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A Greater Purpose for Icebergs: Iceberg Trade to Combat the Effects of Climate Change

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A GREATER PURPOSE FOR ICEBERGS: ICEBERG TRADE TO COMBAT THE EFFECTS OF CLIMATE CHANGE

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ABSTRACT

Three-fourths of the planet's freshwater is stored in glaciers, and as the glaciers melt, humans are forfeiting their greatest freshwater resource. Climbing global temperatures, attributable to greenhouse gas emissions and climate change, accelerate glacial melt while intensifying drought and water scarcity. This Comment identifies a way to relocate our greatest freshwater resource before it melts into the salty sea. Further, this Comment discusses how an iceberg trade could ensure the right to water by creating access to freshwater for all. Finally, this Comment introduces the iceberg trade as an equitable remedy to be employed by the Paris Agreement in the global response to climate change.

INTRODUCTION

Harvesting, transporting, and trading ice is not a new idea. In fact, international dealings in ice were once quite fruitful for the State of Maine. The state's deep lakes, broad rivers, and cold winters produced premium ice.[1] In the nineteenth century, the State of Maine generated more revenue in the ice trade than California in the gold rush.[2] However, as technology evolved, Maine's profitable ice trade soon became obsolete, and by the 1920s, the ice trade was replaced by home refrigerators and urban wholesalers who mechanically produced ice.[3] A century later, it is time to reconsider the closure of a global ice trade. By replacing ice harvested in Maine with icebergs adrift in the Arctic and utilizing new insulating, floating, and towing technology, a global ice trade introduces climate solutions in the face of a warming planet.

This Comment discusses how icebergs present the opportunity to take advantage of melting ice sheets and tap into the Earth's largest freshwater resource. First, this Comment recounts how climate change has created dual dilemmas: (1) melting ice and sea level rise, and (2) intensified weather events, including drought, and increased water scarcity. Next, this Comment reconciles the consequences posed by these two dilemmas with the idea of a modern iceberg trade and its technical feasibility. Finally, this Comment dissects the current and evolving law and policy surrounding iceberg transport and harvesting, and more specifically, how it is equipped to work within the United Nations Framework Convention on Climate Change to facilitate international climate action.

I. CLIMATE CHANGE

As the Earth warms, and the impacts of climate change intensify, more and more of the Earth's population faces water scarcity. Over two billion people live in countries experiencing high water stress,[4] and about four billion people face severe water scarcity during at least one month of the

1. Maine set the standard for quality ice nationwide. Richard Judd, *Ice: A Maine Commodity*, MAINE HISTORY ONLINE, https://www.mainememory.net/sitebuilder/site/773/page/1182/display (last visited Mar. 4, 2024) [https://perma.cc/7V9V-EF35].

2. *Maine Ice Harvesting*, PORTLAND DRY GOODS, https://portlanddrygoods.com/maine-ice-harvesting (last visited Mar. 4, 2024) [https://perma.cc/E75Q-J4SQ].

3. Judd, *supra* note 1.

4. Summary Progress Update 2021: SDG 6 – water and sanitation for all, UN-WATER 7 (July 2021).

year.[5] Stress levels will continue to increase as demand for water grows and the effects of climate change intensify.[6] Everything humans do requires water—for drinking, washing, growing food, and for industry, construction, and manufacturing. Earth is home to more than 7.5 billion people, and its population is projected to exceed 10 billion people by 2050.[7] As the planet's population grows, so does the urgency of the water crisis.[8]

According to the Intergovernmental Panel on Climate Change, the United Nations body that assesses climate science, "human-caused climate change has driven detectable changes in the global water cycle since the mid-20th century" and "is projected to cause substantial further changes at both global and regional scales."[9] Greenhouse gas emissions are the biggest threat facing our planet. To oversimplify the greenhouse effect: greenhouse gas emissions are causing the average global temperatures to rise.[10] When sunlight reaches the Earth, some energy is reflected back into space, and some energy is absorbed and re-radiated as heat.[11] Most of the heat is absorbed by greenhouse gases, instead of returning to space.[12] Because the heat is trapped in the atmosphere by the greenhouse gases, the heat causes the Earth to warm.[13] In comparison to the pace of climate variations throughout the Earth's history, the rate at which the Earth's climate is changing is accelerating.[14] From 1901 to 2016, the global average temperature increased 1.8°F due to greenhouse gas emitting industrial activities.[15] There is no evidence to support any credible natural explanations for this amount of warming; instead, the evidence

5. Mesfin M. Mekonnen & Arjen Y. Hoekstra, *Four Billion People Facing Severe Water Scarcity*, 2 SCI. ADVANCES 1, 1 (2016).

6. World Water Development Report 2019: Leaving No One Behind, Exec. Summary, UNESCO WORLD WATER ASSESSMENT PROGRAMME, U.N. Doc. SC-2019/WS/1 (2019), at 2 [hereinafter *World Water Dev. Rep.*].

7. Fiona Harvey, *Are We Running Out of Water?*, THE GUARDIAN (June 18, 2018, 01:00 AM), https://www.theguardian.com/news/2018/jun/18/are-we-running-out-of-water [https://perma.cc/85KP-DMUG].

8. *Id.*

9. KRISHNA ACHUTARAO ET AL., CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS 85 (Valérie Masson-Delmotte et al. eds., 2021).

10. Melissa Dechak, *Greenhouse Effect 101*, NRDC (June 5, 2023), https://www.nrdc.org/stories/greenhouse-effect-101#whatis [https://perma.cc/62FQ-GGWY].

11. *Id.*

12. *Id.*

13. *Id.*

14. *Observed Changes in Global Climate*, U.S. GLOB. CHANGE RSCH. PROGRAM, https://nca2018.globalchange.gov/chapter/2#key-message-1 (last visited Mar. 4, 2024) [https://perma.cc/67YT-S7BL].

15. *Id.*

consistently points to human activities—especially activities that emit heat-trapping gases—as the dominant cause.[16] It is undisputed that humans are causing the Earth's warming, which in turn, is causing intensified drought and sea level rise.

A. Melting Glaciers

Climate change will affirmatively increase people's demand for water while simultaneously shrinking water supplies. As the Earth's climate warms and glaciers melt, the freshwater contained in glaciers wastes away into the ocean. The amount of iceberg water that annually dissolves into the sea, 3,000 cubic kilometers, is close to the world's annual consumption of freshwater, 3,300 cubic kilometers.[17] Seventy-five percent of the Earth's freshwater is stored in glaciers, making glaciers the largest freshwater reservoir on Earth.[18] Glaciers are large, slow-moving rivers of ice, formed by compacted layers of snow that slowly deform in response to gravity.[19] There are two types of glaciers—alpine glaciers and ice sheets.[20] The latter, including ice caps and ice fields, typically produce icebergs.[21] Melting icebergs do not cause sea level rise, but icebergs do pose risks to maritime travel.[22] The melting of ice sheets causes sea level rise; once the ice has broken away from the ice sheet and becomes an iceberg, it has contributed to sea level rise.[23] As glaciers melt and react to gravity, the front of the glacier, known as the glacier tongue, either rests on land or floats on water. If the tongue is floating, the edge will break off

16. *Id.*

17. UN Water, UN-Water Analytical Brief: Unconventional Water Resources, 26 (2020) [hereinafter *Analytical Brief*].

18. NIRAS GREENLAND, GREENLAND ICE AND WATER FOR EXPORT 12 (Henrik Mai ed., 2d ed. 2015).

19. *Glacier Power – What is Glacial Calving?*, ALASKA SATELLITE FACILITY, https://asf.alaska.edu/information/glacier-power/glacier-power-what-is-glacial-calving/ (last visited Feb. 12, 2024) [hereinafter *Glacier Power*] [https://perma.cc/85GK-94KK].

20. *Glaciers*, NAT'L SNOW AND ICE DATA CTR., https://nsidc.org/learn/parts-cryosphere/glaciers (last visited Mar. 7, 2024) [https://perma.cc/C2YK-G5RT].

21. *Id.*; Lauren Harper, *Glaciers, Ice Sheets, and More: A Primer on the Different Types of Polar Ice*, COLUMBIA CLIMATE SCH. (Feb. 5, 2018), https://news.climate.columbia.edu/2018/02/05/glaciers-ice-sheets-polar-ice/ [https://perma.cc/AWJ7-25C7].

22. Amanda Lynch, Professor, Inst. At Brown for Env't & Soc'y, Pan-Arctic Cooperation: Problems and Prospects, Climate Change in the Arctic (Apr. 27, 2023); *Glaciers: Why They Matter*, NAT'L SNOW AND ICE DATA CTR., https://nsidc.org/learn/parts-cryosphere/glaciers/why-glaciers-matter (last visited Mar. 7, 2024) [https://perma.cc/DS7X-N88Y].

23. Lynch, *supra* note 22.

as the glacier moves forward. This happens through a process known as calving.[24] Calving creates icebergs—large floating chunks of ice that have detached from glaciers.[25]

As glaciers are melting, and sea level is rising, the impacts of a warming climate are also changing the frequency, duration, and geographic distribution of severe storms, floods, and droughts,[26] resulting in "more intense droughts and heavier rainstorms that don't have time to soak into the ground."[27] Over the 21st century, the total land area subject to drought will increase, and droughts will become more frequent and severe.[28] In addition to the ice sheets discussed above, alpine glaciers are also projected to continue to decline as the Earth warms.[29] Alpine glacial melt and runoff supply water to one-sixth of the global population.[30] As these glaciers disappear, so do these communities' source of water, therefore decreasing water availability to one-sixth of the world's population. The combination of a rising sea level and depleted groundwater levels create the conditions for saltwater to intrude into freshwater supplies.[31] As sea levels rise and high tides reach further inland, saltwater may infiltrate groundwater aquifers, which in turn raise the groundwater table below the soil's surface, a process known as saltwater intrusion.[32] Keeping pace with climate change, salt water intrusion is

24. NIRAS GREENLAND, *supra* note 18, at 13.

25. *Glacier Power, supra* note 19.

26. U.S. GLOB. CHANGE RSCH. PROGRAM, FOURTH NATIONAL CLIMATE ASSESSMENT 147-173 (David Reidmiller et al. eds., 2019).

27. Charlie Eichacker, *With Rainfall Scarce, Stonington Has Turned to Trucks to Refill its Public Water Supply*, MAINE PUBLIC (Oct. 27, 2022, 09:10 AM), https://www.mainepublic.org/environment-and-outdoors/2022-10-27/with-rainfall-scarce-stonington-has-turned-to-trucks-to-refill-its-public-water-supply [https://perma.cc/N99X-WJZX].

28. ACHUTARAO ET AL., *supra* note 9.

29. *See generally* Rebecca Lindsey, *Climate Change: Mountain Glaciers*, NAT'L OCEANIC & ATMOSPHERIC ADMIN. (May 14, 2020), https://www.climate.gov/news-features/understanding-climate/climate-change-mountain-glaciers [https://perma.cc/LHB8-XBSR].

30. *Water – at the center of the climate crisis*, UNITED NATIONS https://www.un.org/en/climatechange/science/climate-issues/water (last visited Feb. 9, 2024) [hereinafter *Water – at the center of the climate crisis*] [https://perma.cc/4PLG-KF3U].

31. Eichacker, *supra* note 27.

32. *Saltwater Intrusion: A Growing Threat to Coastal Agriculture*, U.S. DEP'T OF AGRIC., https://www.climatehubs.usda.gov/hubs/northeast/topic/saltwater-intrusion-growing-threat-coastal-agriculture (last visited Feb. 9, 2024) [https://perma.cc/CXT4-W5D4].

happening faster than in past decades.[33] Climate change and increased demand are the two leading causes of water scarcity throughout the globe.

B. Drought & Water Scarcity

Without water, communities are facing economic depression, declining health, increased conflict, and voluntary and forced migration. The time spent traveling to, looking for, and collecting water accounts for billions of dollars in lost economic opportunities.[34] Of the "771 million people in the world who lack access to safe water . . . women are generally tasked with water collection."[35] Waiting in long lines at community kiosks or walking long distances to far-away water resources constitutes time spent, not income earned.[36] Contribution to the economy has been displaced by the pursuit of clean water for sanitation, resulting in an estimated $260 billion lost globally each year.[37]

Climate change, population growth, and increasing water scarcity will put escalating pressure on agriculture and food supply. The agricultural sector utilizes about seventy percent of the freshwater used globally.[38] So as water scarcity grows, agricultural production will be impaired, creating a greater barrier to food, and ultimately increasing global hunger. In addition to hunger, diminishing water resources can cause other long-term public health problems, such as dehydration, disease, and decreased sanitation and hygiene.[39] For instance, in a community along a riverbank, where water volume decreases, forcing opportunity for sanitation to decline, areas of stagnant water—serving as breeding grounds for mosquitoes carrying the West Nile Virus—are concurrently increasing.[40] And beyond disease, reduced stream and river flows will increase the concentration of pollutants in water, leading to further adverse health effects.[41] Peter Gleick of the Oakland-based Pacific Institute explains that

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33. *Id.*

34. *An Economic Crisis*, WATER.ORG, https://water.org/our-impact/water-crisis/economic-crisis/ (last visited Feb. 9, 2024) [https://perma.cc/835P-SLZG].

35. *Id.*

36. *Id.*

37. *Id.*

38. *Water – at the center of the climate crisis*, *supra* note 30.

39. *Health Implications of Drought*, CTRS. FOR DISEASE CONTROL & PREVENTION (Jan. 16, 2020), https://www.cdc.gov/nceh/drought/implications.htm [https://perma.cc/S6LM-7AEZ].

40. *Id.*

41. *Id.*

while it is possible to die of drought-caused thirst, "more and more people are dying from contaminated water or conflict over access to water."[42]

As access to water decreases, conflict over remaining water sources will increase. Water resources may cross political boundaries leading to multiple parties claiming ownership of the scarce resource, or conflict may occur when human activities upstream on a river adversely affect communities living downstream, such as dumping pollutants into the river or diverting large amounts of water away from where the water typically flows.

Without access to water, populations can be forced to relocate for more economic opportunities and a healthier environment. As described above, lack of access to water can lead to conflict. Avoiding conflict and water wars also contributes to relocation and migration. In the worst humanitarian crisis since World War II, severe drought displaced 20 million people across Africa and the Middle East.[43] This severe drought of 2017 contributed to food shortages and an eruption of conflict forcing people from their homes.[44] By the end of the decade, 700 million people will be at risk of displacement, due to worsening drought.[45] "As climate change and growing human population continue to compound the problem of droughts . . . solutions . . . become ever more necessary to stop conflict and migration."[46] Conventional water provisioning approaches are not enough to meet growing freshwater demand in water-scarce areas. Unconventional water resources are an emerging opportunity to narrow

42. Sandy Milne, *How Water Shortages are Brewing Wars*, BBC FUTURE (Aug. 16, 2021) https://www.bbc.com/future/article/20210816-how-water-shortages-are-brewing-wars [https://perma.cc/WJP8-MSDL].

43. *Id.* (citing *Amid Humanitarian Funding Gap, 20 Million People Across Africa, Yemen at Risk of Starvation, Emergency Relief Chief Warns Security Council*, UNITED NATIONS (Mar. 10, 2017), https://press.un.org/en/2017/sc12748.doc.htm [https://perma.cc/A2CX-FN44]. For the sake of comparison, Russia's invasion of Ukraine has displaced an estimated 7.1 million people, and the Israel-Hamas war has displaced an estimated 1.75 million people. *7.1 Million People Displaced by the War in Ukraine: IOM Survey*, INT'L ORG. FOR MIGRATION (Apr. 5, 2022), https://www.iom.int/news/71-million-people-displaced-war-ukraine-iom-survey [https://perma.cc/J3VP-R23Q]; Julia Frankel, *These Numbers Show The Staggering Toll Of The Israel-Hamas War*, AP NEWS (Nov. 5, 2023, 12:51 PM), https://apnews.com/article/israel-hamas-war-death-toll-numbers-injured-5c9dc40bec95a8408c83f3c2fb759da0 [https://perma.cc/465T-SGMH].

44. Milne, *supra* note 42; *Amid Humanitarian Funding Gap, 20 Million People Across Africa, Yemen at Risk of Starvation, Emergency Relief Chief Warns Security Council*, UNITED NATIONS (Mar. 10, 2017), https://press.un.org/en/2017/sc12748.doc.htm [https://perma.cc/N8SP-45C9].

45. Milne, *supra* note 42.

46. *Id.*

the water demand-supply gap.[47] As Jessica Alsford simply stated, "[s]tructurally, the global water landscape needs to change."[48]

II. ICEBERG TRANSPORT & HARVEST

The question facing the international community is whether there is a way, and how, to rectify these climate change induced dilemmas: melting glaciers and intensified drought. Each problem may have its own solution. Melting glaciers may be stopped, or slowed, by global cooling by volcanic eruption, geo-engineering, or a drastic—yet unrealistic—reduction in global greenhouse gas emissions. Water scarcity, because of intensified drought, may be remedied by bulk water transport, water conservation, or mass population relocation. Some of these solutions are simply out of the human population's control, while others would require a herculean effort to craft, pass, and implement global policy. In the meantime, communities must work to slow further climate change and react to the impacts of climate change through mitigation and adaptation.

Climate change mitigation slows the effects of climate change, or makes these effects less severe, by reducing the quantity of greenhouse gases flowing into the atmosphere.[49] There are two ways this reduction can happen: first, by reducing the source of greenhouse gas emissions, e.g., burning fossil fuels for electricity, heat, or transport, and second, by strengthening mechanisms that accumulate and store greenhouse gases, known as "sinks," such as oceans, forests, and soil.[50] Mitigation can slow the effects of climate change, and in turn, provide the Earth's population more time to adapt to climate change.[51] Adaptation reduces the harmful effects by preparing and adjusting to the projected warming climate.[52] Examples of adaptation may include building a seawall to address sea-level rise or discontinued development in areas expected to feel the worse

47. *Analytical Brief*, *supra* note 17, at 3.

48. *A Deep Dive on the Water Crisis*, MORGAN STANLEY (Feb. 14, 2022), https://www.morganstanley.com/ideas/water-scarcity-causes-and-solutions [https://perma.cc/ET7N-ST9W].

49. *What is the Difference Between Adaptation and Mitigation?*, EUR. ENV'T AGENCY (Oct. 30, 2023), https://www.eea.europa.eu/en/about/contact-us/faqs/what-is-the-difference-between-adaptation-and-mitigation [https://perma.cc/U3P6-FSR7].

50. *Responding to Climate Change*, NASA'S JET PROPULSION LAB'Y, https://climate.nasa.gov/solutions/adaptation-mitigation/ (last visited Jan. 15, 2024) [hereinafter *Responding to Climate Change*] [https://perma.cc/ZGS8-GCNR].

51. *Id.*

52. *Id.*

effects of climate change, such as flood plains and coastal wetlands.[53] Adaptation also includes capitalizing on any beneficial climate change effect, e.g., warmer temperatures extending one region's growing season, and thus, increasing that region's agricultural yield.[54]

As the Earth adapts to the impacts of climate change, melting glaciers present an opportunity to reduce the damages of intensified drought. Transporting icebergs to the coast of drought-stricken areas would provide a freshwater resource to communities that previously faced water scarcity. As technology improves, and climate change worsens, iceberg trading, transporting, and harvesting may offer relief from water scarcity.

At first, the idea of towing an iceberg from an Arctic region may not seem practical, but "scientists, scholars and politicians have been considering iceberg-harvesting as a potentially viable freshwater source since the 1950s."[55] Iceberg technology is available and regularly used; for instance, when icebergs float too closely to offshore platforms, the Canadian oil and gas industry will tow away the iceberg to stop the risk of collision.[56]

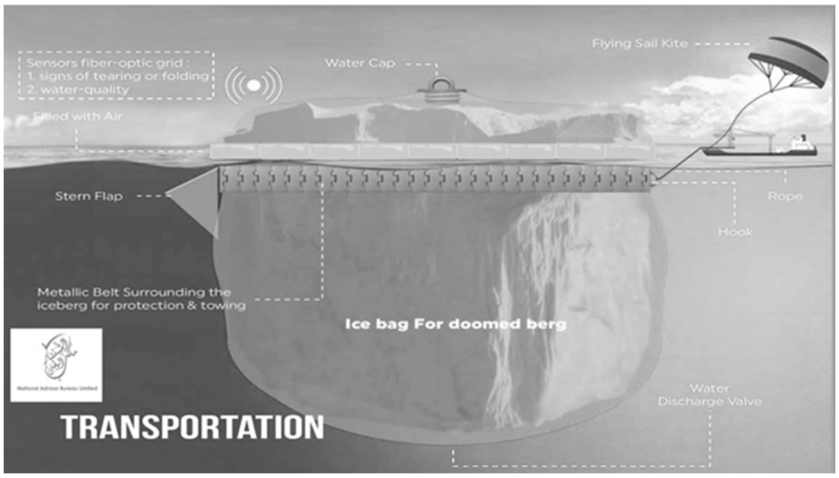

Figure 1: *Iceberg Reservoir Invention Diagram.*[57]

53. Env't Resilience Inst., *Adaptation Strategies for Sea-Level Rise*, IND. UNIV., https://eri.iu.edu/erit/strategies/sea-level-rise.html (last visited Mar. 7, 2024) [https://perma.cc/3LQY-XSAP].

54. *Responding to Climate Change*, *supra* note 50.

55. *Analytical Brief*, *supra* note 17, at 25.

56. *Id.* However, iceberg towing has yet to be carried out on a large scale. *See id.*

57. *Cutting-Edge Technology Unveiled for the UAE Iceberg Project*, BUSINESS WIRE (Mar. 14, 2022), https://www.businesswire.com/news/home/20220314005338/en/Cutting-Edge-Technology-Unveiled-for-the-UAE-Iceberg-Project [https://perma.cc/C45B-YGWD].

Additionally, a technological advancement known as an "Iceberg Reservoir" has earned a patent from the U.K. Intellectual Property Office.[58] The patent was granted to Abdulla Alshehhi, an Emirati inventor, and the founder of the United Arab Emirates (UAE) Iceberg Project.[59] The technology includes flexible, insulated, and cost-effective reservoirs, like a bag, that encompass the icebergs and attach to the vessel towing the iceberg to its destination.[60]

The technology and infrastructure required to bring the ice, water, or both, from the floating iceberg to land is less clear. While it will likely involve a system of small pipes,[61] another method may be the use of a mechanical claw.[62] Ron Stamp, a Canadian who travels to Greenland to harvest water from icebergs, retrofitted his shipping vessel after the cod fishery collapse and moratorium in 1992.[63] Now, Stamp's vessel can sidle up close to icebergs, and use a mechanical claw to rip "1,500-pound bites of ice from floating bergs and deposit[] them in tanks below deck."[64] Once the ice is harvested and stored below deck, Stamp and his crew return to St. John's, Newfoundland.[65] From here, the once-frozen resource is transferred to a container vessel bound for a bottling plant in Montreal.[66]

Floating in international waters off the coast of Dubai, the UAE Iceberg Project plans to chip blocks of ice from the surface of the iceberg, crush chipped ice into water, and then store water in large tanks for transportation to shore.[67] Most of an iceberg is underwater, so the distance from the iceberg to shore is limited by the depth of the water as collision with the seabed will preclude the iceberg from being towed any closer to

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58. *Id.*

59. *Id.*

60. *Id.*

61. Conversation and class discussion with Dr. Paul Mayewski, LAW 743: Arctic Law, Science, and Policy, University of Maine School of Law (Apr. 12, 2023).

62. Andrew Zajac, *Tasteless or Brilliant? Iceberg Water Might be Both*, L.A. TIMES, (Nov. 21, 2010), https://www.latimes.com/archives/la-xpm-2010-nov-21-la-na-iceberg-water-20101121-story.html [https://perma.cc/QC4V-H8PR].

63. Jenny Higgins, *Cod Moratorium*, NFLD. HERITAGE (2009), https://www.heritage.nf.ca/articles/economy/moratorium.php [https://perma.cc/2JHY-ZENZ]; Zajac, *supra* note 62.

64. Zajac, *supra* note 62.

65. *Id.*

66. *Id.*

67. Anjana Sankar, *Will Antarctic Icebergs Solve Fresh Water Crisis in UAE?*, KHALEEJ TIMES (Oct. 4, 2022, 3:02 PM), https://www.khaleejtimes.com/uae/will-antarctic-icebergs-solve-fresh-water-crisis-in-uae [https://perma.cc/75EL-56DE].

shore. This limitation may be minimized by anticipatory dredging and selecting a deep water port as the iceberg's destination.

In determining an iceberg's origin, existing institutions have the expertise to help. Spooked and motivated by the Titanic's sinking, the International Ice Patrol was established to "monitor the iceberg danger in the North Atlantic Ocean and provide relevant warning products to the maritime community."[68] With improved maritime navigation and shipping capacity, knowing the location of icebergs has become crucial in avoiding dangerous collisions.[69] The International Ice Patrol tracks where icebergs have been, and further, the Water, Peace, and Security Partnership knows where the icebergs should go.[70] The Water, Peace, and Security Partnership predicts and warns of climate conflict hotspots with an accuracy rate of eighty-six percent.[71] The Partnership watches "rainfall, crop failures, population density, wealth, agricultural production, levels of corruption, droughts, and flooding" among other conditions to determine future climate conflict hotspots.[72] To alleviate intensified-drought-induced water scarcity and conflict, the Partnership's data could be used to determine the most beneficial destination for an iceberg. In the interest of the global population, iceberg transport and harvest must be used to aid vulnerable populations, and not exclusively for the commercialization of water.

The cost of the moving icebergs will depend on the size, shape, and distance travelled;[73] however, "[c]ompared to the estimates for other options such as long-distance inter-basin water transfer or desalination, iceberg harvesting would be a relative bargain."[74] Plus, the sheer volume of fresh water contained in icebergs ensures the cost of accessing this

68. *International Ice Patrol – About Us*, U. S. COAST GUARD NAVIGATION CTR., https://www.navcen.uscg.gov/international-ice-patrol-about-us (last visited Feb. 12, 2024) [https://perma.cc/62QX-S3U6].

69. Erin Christensen & John Luzader, *From Sea, to Air, to Space*, *GPS Overview*, U.S. COAST GUARD NAVIGATION CTR., https://www.navcen.uscg.gov/from-sea-to-air-space (last visited Feb. 12, 2024) [https://perma.cc/UA55-ZQW2].

70. *See About the Water, Peace and Security Partnership,* WATER PEACE SEC., https://waterpeacesecurity.org/info/our-approach (last visited Feb. 28, 2024) [https://perma.cc/GS7N-AEB8].

71. *Abstract*, WATER PEACE SEC., https://waterpeacesecurity.org/info/methodology (last visited Feb. 12, 2024) [https://perma.cc/8TUC-AVX6].

72. Milne, *supra* note 42.

73. Sankar, *supra* note 67.

74. *Analytical Brief*, *supra* note 17, at 35.

water will be recouped.[75] Plus, the very existence of an iceberg off the coast of a hot, arid, region stands to become a tourist attraction, thereby creating another opportunity for profit.[76] Theoretically, just one relocated iceberg could (1) help end local water scarcity, (2) bottle and export fresh water, and (3) attract tourists.[77] The benefits of relocating icebergs seem tremendous, but many environmental impacts remain unknown. Not specific to Arctic regions, but likely analogous, the National Oceanic and Atmospheric Administration (NOAA) "suggested that pulling large quantities of icebergs out of the Antarctic has the potential to cause significant harm to Antarctic wildlife and ecosystems."[78] The most harmful impacts of iceberg allocation will likely take place at the destination of the transported iceberg, such as when the water is shallow "near its point of destination, the bottom [of the iceberg] could start to drag against the sea floor," crush wildlife habitat, disturb and churn up amounts of dirt, and ultimately "permanently alter[] the sea floor's topography."[79] Conversely, a local iceberg could have tremendous environmental benefits, besides combatting water scarcity, such as attracting clouds and associated rain, leading to increased fertile land for agriculture production or a potential carbon sink to further mitigate the impacts of climate change.[80] However, "no study has adequately considered the primary and

75. Aristos Georgiou, *Americans Are Running Out of Water. A Towering Iceberg Could Be the Answer*, NEWSWEEK (Nov. 18, 2022, 10:58 AM), https://www.newsweek.com/americans-running-out-water-towering-iceberg-could-answer-1760627 [https://perma.cc/3WZC-44NN].

76. Sankar, *supra* note 67.

77. *See* Sankar, *supra* note 67. The UAE Iceberg Project planned to "end water scarcity in the region," and make UAE "one of the biggest exporters of fresh water in the world," all while using the floating icebergs as tourist attractions. *Id.* The Project was slated to be completed in 2020. *Id.* However, there is not an iceberg floating off the coast of Fujairah, UAE, and the Project's website, www.icebergs.world, is no longer active. *See generally* Derek Baldwin, *Trial Run for UAE Iceberg Project in 2019*, GULF NEWS (July 1, 2018, 8:10 PM), https://gulfnews.com/uae/environment/trial-run-for-uae-iceberg-project-in-2019-1.2244996 [https://perma.cc/H67G-YNWW].

78. Cory J. Lewis, *Iceberg Harvesting: Suggesting a Federal Regulatory Regime for a New Freshwater Source*, 43 B.C. ENV'T. AFF. L. REV. 439, 449 (2015); *see also Water from Icebergs*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., http://oceanexplorer.noaa.gov/edu/learning/player/lesson12/l12la1.html (last visited Feb. 5, 2015) [http://perma.cc/PR8R-NVW3].

79. Lewis, *supra* note 78, at 450.

80. Sankar, *supra* note 67; Paul Ratner, *Watch How UAE Plans to Drag Icebergs from Antarctica to Solve Its Water Shortage*, BIG THINK (May 7, 2017), https://bigthink.com/the-present/watch-how-a-country-plans-to-drag-an-iceberg-from-antarctica-to-solve-its-water-shortage/ [https://perma.cc/8WKB-HVP8].

secondary impacts that iceberg harvesting would have once the ice reaches its onshore destination and is then distributed domestically."[81]

III. LAW & POLICY

There are three ways to think about iceberg governance: (1) iceberg harvesting exists within a legal vacuum,[82] (2) like fish, icebergs are a resource available to every state under United Nations Convention on the Law of the Sea (UNCLOS) Art. 87,[83] or (3) icebergs are subject to the controlling law of their coastal state of origin, specifically with regard to pollution under UNCLOS Art. 234.[84] The latter poses the most stringent governance.

UNCLOS divided the sea into different jurisdictions based on distance from the shore, such as the territorial sea, contiguous zone, exclusive economic zone, continental shelf, and the high seas.[85] Different jurisdictions require different practices, e.g., imagine a submarine moving throughout the ocean: the submarine traveling through another state's territorial sea must move on the sea's surface, but when that submarine is traveling through a jurisdiction farther from the shore, it may navigate fully-submerged underwater.[86] Furthermore, different states have different authority depending on their maritime jurisdiction. For instance, Arctic states have the greatest authority in ice-covered areas of the ocean in accordance with UNCLOS Art. 234, which states:

> Coastal States have the right to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction and control of marine pollution from vessels in ice-covered areas within the limits of the exclusive economic zone, where particularly severe climatic conditions and the presence of ice covering such areas for most of the year create obstructions or exceptional hazards to navigation, and pollution of the marine environment could cause major harm to or irreversible disturbance of the ecological balance. Such laws and regulations shall have

81. Lewis, *supra* note 78, at 450.

82. *Id.* at 442.

83. U.N. Convention on the Law of the Sea, art. 87, *opened for signature* Dec. 10, 1982, 1833 U.N.T.S. 397 [hereinafter UNCLOS]; Mateusz Osiecki, *United Arab Emirates "Iceberg Project" – Would an Ambitious Concept Comply with International Law?*, 16 IUS NOVUM 191, 193 (2022) (discussing UAE Iceberg Project's claim that icebergs can be considered a "resource and subject to acquisition for private use anywhere in the world").

84. UNCLOS, *supra* note 83, art. 234.

85. *See generally* UNCLOS, *supra* note 83, arts. 3, 33, 57, 76, 86.

86. UNCLOS, *supra* note 83, art. 20.

> due regard to navigation and the protection and preservation of the marine environment based on the best available scientific evidence.[87]

Under the guise of "prevention, reduction and control of marine pollution," Russia has used UNCLOS Art. 234 to control the Northern Sea Route.[88] Using the same guise, Arctic states could use Art. 234 to govern icebergs, and ultimately, control an iceberg's capture, transfer, and use.[89] However, an Arctic state's broad authority to address marine pollution disappears beyond the coastal state's exclusive economic zone, i.e., in water farther than 200 nautical miles from the shore of the coastal state.[90] For Arctic states hoping to exhibit power over iceberg harvesting, transport, and trade, it would be advantageous to follow Russia's example and use their authority vested in UNCLOS Art. 234 to assert their right to icebergs floating in their waters, or at the very least, originating in their waters.

Conversely, UNCLOS Art. 234 may act as a barrier for non-Arctic states. UNCLOS Parties seeking to control icebergs, without the vested authority of UNCLOS Art. 234, are likely to argue icebergs are governed by UNCLOS Art. 87. Art. 87 enumerates the freedoms of the high seas, but the freedom to harvest, transport, or trade icebergs is not expressly contained in UNCLOS Art. 87.[91] Not dissuaded, the UAE Iceberg Project uses the freedom of the high seas as its legal basis to commercialize icebergs, arguing icebergs are a "resource and subject to acquisition for private use anywhere in the world."[92] This broad interpretation of Art. 87 has not been substantiated, but that does not foreclose the opportunity to utilize the freshwater stored in icebergs. UNCLOS Art. 140 supports an iceberg trade, and all activity in the high seas, when the activity is "carried out for the benefit of mankind."[93] In sum, UNCLOS likely does not

87. UNCLOS, *supra* note 83, art. 234.

88. For instance, "[o]ne Russian law requires all vessels passing through the Northern Sea Route to be piloted by Russians," and another "requires that passing vessels pay tolls and provide advance notice of their plans to use the route." *Melting Arctic Ice Could Transform International Shipping Routes, Study Finds*, BROWN UNIV., https://www.brown.edu/news/2022-06-22/arctic (last visited Jan. 15, 2024) [https://perma.cc/U6ZD-ZB3C].

89. *See generally* Stanley P. Fields, *Article 234 of the United Nations Law of the Sea: The Overlooked Linchpin for Achieving Safety and Security in the U.S. Arctic?*, 7 HARV. NAT'L SEC. J. 55, 72-103 (2016).

90. UNCLOS, *supra* note 83, arts. 234, 57.

91. UNCLOS, *supra* note 83, art. 87.

92. Osiecki, *supra* note 83, at 193.

93. UNCLOS, *supra* note 83, art. 140.

provide the legal basis for commercialized iceberg activity but does provide the legal basis for an iceberg trade to combat the effects of climate change for the benefit of mankind.

Global players, like the United States, who are not a Party to UNCLOS, are likely to argue that harvesting, transporting, and trading icebergs exists in a legal vacuum.[94] By ignoring any potential pre-existing iceberg governance and policy, these entities are not subject to controlling law and can potentially create iceberg resource regulation in a way to protect and prioritize their interests.[95] Any activity of this sort is mere speculation.

A. Right to Water

To shift the perspective away from a legal affirmation to transport and harvest icebergs, it is crucial to consider the possibility that the legal authority, and potential duty, to transport and harvest icebergs originates from a right to water. An inherent right to water is included in express rights in the 1948 Universal Declaration of Human Rights (UDHR),[96] the 1967 International Covenant on Economic, Social and Cultural Rights (ICESCR),[97] and the 1966 International Covenant on Civil and Political Rights (ICCPR).[98] Article 25 of the UDHR reads, "[e]veryone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services . . . ."[99] Freshwater is essential to food, as well as hygiene and sanitation, which is essential to medical care. There cannot be a right to a standard of living adequate for health and well-being without a right to water. Less than two decades later, the ICESCR declared "the right of everyone to an adequate standard of living for himself and his family, including adequate food, clothing and housing, and to the continuous improvement of living conditions."[100] At the most basic level, without access to water, a right to food is impossible. Furthermore, the ICESCR assigns responsibility to Parties to "take appropriate steps to

94. *See* Lewis, *supra* note 78, at 442.

95. *Id.*

96. G.A. Res. 217 (III) A, Universal Declaration of Human Rights (Dec. 10, 1948) [hereinafter UDHR].

97. G.A. Res. 2200 (XXI) A, International Covenant on Economic, Social and Cultural Rights, art. 11, (Dec. 16, 1966) [hereinafter ICESCR].

98. G.A. Res. 2200 (XXI) A, International Covenant on Civil and Political Rights (Dec. 16, 1966) [hereinafter ICCPR].

99. UDHR, *supra* note 96, art. 25.

100. ICESCR, *supra* note 97, art 11.

ensure the realization of this right, recognizing to this effect the essential importance of international co-operation based on free consent"[101] supporting the notion that the term "right" implies that States have a duty to protect and promote those rights for an individual. The second sentence of Article 11 mandates international cooperation and action to ensure each person's right to an adequate standard of living.[102]

The ICCPR expressly declared a right to life in Article 6, asserting "[e]very human being has the inherent right to life. This right shall be protected by law. No one shall be arbitrarily deprived of his life."[103] A deprivation of water is a deprivation of life; therefore, the deprivation of water is a violation of human rights. International human rights law obliges states to work towards achieving universal access to water, absent of discrimination, while prioritizing those most in need.[104] If the right to life must be protected by law, then the deprivation of water must be outlawed. Fueled by human activity and its associated greenhouse gas emissions, the Earth's warming arbitrarily deprives people of their lives, which is a violation of the last sentence of Article 6 of the ICCPR. It follows that, emission-generating activities, which are intensifying weather events and arbitrarily increasing water scarcity, and in turn depriving life, must be outlawed as they are a violation of other human rights. In sum, large-scale greenhouse gas emissions are violating the human rights of the people in the communities feeling climate change's harshest impacts and states are obligated to craft and implement policy to reverse these human rights violations.

B. The Paris Agreement

Continued greenhouse gas emissions, and continued warming temperatures will "unleash far more severe climate change impacts, including more frequent and severe droughts . . ." exacerbating water scarcity, water deprivation, and increasing human rights violations.[105] In 2015, in response to the deadly effects of climate change, 196 Parties at the United Nations Climate Change Conference (COP21) in Paris, France joined forces by signing, and committing to, the Paris Agreement, a legally

101. *Id.*
102. *Id.*
103. ICCPR, *supra* note 98, art. 6.
104. *World Water Dev. Rep., supra* note 6, at 2.
105. Alind Chauhan, *Why 2023 Was the Warmest Year Ever, and What Happens Now*, THE INDIAN EXPRESS (Jan. 10, 2024, 7:37 AM), https://indianexpress.com/article/explained/explained-climate/why-2023-was-the-warmest-year-ever-9102355/ [https://perma.cc/5DRD-M84F].

binding international treaty on climate change.[106] Working in five-year cycles, the Paris Agreement prompts increasingly ambitious climate action.[107] So every five years, each Party to the Paris Agreement "ratchet[s] up" their climate commitments. Climate commitments are known as Nationally Determined Contributions (NDCs), which outline how each country will accomplish the goals enumerated in the Paris Agreement.[108]

1. Loss & Damages

The countries who have emitted the least amount of greenhouse gases are generally the same countries that have been harmed the greatest by the compounding effects of climate change.[109] For example, Pakistan has contributed less than one percent of the global greenhouse gas emissions, yet in the summer of 2022, a third of the country was underwater.[110] A glacier-melting heatwave, immediately followed by extreme rainfall, caused severe flooding, and ultimately the death of 1,700 people, stranded communities, drowned and damaged crops, orchards, and livestock; even after the rain stopped, malaria cases surged as mosquitoes bred in stagnant water.[111] Higher temperatures in Pakistan, due to climate change, intensified the rainfall that devastated the country.[112] The Paris Agreement offered a glimmer of hope for countries like Pakistan when it reaffirmed

106. *The Paris Agreement*, UNITED NATIONS CLIMATE CHANGE, https://unfccc.int/process-and-meetings/the-paris-agreement (last visited Feb. 19, 2024) [https://perma.cc/E9ZN-ZB8U]; U.N. Framework Convention on Climate Change, *Report of the Conference of the Parties on its twenty-first session*, U.N. Doc. FCCC/CP/2015/10/Add.1 (Jan. 29, 2016).

107. *The Paris Agreement: How Does the Paris Agreement Work?*, UNITED NATIONS CLIMATE CHANGE, https://unfccc.int/process-and-meetings/the-paris-agreement (last visited Dec 30, 2023) [hereinafter *How Does the Paris Agreement Work?*] [https://perma.cc/PXN8-WYKV].

108. *Id.*

109. Seth Borenstein & Drew Costley, *Climate Change Caused by Wealthy Nations Creates Harm for Poorer, Study Says*, PBS NEWSHOUR (July 12, 2022), https://www.pbs.org/newshour/science/climate-change-caused-by-wealthy-nations-creates-harm-for-poorer-study-says [https://perma.cc/X9E8-D8EY].

110. Bethany Tietjen, *Many of the World's Poorest Countries are the Least Polluting but the Most Climate Vulnerable. Here's What They Want at COP27*, PBS NEWSHOUR (Nov. 2, 2022, 1:29 PM), https://www.pbs.org/newshour/science/many-of-worlds-poorest-countries-are-the-least-polluting-but-the-most-climate-vulnerable-heres-what-they-want-at-cop27 [https://perma.cc/WMA7-EC6C].

111. *Id.*

112. Friederike E. L. Otto et al., *Climate Change Likely Increased Extreme Monsoon Rainfall, Flooding Highly Vulnerable Communities in Pakistan*, 2 ENV'T RSCH.: CLIMATE 2, 3 (2023).

that "developed countries should take the lead in providing financial assistance to countries that are less endowed and more vulnerable" to the impacts of climate change.[113] The glimmer of hope evolved into a loss and damages fund.[114] A dedicated fund, financed by developed countries, will aid developing countries, who are most vulnerable to the harmful effects of climate change, with recovery, resilience, and preparation for past, current, and future climate impacts.[115]

The Alliance of Small Island States was the first to introduce a loss and damages strategy, emphasizing the importance of linking climate change mitigation to a compensatory scheme.[116] The idea of loss and damages mirrors the American tort system's two central concerns: harm caused by human activity and allocation of harm-caused-costs.[117] The American tort system works to reallocate costs from the victims of harm to those who are found to have contributed to creating the harm.[118] Similarly, a loss and damages fund would create a compensatory scheme to transfer the costs of climate change from the victims of climate change to the perpetrators of climate change. The UNFCCC defines loss and damage as "the actual and/or potential manifestation of impacts associated with climate change in developing countries that negatively affect human and natural systems."[119] For example, climate change impacts may manifest as extreme weather events, like the heatwave and torrential downpour in Pakistan, or climate change impacts may manifest over time,

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113. *The Paris Agreement*, UNITED NATIONS CLIMATE CHANGE, https://unfccc.int/process-and-meetings/the-paris-agreement (last visited Feb. 3, 2024) [https://perma.cc/DL3S-FJ5P].

114. Nathan Rott et al., *Did the World Make Progress on Climate Change? Here's What Was Decided at Global Talks*, NPR (Nov. 20, 2022, 9:44 AM), https://www.npr.org/2022/11/20/1137349916/did-the-world-make-progress-on-climate-change-heres-what-was-decided-at-global-t [https://perma.cc/3RZ6-RLPE].

115. *See generally* Lauren Sommer, *Countries Promise Millions for Damages From Climate Change. So How Would That Work?*, NPR (Dec. 1, 2023, 5:00 AM), https://www.npr.org/2023/12/01/1216243518/cop28-loss-damage-fund-climate-change# [https://perma.cc/5NW7-Z8N4].

116. Cynthia Liao, et al., *What Is Loss and Damage?*, CHATHAM HOUSE (Dec. 6, 2022), https://www.chathamhouse.org/2022/08/what-loss-and-damage [https://perma.cc/XA7F-GKHK].

117. David A. Grossman, *Warming up to a Not-So-Radical Idea: Tort-Based Climate Change Litigation*, 28 COLUM. J. ENV'T. L. 1, 3 (2003).

118. *Id.* at 2.

119. Saleemul Huq & Roger-Mark De Souza, *Climate Compensation: How Loss and Damage Fared in the Paris Agreement*, NEW SEC. BEAT (Jan. 12, 2016), https://www.newsecuritybeat.org/2016/01/loss-damage-fared-paris-agreement/ [https://perma.cc/HXF3-ZUAT].

like sea level rise and glacial retreat.[120] Specifically, "[l]oss" refers to the "complete disappearance of something such as human lives, habitats, or even species . . . gone forever and cannot be brought back," whereas "[d]amage" is "something that can be repaired, such as a road or building or embankment."[121] A loss and damages fund shifts the cost of climate change consequences by assisting developing countries in responding to their climate-caused loss and damage.[122]

Almost seven years after the signing of the Paris Agreement, countries closed COP27 with hard-fought negotiations, and finally, a deal for a loss and damages fund.[123] Developed nations, such as the United States and those constituting the European Union, were hesitant about an agreement which relies on more developed nations to pay up.[124] Some hesitation and push back against contributing to a loss and damages fund is based on the speculative concern that developing nations will misappropriate received funds.[125] Although a deal regarding a loss and damages fund was finally struck, questions remain about the details of the fund, and it will likely be several years before the fund is operating as intended.[126] While not ideal, it is realistic that wealthy, high-emitting, developed countries would be resistant about contributing to a loss and damages fund.

2. Injunctive Relief

In the American tort system, the alternative to monetary remedies and compensatory damages is injunctive relief.[127] Injunctive relief is a type of remedy that restrains the liable party from doing certain acts or requires

120. *Id.*

121. *Id.*

122. *COP27 Reaches Breakthrough Agreement on New "Loss and Damage" Fund for Vulnerable Countries*, UNITED NATIONS CLIMATE CHANGE (Nov. 20, 2022), https://unfccc.int/news/cop27-reaches-breakthrough-agreement-on-new-loss-and-damage-fund-for-vulnerable-countries [https://perma.cc/SZ8A-7HKF].

123. Valerie Volcovici et al., *COP27 Delivers Climate Fund Breakthrough at Cost of Progress on Emissions*, REUTERS (Nov. 21, 2022, 1:01 AM), https://www.reuters.com/business/cop/countries-agree-loss-damage-fund-final-cop27-deal-elusive-2022-11-20/ [https://perma.cc/NF4C-ZVJ6].

124. *Id.*

125. Borenstein & Costley, *supra* note 109.

126. Volcovici et al., *supra* note 123.

127. *See generally Injunction*, CORNELL L. SCH., https://www.law.cornell.edu/wex/injunction (last visited Feb. 3, 2024) [hereinafter *Injunction*] [https://perma.cc/B8DX-S3JH].

the liable party to act a certain way.[128] Generally, "injunctive relief is only available when there is no other remedy at law and irreparable harm will result if an injunction is not granted."[129] Continuing the analogy of the American tort system and climate action within the UNFCCC, injunctive relief, as opposed to a loss and damages fund, should be considered. Developed countries will remain hesitant to contribute to a loss and damages fund. Eventually, after hesitation, comes negotiation, all while vulnerable, underdeveloped countries are facing irreparable harm. It is time that an injunction—action or ceased action—is seriously considered.

Possibly the most effective form of remedy would be an injunction on extracting and burning fossil fuel and emitting greenhouse gases. A sudden moratorium is unrealistic, as certain sectors of the global economy are so closely aligned with the fossil fuel industry.[130] Instead, NDCs, as discussed above, explain each country's action plan to phase out fossil fuels and cut emissions.[131] As an alternative to ceasing action, another equitable remedy worth considering is natural resource contribution. If developed countries are not willing to contribute to a loss and damages fund, they may be willing to contribute a resource of which they have excess. Specifically, wealthy, developed, greenhouse gas emitting countries may be willing to contribute freshwater in the form of an iceberg, to countries suffering from water scarcity caused by droughts intensified by warming temperatures.

As mentioned earlier, there is concern surrounding developing countries, who would have received financial support from a loss and damages fund, failing to use the money for mitigation and adaptation, as intended. Contribution of resources, like fresh water contained in an iceberg, in lieu of strictly financial support, assuages the concern that receiving countries could misappropriate funds. However, providing or contributing a resource, without the proper management program in the destination location could be a futile action. For instance, delivering an iceberg to the coast of a drought-stricken community is purposeless without the infrastructure to harvest the ice, and bring water to shore at the iceberg's destination. Furthermore, a comprehensive water distribution and management system is required for maximum benefit and to ensure

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128. Injunctive relief is also known as an injunction. *Injunctive Relief*, CORNELL L. SCH., https://www.law.cornell.edu/wex/injunctive_relief (last visited Jan. 11, 2024) [https://perma.cc/B8DX-S3JH] [hereinafter *Injunctive Relief*]. "An injunction is a court order requiring a person to do or cease doing a specific action." *Injunction*, *supra* note 127.

129. *Injunctive Relief*, *supra* note 128.

130. *See generally* Arthur Rempel & Joyeeta Gupta, *Fossil Fuels, Stranded Assets and COVID-19: Imagining an Inclusive & Transformative Recovery*, 146 WORLD DEV. 1, 1-3 (2021).

131. *How Does the Paris Agreement Work?*, *supra* note 107.

water landed with the most vulnerable and in-need communities, even though there may be a temptation to harvest, bottle, and sell water for economic gain instead. Combating the impacts of climate change through natural resource aid, specifically iceberg contribution, will require more than the physical delivery of an iceberg from Arctic regions to drought-stricken, water-scarce communities.

CONCLUSION

The Earth is warming, glaciers are melting, and the planet's largest resource of freshwater is wasting into the ocean. At the same time, warming temperatures are causing intensified weather events, more severe droughts, and increased water scarcity. Demand for water is rising while supply of water is diminishing. Humans have a right to water, and states are obliged to work towards ensuring this right. The technology and demand exist for the unconventional method of water capture, transport, and harvest of icebergs. States must collaborate and cooperate to craft, pass, and implement policy that protects the most vulnerable from the impacts of climate change. While striking a deal for a loss and damages fund was a tremendous feat, the Earth does not have infinite time to negotiate the unanswered questions of a loss and damages fund. In the meantime, stakeholders cannot be closed-minded to alternative climate action, such as natural resource trade, and more specifically, a global iceberg trade. Many unknowns remain, and further studies and data gathering are needed, but the citizens of the Earth cannot rule out the transport and harvest of icebergs in the face of catastrophic, even deadly, effects of climate change.