigenous people have adapted well to the extreme conditions of the North and have already

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186. See U.N. Framework Convention on Climate Change, Rep. of the Conference of the Parties on Its Twenty-First Session at 2, U.N. Doc. FCCC/CP/2015/10/Add.1 (Jan. 29, 2016).

187. UNITED NATIONS OFF. FOR DISASTER RISK REDUCTION, SENDAI FRAMEWORK FOR DISASTER RISK REDUCTION 2015-2030 7, 12 (Mar. 18, 2015).

188. Roche Mahon, *The Human Dimension of Disaster Risk Reduction: Social Sciences and Climate Adaptation*, INT'L SCI. COUNCIL (Oct. 26, 2023), <https://council.science/current/blog/the-human-dimension-of-disaster-risk-reduction/> [<https://perma.cc/6UHQ-WCJC>].

189. ARCTIC COUNCIL, ARCTIC RESILIENCE REPORT 2016, ix-x (2016).

190. SUSTAINABLE DEV. WORKING GRP., ARCTIC COUNCIL, ARCTIC RESILIENCE ACTION FRAMEWORK (ARAF) 2017-2019 IMPLEMENTATION PROJECT: FINAL PROJECT REPORT iii-iv (2019).

191. SUSTAINABLE DEV. WORKING GRP., ARCTIC COUNCIL, ARCTIC RESILIENCE FORUM 2020 2-6 (2021).

192. J.E. WALSH, ET AL., NAT'L OCEANIC & ATMOSPHERIC ADMIN., ARCTIC REPORT CARD 2022: PRECIPITATION 1 (2022); Rebecca Lindsey & Michon Scott, *Climate Change: Arctic Sea Ice Summer Minimum*, CLIMATE.GOV (Oct. 18, 2022), <https://www.climate.gov/news-features/understanding-climate/climate-change-arctic-sea-ice-summer-minimum> [<https://perma.cc/LU2P-UGW8>].

193. A. K. Jay, et al., *The Fifth National Climate Assessment*, NCA5 (2023), <https://nca2023.globalchange.gov/> [<https://perma.cc/KF9V-6BLL>].

194. See INT'L WORK GRP. FOR INDIGENOUS AFFS., THE INDIGENOUS WORLD 2023 6 (Dwayne Mamo et al., eds., 2023) <https://www.iwgia.org/en/ip-i-iw/411-ipcc/5156-iw-2023-ipcc.html> [<https://perma.cc/6KFS-CZF>].

195. *Arctic Communities*, WWF, <https://www.arcticwwf.org/our-priorities/arctic-communities/> (last visited Mar. 17, 2024) [<https://perma.cc/T9AR-HJ6D>].

proved that they have a high level of adaptive capacity.<sup>196</sup> However, stressing factors rooted in their recent history and current politics challenge their ability to adapt to changing conditions.

Urgent actions are needed to combat climate change and mitigate its negative impacts to achieve all Sustainable Development Goals.<sup>197</sup> To better respond to climate change challenges, global society should change its whole way of thinking.

- First, there should be an acknowledgment of the interconnection and interdependence between people, nature, and the economy.<sup>198</sup>
- To solve complex climate challenges and build community resilience, a holistic approach that considers Indigenous knowledge, colonial history, cultural aspects, and Indigenous people's rights (including rights of officially unrecognized Indigenous peoples) is required.<sup>199</sup>
- Development of climate change adaptation strategies must consider equal partnerships between Indigenous communities, scientists, and policymakers at all levels, where Indigenous knowledge and Indigenous worldview can be integrated in the development of climate change adaptation strategies.<sup>200</sup>

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196. See generally Adam Stepein, *Arctic Indigenous Peoples, Climate Change Impacts, and Adaptation*, E-INT'L REL. (Apr. 10, 2014), <https://www.e-ir.info/2014/04/10/arctic-indigenous-peoples-climate-change-impacts-and-adaptation> [https://perma.cc/MDR2-SFJQ].

197. *Goal 13: Take Urgent Action to Combat Climate Change and its Impacts*, UNITED NATIONS, <https://www.un.org/sustainabledevelopment/climate-change/> (last visited Mar. 17, 2024) [https://perma.cc/4U8-PFQA].

198. See James D. Ford, et al., *Including Indigenous Knowledge and Experience in IPCC Assessment Reports*, 6 NATURE CLIMATE CHANGE 349, 351-52 (2016); George C.D. Adamson et. al., *Re-thinking the Present: The Role of a Historical Focus in Climate Change Adaptation Research*, 48 GLOB. ENV'T CHANGE 195, 196 (2018); *Siberian City Fights Melting Permafrost*, RADIO FREE EUROPE RADIO LIBERTY (Dec. 17, 2018, 16:51 GMT), <https://www.rferl.org/a/russia-yakutsk-warming/29661282.html> [https://perma.cc/6NAE-4V3D]; Karim-Aly S. Kassam et. al., *Anticipating Climatic Variability: The Potential of Ecological Calendars*, 46 HUM. ECOLOGY 249, 249-50 (2018); THE NATURE CONSERVANCY, *THE VOICE, CHOICE, AND ACTION FRAMEWORK: A CONSERVATION PRACTITIONER'S GUIDE TO INDIGENOUS AND COMMUNITY-LED CONSERVATION* 11 (2d ed. 2022).

199. See Angus W. Naylor et al., *Monitoring the Dynamic Vulnerability of an Arctic Subsistence Food System to Climate Change: The Case of Ulukhaktok, NT*, PLOS ONE, Sept. 2021, at 1, 21; Solovyeva, *supra* note 8, at xxii-xxiii.

200. EUGENIA RECIO & DINA HESTAD, INT'L INST. FOR SUSTAINABLE DEV., *INDIGENOUS PEOPLES: DEFENDING AN ENVIRONMENT FOR ALL* 8-9 (2022).

- Indigenous knowledge and communities' interests need to be prioritized in land use policies in order to bring balance to the people-nature relationship, which would help to combat climate change in the long term. As Intergovernmental Panel on Climate Change states in its Sixth Assessment Report (2021): "Indigenous knowledge contains unique information sources about past changes and potential solutions to present issues."<sup>201</sup> This is because Indigenous knowledge is connected to the place where people live and is based on experience and understanding of local conditions.<sup>202</sup>

Even in democratic societies, social change is an extremely difficult, complicated process,<sup>203</sup> and in Russia, it is even more challenging. There is no territorial security or legal recognition of ownership of land and resources on a regional level, including ethnic republics.<sup>204</sup> In Russian law, not all Indigenous people are recognized as Indigenous. Therefore, unrecognized Indigenous people have no legal basis to defend their rights. It is extremely difficult to change toward sustainably managing and utilizing land and renewable natural resources under such conditions. However, social change is urgently needed to help Indigenous peoples address and solve their challenges in this time of uncertainty. Support from governments on the international, federal, and regional levels, Indigenous rights activists, and scientific communities is crucial for mitigating the adverse consequences of climate change. By successfully addressing climate change impacts in the Arctic, other regions of the world beyond the Arctic may also be better equipped to deal with global warming challenges.

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201. IPCC 2021, *supra* note 143.

202. Patricia Cochran et al., *Indigenous Frameworks for Observing and Responding to Climate Change in Alaska*, 120 CLIMATIC CHANGE 577, 559 (2013); see INT'L LAB. OFF., DECENT WORK FOR INDIGENOUS AND TRIBAL PEOPLES IN THE RURAL ECONOMY 5 (2019); Solovyeva, *supra* note 8, at 405-06; Menka, *supra* note 138.

203. See KARI MARIE NORGGAARD, LIVING IN DENIAL: CLIMATE CHANGE, EMOTIONS, AND EVERYDAY LIFE 74, 74 (2011); Robert J. Brulle & Kari Marie Norgaard, *Avoiding Cultural Trauma: Climate Change and Social Inertia*, 28 ENV'T POLS. 886, 886-87 (2019).

204. Liubov Suliandziga & Rodion Sulyandziga, *Russian Federation: Indigenous Peoples and Land Rights*, 20 THE FOURTH WORLD J. no. 1, 2020, at 1, 4.