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Human Rights Dimensions of Bioenergy With Carbon Capture and Storage: A Framework for Climate Justice in the Realm of Climate Geoengineering

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Introduction

One of the most striking aspects of the new Paris Agreement[1] to the United Nations Framework Convention on Climate Change (UNFCCC)[2] is the incorporation of human rights language in its preamble. While the human rights community in recent years has sought to highlight the nexus between climate change and human rights,[3] the climate change community has historically been far more reluctant to do so.[4] In 2010, however, the Parties to the UNFCCC adopted a resolution providing that the Parties "should, in all *climate change related actions*, fully respect human rights."[5] After contentious debate,[6] the Paris Agreement became the first climate change instrument, and one of the first environmental

1. *Adoption of the Paris Agreement*, UNFCC Conference of the Parties, 21st Sess., U.N. Doc. FCCC/CP/2015/10/Add.1 (Dec. 12, 2015), http://unfccc.int/files/home/application/pdf/paris_agreement.pdf [hereinafter *Paris Agreement*].
2. United Nations Framework Convention on Climate Change, May 9, 1992, 31 I.L.M. 849.
3. *See, e.g.*, United Nations Human Rights Council Res. 29/15, Human Rights and Climate Change (2015) ("Affirming that human rights obligations, standards and principles have the potential to inform and strengthen international, regional and national policymaking in the area of climate change"), http://ap.ohchr.org/documents/dpage_e.aspx?si=A/HRC/29/L.21; United Nations Human Rights Council Res. 26/27, Human Rights and Climate Change, 26th Sess., U.N. Doc. A/HRC/RES/26/27 (2014) ("Emphasizing that the adverse effects of climate change have a range of implications, both direct and indirect, for the effective enjoyment of human rights"), http://ap.ohchr.org/documents/dpage_e.aspx?si=A/HRC/26/L.33/Rev.1; United Nations Human Rights Council Res. 10/4, Human Rights and Climate Change, 10th Sess., U.N. Doc. A/HRC/10/L.11 (2009) ("Climate change-related impacts have a range of implications, both direct and indirect, for the effective enjoyment of human rights"), http://ap.ohchr.org/documents/E/HRC/resolutions/A_HRC_RES_10_4.pdf; *Report of the Office of the United Nations High Commissioner for Human Rights on the Relationship Between Climate Change and Human Rights*, U.N. Human Rights Council, 10th Sess., Provisional Agenda Item 2, at para. 75, U.N. Doc. A/HRC/10/61 (2009).
4. Sheila R. Foster & Paolo Galizzi, *Human Rights and Climate Change: Building Synergies for a Common Future*, *in* Climate Change Law 43, 44 (Daniel A. Farber & Marjan Peeters eds., 2016); Megan H. Herzog, *Coastal Climate Change Adaptation and International Human Rights*, *in* Climate Change Impacts on Ocean and Coastal Law 593, 605 (Randall S. Abate ed., 2015).
5. *Report of the Conference of the Parties on Its Sixteenth Session, Held in Cancun From 29 November to 10 December 2010—Addendum, Part Two: Action Taken by the Conference of the Parties at Its Sixteenth Session, Decisions Adopted by the Conference of the Parties*, UNFCCC, 16th Sess., Decision 1/CP.16, at 4, para. 8, U.N. Doc. FCCC/CP/2010/7/Add.1 (2010) (emphasis added), http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf. While not explicitly referring to human rights impacts, the Kyoto Protocol to the UNFCCC includes consistent language, providing that industrialized countries should strive to "minimize adverse social, environmental and economic impacts on developing country Parties" in terms of mitigation response measures. *Decisions Adopted by the Conference of the Parties*, UNFCCC, Decision 1/CP.3, U.N. Doc. FCCC/CP/1997/L.7/Add.1 (1997), *reprinted in* 37 I.L.M. 22 (1997), at art. 3(14).
6. *Human Rights in Climate Pact Under Fire: Norway, Saudis, US Blocking Strong Position*, Hum. Rts. Watch, Dec. 7, 2015, https://www.hrw.org/news/2015/12/07/human-rights-climate-pact-under-fire; Marc Limon, *Why Human Rights Must Be at Heart of Climate Change Decisions*, World Econ. F., Sept. 14, 2015, https://www.weforum.org/agenda/2015/09/why-human-rights-must-be-at-the-heart-of-climate-change-decisions/.

agreements, to explicitly recognize the relevance of human rights in the context of climate change policymaking.[7]

In pertinent part, the Agreement provides:

> Parties should, when taking action to address climate change, respect, promote and consider their respective obligations on human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities and people in vulnerable situations and the right to development, as well as gender equality, empowerment of women and intergenerational equity.[8]

While the Paris Agreement's recognition of the potential human rights impacts of responses to climate change is a positive step forward, there is a compelling need to translate this provision, as Basil Ugochukwu observed in 2015, "in ways that integrate human rights into practical actions in specific climate change policies."[9]

This chapter proposes a framework for operationalizing the Paris Agreement's human rights language in the context of an emerging potential response to climate change, bioenergy with carbon capture and storage (BECCS). BECCS seeks to reduce concentrations of carbon dioxide (CO_2) in the atmosphere in a process by which biomass is converted to heat, electricity, or liquid or gas fuels, coupled with CO_2 capture and sequestration (CCS), whereby CO_2 is stored terrestrially or in the ocean.[10] BECCS is denominated a "negative emissions technology" because it can effectuate a permanent net removal of CO_2, as opposed to processes that merely reduce emissions to the atmosphere.[11] BECCS facilitates this by absorption of carbon dioxide by the burning of biomass feedstocks, and subsequent storage for indefinite periods of time in geological formations.[12] More broadly,

7. *Report of the Special Rapporteur on the Issue of Human Rights Obligations Relating to the Enjoyment of a Safe, Clean, Healthy, and Sustainable Environment*, U.N. Human Rights Council, 31st Sess., Agenda Item 36, at 6, U.N. Doc. A/HRC/31/52 (2006), http://www.ohchr.org/EN/HRBodies/HRC/RegularSessions/Session31/Documents/A%20HRC%2031%2052_E.docx.
8. *Paris Agreement*, *supra* note 1, at pmbl.
9. Basil Ugochukwu, CIGI Papers, No. 82—Climate Change and Human Rights: How? Where? When? 9 (2015). *See also* International Human Rights Law Clinic et al., Protecting People and the Planet: A Proposal to Address the Human Rights Impacts of Climate Change Policy 7 (2009), https://repositories.lib.utexas.edu/bitstream/handle/2152/7464/Protecting_People_and_the_Planet-Berkeley.pdf?sequence=2&isAllowed=y.
10. European Biofuels Technology Platform, Biomass With CO_2 Capture and Storage (Bio-CCS) 5 (2012), http://biofuelstp.eu/downloads/bioccsjtf/EBTP-ZEP-Report-Bio-CCS-The-Way-Forward.pdf.
11. International Energy Agency, Combining Bioenergy With CCS: Reporting and Accounting for Negative Emissions Under UNFCCC and the Kyoto Protocol 6 (2011), https://www.iea.org/publications/freepublications/publication/bioenergy_ccs.pdf.
12. C. Gough & N.E. Vaughan, Synthesizing Existing Knowledge on the Feasibility of BECCS 5 (Feb. 2015), http://avoid-net-uk.cc.ic.ac.uk/wp-content/uploads/delightful-downloads/2015/07/

BECCS is a technological option that falls under the broader rubric of "climate geoengineering," defined by the U.K.'s Royal Society as "the deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change."[13]

Part I of the chapter provides an overview of climate geoengineering options, with a focus on BECCS, and considers why these options are being actively discussed in the climate policymaking community. Part II discusses the potential human rights implications of BECCS, including within the context of the Paris Agreement. Part III proposes a human rights-based approach to operationalizing the human rights provisions of the Paris Agreement in the context of BECCS. It suggests that a human rights-based approach is an important safeguard to address intrinsic issues of equity and justice that would arise if the international community opts to implement this climate geoengineering strategy.[14]

I. The Growing Impetus for Climate Geoengineering and BECCS

In recent years, there has been mounting evidence that temperature increases of 1.5–2°C above pre-industrial levels could have extremely serious impacts on global ecosystems and human institutions, especially in vulnerable developing countries.[15] There has also been growing concern that feckless climate policy responses may ensure that the globe exceeds critical climatic thresholds during this century, or that we could pass critical "tipping points" that precipitate abrupt, and nonlinear, climatic change on the earth.[16] As a consequence,

Synthesising-existing-knowledge-on-the-feasibility-of-BECCS-AVOID-2_WPD1a_v1.pdf.

13. The Royal Society, Geoengineering the Climate: Science, Governance, and Uncertainty 11 (2009), https://royalsociety.org/~/media/Royal_Society_Content/policy/publications/2009/8693.pdf.
14. Michael Burger & Jessica Wentz, Climate Change and Human Rights 10 (United Nations Environment Programme 2015), http://apps.unep.org/publications/index.php?option=com_pub&task=download&file=011917.
15. Carl-Friedrich Schleussner et al., *Differential Climate Impacts for Policy-Relevant Limits to Global Warming: The Case of 1.5 C and 2 C*, 7 Earth Sys. Dynamics 327–51 (2016); Hannah Osborne, *Paris COP21 Climate Talks: What Is the 2C Limit and What Happens if Global Warming Exceeds It?*, Int'l Bus. Times, Nov. 28, 2015, http://www.ibtimes.co.uk/paris-cop21-climate-talks-what-2c-limit-what-happens-if-global-warming-exceeds-it-1530851; World Bank Group, Turn Down the Heat 5–29 (2014), https://openknowledge.worldbank.org/handle/10986/20595; V. Ramanathan & Y. Feng, *On Avoiding Dangerous Anthropogenic Interference With the Climate System: Formidable Challenges Ahead*, 105 Proc. Nat'l Acad. Sci. 14245, 14245 (2008).
16. U.S. Government Accountability Office (GAO), Report to the Chairman, Committee on Science and Technology, House of Representatives, Climate Change: A Coordinated Strategy Could Focus Federal Geoengineering Research and Inform Governance Efforts 6 (2010) (GAO-10-903), http://www.gao.gov/assets/320/310105.pdf. Mason Inman, *Planning for Plan B*, 4 Nature Climate Change 7, 7 (2010).

climate geoengineering options, considered largely outside the mainstream of climate policymaking until a decade ago,[17] have emerged from the shadows, leading to legislative hearings,[18] calls for government-sponsored research programs,[19] limited scientific research,[20] and extensive assessment by the Intergovernmental Panel on Climate Change (IPCC).[21] Many members of the climate community were extremely hopeful that the Paris Agreement would prove to be a transformative moment in terms of climate policymaking. However, while the Agreement aims to hold temperatures to within this range,[22] the emissions reduction pledges made by the Parties to the UNFCCC to date put

17. Nils Markusson et al., "*In Case of Emergency Press Here": Framing Geoengineering as a Response to Dangerous Climate Change*, 5 WIREs Climate Change 281, 281 (2014); GAO, *supra* note 16; *see* Wil Burns & Simon Nicholson, *Governing Climate Geoengineering*, *in* New Earth Politics 345–50 (Simon Nicholson & Sikina Jinnah eds., 2016).
18. Chairman Bart Gordon, U.S. House Committee on Science and Technology, Engineering the Climate: Research Needs and Strategies for International Coordination ii (2010), http://democrats.science.house.gov/sites/democrats.science.house.gov/files/10-29%20Chairman%20Gordon%20Climate%20Engineering%20report%20-%20FINAL.pdf; U.K. House of Commons Science and Technology Committee, The Regulation of Geoengineering—Fifth Report of Session 2009–10, at 27–43 (2010), http://www.publications.parliament.uk/pa/cm200910/cmselect/cmsctech/221/221.pdf.
19. The Royal Society, *supra* note 13, at ix; National Research Council of the National Academies, Climate Intervention: Reflecting Sunlight to Cool Earth 6 (2015), http://www.nap.edu/catalog/18988/climate-intervention-reflecting-sunlight-to-cool-earth; National Research Council of the National Academies, Climate Intervention: Carbon Dioxide Removal and Reliable Sequestration 107 (2015), http://www.nap.edu/catalog/18805/climate-intervention-carbon-dioxide-removal-and-reliable-sequestration. Most recently, a bill, S. 2084, was introduced into the U.S. Senate calling for the U.S. Department of Energy to study one category of climate geoengineering, which it terms "albedo modification," also known as solar radiation management (*see infra* notes 24–35 and accompanying text); Energy and Water Development Appropriations Bill, S. Rep. No. 114-236, 114th Cong. (2015/2016).
20. Institute for Advanced Sustainability Studies, *Managing the Climate? The Risks and Uncertainties of Climate Engineering*, http://www.iass-potsdam.de/en/research/emerging-technologies/climate-engineering (last visited Aug. 22, 2016); Eli Kintisch, *Bill Gates Funding Geoengineering Research*, Sci., Jan. 26, 2010, http://www.sciencemag.org/news/2010/01/bill-gates-funding-geoengineering-research; Cao Long et al., *Geoengineering: Basic Science and Ongoing Research Efforts in China*, 6 Advances in Climate Change Res. 188–96 (2015).
21. IPCC, Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change 29 (2013), http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf [hereinafter Climate Change 2013]; IPCC, Climate Change 2014: Impacts, Adaptation and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change 92 (2014), https://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-PartA_FINAL.pdf; Ottmar Edenhofer et al., Climate Change 2014: Mitigation of Climate Change, Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change 256 (2014), https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_full.pdf. Moreover, the chair of the IPCC, Hoesung Lee, has advocated research on potential large-scale deployment of climate geoengineering, including governance considerations. Suzanne Goldenberg, *UN Climate Science Chief: It's Not Too Late to Avoid Dangerous Temperature Rise*, The Guardian, May 11, 2016, https://www.theguardian.com/environment/2016/may/11/un-climate-change-hoesung-lee-global-warming-interview.
22. *Paris Agreement*, *supra* note 1, at art. 2(1)(a).

the globe on track for temperature increases of between 2.6–3.7°C by 2100,[23] with even higher temperatures in centuries to come.[24]

Climate geoengineering options are generally divided into two broad categories: solar radiation management (SRM) and CO_2 removal (CDR).[25] SRM geoengineering approaches focus on reducing the amount of solar radiation absorbed by the earth (estimated at approximately 235 $W \cdot m^{-2}$ currently) by an amount sufficient to offset some, or all, of the increased trapping of infrared radiation by rising levels of greenhouse gases (GHGs).[26] There are three leading SRM options. The first is sulfur aerosol injection (SAI), which would seek to enhance planetary albedo (surface reflectivity of sun's radiation) through the injection of a gas, such as sulfur dioxide, into the stratosphere, potentially exerting a potent cooling effect.[27] The sec-

23. Joeri Rogelj et al., *Paris Agreement Climate Proposals Need a Boost to Keep Warming Well Below 2°C*, 534 Nature 631, 634 (2016); *Paris Agreement: Stage Set to Ramp Up Climate Action*, Climate Action Tracker, Dec. 12, 2015, http://climateactiontracker.org/news/257/Paris-Agreement-stage-set-to-ramp-up-climate-action.html; Kelly Levin & Taryn Fransen, *INSIDER: Why Are INDC Studies Reaching Different Temperature Estimates?*, World Resources Inst., Nov. 9, 2015, http://www.wri.org/blog/2015/11/insider-why-are-indc-studies-reaching-different-temperature-estimates. The Paris Agreement provides for a "global stocktake" every five years "to assess the collective progress towards achieving the purpose of this Agreement and its long-term goals," with an eye to enhancing domestic and international commitments to meet the Agreement's overarching objectives, if necessary. *Paris Agreement*, *supra* note 1, at art. 14. While this provision could help the Parties avoid passing the 2°C threshold, this would require strengthened commitments prior to the Agreement entering into force, and more ambitious long-term commitments. Wolfgang Obergassel et al., Phoenix From the Ashes—An Analysis of the Paris Agreement to the United Nations Framework Convention on Climate Change 45 (Wuppertal Institute for Climate, Environment, and Energy 2016), http://wupperinst.org/uploads/tx_wupperinst/Paris_Results.pdf. Economic models project that the 2°C target could be "lost" in terms of economic feasibility by 2027, and the 2.5°C target after 2040. Guido Visconti, Fundamentals of Physics and Chemistry 765, 771 (2016). Moreover, the world's remaining "carbon budget" to avert passing the 2°C threshold may also be far lower than many current estimates given uncertainties about many critical parameters. Glen P. Peters, *The "Best Available Science" to Inform 1.5°C Policy Choices*, 6 Nature Climate Change 1 (2016), http://www.nature.com/nclimate/journal/vaop/ncurrent/pdf/nclimate3000.pdf.

24. Peter U. Clark et al., *Consequences of Twenty-First Century Policy for Multi-Millennial Climate and Sea-Level Change*, 6 Nature Climate Change 360, 361 (2016); Gregory Trencher, *Climate Change: What Happens After 2100?*, Our World, Nov. 16, 2011, http://ourworld.unu.edu/en/climate-change-what-happens-after-2100.

25. William C.G. Burns, *Geoengineering the Climate: An Overview of Solar Radiation Management Options*, 46 Tulsa L. Rev. 283, 286 (2012). Alternatively, some commentators divide climate geoengineering options into "shortwave" and "longwave" approaches; *see* T.M. Lenton & N.E. Vaughan, *The Radiative Forcing Potential of Different Climate Geoengineering Options*, 9 Atmospheric Chemistry & Physics 5539, 5540 (2009), whereas the U.S. National Academy of Sciences uses the term "albedo modification" instead of "solar radiation management." Climate Intervention: Reflecting Sunlight to Cool Earth, *supra* note 19, at 6.

26. Michael C. MacCracken, Beyond Mitigation: Potential Options for Counter-Balancing the Climatic and Environmental Consequences of the Rising Concentrations of Greenhouse Gases, Policy Research Working Paper 4938, World Bank, Development Economics 15 (2009), https://openknowledge.worldbank.org/bitstream/handle/10986/4132/WPS4938.pdf;sequence=1.

27. Peter J. Irvine et al., *An Overview of the Earth System Science of Solar Geoengineering*, WIREs Climate Change, July 14, 2016, http://onlinelibrary.wiley.com/doi/10.1002/wcc.423/full; A.V. Eliseev, I.I. Mokhov & A.A. Karpenko, *Global Warming Mitigation by Means of Controlled Aerosol Emissions Into*

ond is marine cloud brightening schemes, which contemplate dispersal of seawater droplets approximately 1 μm in size into marine stratiform clouds to increase their albedo.[28] The third option is space-based systems, which involve positioning sun-shields in space to reflect or deflect solar radiation back to space.[29]

By contrast, CO_2 removal approaches seek to remove and sequester CO_2 from the atmosphere, either by enhancing natural sinks for carbon, or deploying chemical engineering to remove CO_2 from the atmosphere.[30] Examples of CDR approaches include: ocean iron fertilization, whereby certain ocean regions would be seeded with iron or other substances to stimulate phytoplankton production to sequester carbon[31]; terrestrial enhanced weathering, which seeks to increase natural chemical silicate rock weathering to capture atmospheric carbon dioxide[32]; direct air capture, which seeks to extract CO_2 from ambient air in a closed-loop industrial process[33]; and BECCS.

There has been some guarded support for research into SRM options in recent years.[34] Advocates have usually emphasized the potential to use such technologies to avoid passing critical climatic thresholds,[35] or to reverse potential catastrophic climatic changes, such as rapid melting of the Greenland ice sheets.[36] However, there has also been substantial resistance to SRM

the Stratosphere: Global and Regional Peculiarities of Temperature Response as Estimated in IAP RAS CM Simulations, 22 Atmospheric & Oceanic Optics 388, 390 (2009).

28. Blaž Gasparini & Ulrike Lohmann, *Why Cirrus Cloud Seeding Cannot Substantially Cool the Planet*, 121 J. Geophysical Res. Atmospheres 4877, 4878 (2016); Keith Bower et al., *Computational Assessment of a Proposed Technique for Global Warming Mitigation Via Albedo-Enhancement of Marine Stratocumulus Clouds*, 82 Atmospheric Res. 328, 329 (2006).
29. Takanobu Kosugi, *Role of Sunshades in Space as a Climate Control Option*, 67 Acta Astronautica 241, 242 (2010); Roger Angel, *Feasibility of Cooling the Earth With a Cloud of Small Spacecraft Near the Inner Lagrange Point (L1)*, 103 Proc. Nat'l Acad. Sci. 17184, 17184 (2006).
30. Timothy Lenton, *The Global Potential for Carbon Dioxide Removal*, *in* Geoengineering of the Climate System 53 (Roy Harrison & Ron Hester eds., 2014); Climate Change 2013, *supra* note 21, at Annex III, Glossary, at 1449 (2013).
31. Matthew Hubbard, *Barometer Rising: The Cartagena Protocol on Biosafety as a Model for Holistic International Regulation of Ocean Fertilization Projects and Other Forms of Geoengineering*, 40 Wm. & Mary Envtl. L. & Pol'y Rev. 591, 598 (2016).
32. Nils Moosdorf et al., *Carbon Dioxide Efficiency of Terrestrial Enhanced Weathering,* 48 Envtl. Sci & Tech. 4809, 4890 (2014).
33. K.S. Lackner, *Capture of Carbon Dioxide From Ambient Air*, 176 Eur. Physical J. Special Topics 93–106 (2009).
34. M. Granger Morgan et al., *Needed: Research Guidelines for Solar Radiation Management*, 29 Issues Sci. & Tech. (2013), http://issues.org/29-3/morgan-3/; Climate Intervention: Reflecting Sunlight to Cool Earth, *supra* note 19, at 177–92.
35. The Royal Society, *supra* note 13, at 50; Clive Hamilton, Ethical Anxieties About Geoengineering: Moral Hazard, Slippery Slope, and Playing God, Paper Presented to a Conference of the Australian Academy of Science, Canberra (Sept. 27, 2011), at 1–2, http://www.homepages.ed.ac.uk/shs/Climatechange/Geo-politics/ethical_anxieties_about_geoengineering.pdf.
36. Hamilton, *supra* note 35, at 2.

research or deployment, with opponents citing large potential risks, including potentially radical changes in precipitation patterns, which could, inter alia, radically alter monsoon patterns in some regions, including South Asia; deplete the ozone layer; and cause huge pulses of warming if the use of such technologies were terminated.[37]

Should society ultimately choose to deploy climate geoengineering strategies, policymakers will most likely embrace the CO_2 removal approach of BECCS. This is true for two reasons. First, whether wholly justified or not,[38] BECCS is increasingly being portrayed as a "benign"[39] or "safe solution,"[40] perhaps primarily in comparison to the risks associated with SRM approaches.[41] Additionally, large-scale deployment of BECCS has been identified in many climate integrated assessment models as "central to the feasibility of not exceeding 2°C."[42] For example, of the 204 scenarios in the IPCC's Fifth Assessment Report, which project temperature increases below 2°C by 2100, 184 contemplate large-scale deployment of BECCS.[43] However, as outlined in the next section, while BECCS provides great promise in helping the world address climate change, it presents great perils, some with substantial implications for human rights.

37. William C.G. Burns, *Climate Geoengineering: Solar Radiation Management and Its Implications for Intergenerational Equity*, 4 Stan. J.L. Sci. & Pol'y 38–55 (2011).
38. *See infra* Part II.
39. Peter Read & Jonathan Lermit, *Bio-Energy With Carbon Storage (BECS): A Sequential Decision Approach to the Threat of Abrupt Climate Change*, 30 Energy 2654, 2666 (2005).
40. Bobo Zheng & Jiuping Xu, *Carbon Capture and Storage Development Trends From a Techno-Paradigm Perspective*, 7 Energies 5221, 5240 (2014).
41. Climate Intervention: Carbon Dioxide Removal and Reliable Sequestration, *supra* note 19, ch. 2, at 5, http://www.nap.edu/read/18805/chapter/2.
42. Gough & Vaughan, *supra* note 12, at 7. *See also* José Roberto Moreira et al., *BECCS Potential in Brazil: Achieving Negative Emissions in Ethanol and Electricity Production Based on Sugar Cane Bagasse and Other Residues*, 179 Applied Energy 55, 56 (2016) (noting that BECCS "will play a vital role in reaching the required level of emission reductions in the future").
43. Gough &Vaughan, *supra* note 12, at 5. *See also* Pete Smith et al., *Agriculture, Forestry, and Other Land Use (AFOLU)*, *in* Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change 870 (2015), http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter11.pdf; Olivier Boucher et al., *In the Wake of the Paris Agreement, Scientists Must Embrace New Directions for Climate Change Research*, 113 Proc. Nat'l Acad. Sci. 7287, 7288 (2016); Sabine Fuss, *Optimal Mitigation Strategies With Negative Emission Technologies and Carbon Sinks Under Uncertainty*, 118 Climatic Change 73, 74 (2013). One recent study projected potential sequestration of 1.5 Gt CO_2/yr by 2050 and 5–16 Gt CO_2/yr by 2100. Ben Caldecott et al., Stranded Carbon Assets and Negative Emissions Technologies, Working Paper 19, 22 (Smith School of Enterprise and the Environment, University of Oxford 2015), http://www.smithschool.ox.ac.uk/research-programmes/stranded-assets/Stranded%20Carbon%20Assets%20and%20NETs%20-%2006.02.15.pdf. By comparison, 2015 global CO_2 emissions were projected to be 35.7 Gt CO_2. Robert B. Jackson, *Reaching Peak Emissions*, 6 Nature Climate Change 7, 7 (2016).

II. BECCS and Its Potential Ramifications for Human Rights

Human rights are universal standards supported by legal guarantees that seek to protect both individuals and groups from contravention of what are recognized as fundamental freedoms premised on protection of values such as freedom, dignity, and fairness.[44] As such, they establish minimum standards for individuals and groups that cannot be contravened in the pursuit of aggregate societal benefits.[45] Most fundamentally, human rights protections seek to ensure that laws and political and social structures are grounded in moral reasons and moral discourse, and are justifiable within a framework of appropriate legal and political structures.[46] Therefore, human rights provide a critical link between protection of a vital interest and imposition of a duty on others to protect and promote the interest.[47] Large-scale deployment of BECCS could threaten a number of human rights interests.

A. BECCS and the Human Right to Food

The right to adequate food is established by a number of human rights instruments at the international and regional levels,[48] including the International Covenant on Economic, Social, and Cultural Rights (ICESCR), which seeks to protect "the fundamental right of everyone to be free from

44. Office of the U.N. High Commissioner for Human Rights, Frequently Asked Questions on a Human Rights-Based Approach to Development Cooperation 1 (2006), http://www.ohchr.org/Documents/Publications/FAQen.pdf. *See also* Henry Shue, *Changing Images of Climate Change: Human Rights and Future Generations*, 5 J. Hum. Rts. & Env't 50, 58 (2014).
45. Simon Caney, *Climate Change, Human Rights, and Moral Thresholds*, *in* Climate Ethics 73–90 (Stephen Gardiner et al. eds., 2010); Frédéric Mégret, *Nature of Obligations*, *in* International Human Rights Law 129 (Daniel Moeckli, Sangeeta Shah & Sandesh Sivakumaran eds., 2010).
46. Rainer Frost, *The Justification of Human Rights and the Basic Right to Justification: A Reflexive Approach*, 120 Ethics 711, 734 (2010).
47. Charles Jones, *The Human Rights to Subsistence*, 30 J. Applied Phil. 57, 58 (2013).
48. *See, e.g.*, Universal Declaration of Human Rights art. 25, G.A. Res. 217A, U.N. GAOR, 3d Sess., 67th plen. mtg., U.N. Doc. A/810 (1948) (providing part of the right to an adequate standard of living), http://www.un.org/en/universal-declaration-human-rights/; Convention on the Rights of the Child (CRC), G.A. Res. 44/25, U.N. GAOR, 44th Sess., Annex, Supp. No. 49, at 167, U.N. Doc. A/44/49 (1989), at art. 24(2)(c) & (e), http://www1.umn.edu/humanrts/instree/k2crc.htm; Convention on the Rights of Persons With Disabilities, G.A. Res. 61/106, U.N. Doc. A/RES/61/106 (2006), at art. 25(f), http://www.un.org/disabilities/documents/convention/convoptprot-e.pdf; Convention on the Elimination of All Forms of Discrimination Against Women, G.A. Res. 34/180, U.N. GAOR, 34th Sess., Supp. No. 46, at 193, U.N. Doc. A/34/46 (1979), at art. 12, http://www.un.org/womenwatch/daw/cedaw/cedaw.htm; African Charter on Human and Peoples' Rights, OAU/CAB/LEG/67/3/Rev.5 (Org. of African Unity) (1996), *reprinted in* Human Rights Law in Africa (Christof Heyns ed., 1996) (implicit in Articles 4, 16, and 22), http://www.achpr.org/files/instruments/achpr/banjul_charter.pdf.

hunger."[49] A report of the Office of the High Commissioner on Human Rights (OHCHR) indicated that States must take necessary actions to ensure freedom from hunger and access to adequate food, "even in times of natural or other disasters."[50] The ICESCR Committee General Comment No. 12 states that "accessibility encompasses both economic and physical accessibility."[51] Therefore, the Comment continues, vulnerable groups such as displaced peoples and indigenous populations "may need attention through special [programs]."[52]

Deployment of BECCS could raise food prices, and/or displace agricultural production, in ways that could also imperil food security and violate the right to food. One striking feature of BECCS is the potential amount of land that may need to be diverted from other uses, including food production and livelihood-related activities, to provide bioenergy feedstocks. Delivery of a relatively modest 3 Gt of CO_2 equivalent (CO2-eq) negative emissions annually would require a land area of approximately 380–700 million ha 2100, translating into 7–25% of agricultural land and 25–46% of arable and permanent crop area.[53] The range of land demands would be 2–4 times larger than land areas that have been classified as abandoned or marginal.[54] This level of emissions removal would be equivalent to a startling 21% of total current human appropriate net primary productivity.[55] While it might be possible to reduce these impacts by more of an emphasis on the use of agricultural residue and waste feedstocks, this option could prove to be extremely limited.[56]

Demands on land of this magnitude could substantially raise food prices on basic commodities.[57] This could imperil food security for many of the world's most vulnerable, with many families in developing countries already

49. International Covenant on Economic, Social, and Cultural Rights, 993 U.N.T.S. 3, *reprinted in* 6 I.L.M. 360 (1967), at art. 11(2), http://www.ohchr.org/EN/ProfessionalInterest/Pages/CESCR.aspx.
50. *Report of the Office of the United Nations High Commissioner for Human Rights on the Relationship Between Climate Change and Human Rights*, *supra* note 3, at 9.
51. *CESCR General Comment No. 12: The Right to Adequate Food (Art. 11)*, U.N. ESCOR Comm. on Economic, Social, and Cultural Rights, at para. 13, U.N. Doc. E/C.12/1999/5 (1999).
52. *Id.*
53. Pete Smith et al., *Biophysical and Economic Limits to Negative CO_2 Emissions*, 6 Nature Climate Change 42, 46 (2016). *See also* Phil Williamson, *Scrutinize CO_2 Removal Methods*, 530 Nature 153, 154 (2016).
54. Smith et al., *supra* note 53, at 46.
55. *Id.*
56. Caldecott, Lomax & Workman, *supra* note 43, at 16; David Sommerstein, *Is Burning Trees Still Green? Some Experts Now Question Biomass*, NPR, July 12, 2016, http://www.npr.org/2016/07/12/482937940/is-burning-trees-still-green-some-experts-now-question-biomass.
57. Scott Barrett, *Solar Geoengineering's Brave New World: Thoughts on the Governance of an Unprecedented Technology*, 8 Rev. Envtl. Econ. 249, 254 (2014).

expending 70–80% of their income on food.[58] There is empirical evidence to support this proposition in the context of efforts in the past decade to increase biofuel expansion. Biofuel expansion, in many cases at the expense of food production, was one of the major factors precipitating substantial spikes in food prices in 2007/2008 and 2012.[59] Food price increases and reduction of food production imperiled the food security of many in Africa and in other parts of the developing world.[60] Increases in food prices in 2007 led to food riots in a number of countries and elevated the number of people living in hunger to a historical high of over one billion.[61] According to a 2008 report by Oxfam, the "scramble to supply" biofuels like palm oil, which was partly driven by EU biofuel targets, exacerbated the food price crises, brought "30 million people into poverty," and put 60 million indigenous people at risk.[62] While it is difficult to estimate the impact of large-scale deployment of BECCS on food prices, even the far more modest goal of scaling up biofuels production could result in price increases of 15–40%.[63]

Efforts to develop feedstock for bioenergy can also result in displacement of the poor from land, which can undermine food security, as well as livelihoods, political power, and social identity.[64] A recent report listed more than

58. United Nations Office of the High Commissioner, Mandate of the Special Rapporteur on the Right to Food, Note on the Impacts of the EU Biofuels Policy on the Right to Food (2013), http://www.srfood.org/images/stories/pdf/otherdocuments/20130423_biofuelsstatement_en.pdf; Ottmar Edenhofer et al., *Addressing Transformation Pathways*, *in* Climate Change 2014: Mitigation of Climate Change, Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change 91 (2014), https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_full.pdf; GAO, Center for Science, Technology, and Engineering, Climate Engineering: Technical Status, Future Directions, and Potential Responses 25 (2011), http://www.gao.gov/assets/330/322208.pdf.

59. ActionAid, Caught in the Net: How "Net-Zero Emissions" Will Delay Real Climate Action and Drive Land Grabs 7 (2015), http://www.actionaid.org/sites/files/actionaid/caught_in_the_net_actionaid.pdf. Some studies have attributed 30% of grain price increases from 2000–2007 to demand for biofuels. Mark W. Rosegrant, Biofuels and Grain Prices: Impacts and Policy Responses 2 (International Food Policy Research Institute 2008), http://www.ifpri.org/publication/biofuels-and-grain-prices.

60. Bamikole Amigun et al., *Biofuels and Sustainability in Africa*, 15 Renewable & Sustainable Energy Rev. 1360, 1362 (2011).

61. International Bar Association, Climate Change Justice and Human Rights Task Force Report, Achieving Justice and Human Rights in an Era of Climate Disruption 183 (2014), http://www.ibanet.org/PresidentialTaskForceClimateChangeJustice2014Report.aspx.

62. Oxfam, Climate Wrongs and Human Rights: Putting People at the Heart of Climate-Change Policy 15–16 (2008). *See also* Center for Human Rights and Global Justice, New York University School of Law, Foreign Land Deals and Human Rights: Case Studies on Agricultural and Biofuel Investment (2010).

63. Hans Morten Haugen, *International Obligations and the Right to Food: Clarifying the Potentials and Limitations in Applying a Human Rights Approach When Facing Biofuels Expansion*, 11 J. Hum. Rts. 405, 406 (2012).

64. Lorenzo Cotula et al., Fuelling Exclusion? The Biofuels Boom and Poor People's Access to Land 14 (International Institute for the Environment and Development and Food and Agriculture Organization 2008), http://pubs.iied.org/pdfs/12551IIED.pdf.

293 reported "land grabs" for the purposes of biofuel plantation expansion, encompassing more than 17 million ha of land.[65] Moreover, there is ample historic evidence of land seizures from vulnerable populations for other economic enterprises, including mineral extraction and industrial projects.[66] While supporters of BECCS contend that bioenergy expansion can be effectuated primarily through "marginal," "degraded," or "abandoned" land,[67] primarily found in developing countries, the reality is that hundreds of millions may rely on these lands for income and sustenance.[68] For example, substantial portions of grazing lands are barren during the dry season in developing countries, and thus classified as "degraded." Yet these lands are often productive during the rainy season and relied on for food and income by poor families.[69] Moreover, there is likely to be substantial pressure to dedicate additional land to agricultural production in the future given projected increases in population and affluence.[70]

Finally, incentives for feedstock production may result in farmers converting substantial swaths of land from food crop production, reducing food supplies for local populations.[71] For example, in one region of Brazil, conversion of land from cassava and rice production to oil seed for biofuel production undermined food security.[72] A 2011 study indicated that more than half of the world's bioenergy potential is centered in two regions with very large poor and vulnerable populations: (1) sub-Saharan Africa and (2) Latin America and the Caribbean.[73]

65. ActionAid, *supra* note 59, at 7. *See also* Evadné Grant & Onita Das, *Land Grabbing, Sustainable Development, and Human Rights*, 4 Transnat'l Envtl. L. 289 (2015); Lili Fuhr & Niclas Hällström, *The Myth of Net-Zero Emissions*, Heinrich Böll Found., Dec. 10, 2014, https://www.boell.de/en/2014/12/10/myth-net-zero-emissions.
66. Prakash Kashwan, *The Politics of Rights-Based Approach in Conservation*, 31 Land Use Pol'y 613, 622 (2013).
67. Raphael Slade et al., *Global Bioenergy Resources*, 4 Nature Climate Change 99, 100 (2014); Secretariat of the Convention on Biological Diversity, CBD Technical Series No. 65: Biofuels and Biodiversity 32 (2012), https://www.cbd.int/doc/publications/cbd-ts-65-en.pdf.
68. Rachel Smolker & Almuth Ernsting, BECCS (Bioenergy With Carbon Capture and Storage): Climate Saviour or Dangerous Hype?, 8 (Biofuelwatch 2012), http://www.biofuelwatch.org.uk/2012/beccs_report/; Secretariat of the Convention on Biological Diversity, *supra* note 67, at 32.
69. Slade et al., *supra* note 67, at 103.
70. Stefan Bringezu et al., *Beyond Biofuels: Assessing Global Land Use for Domestic Consumption of Biomass: A Conceptual and Empirical Contribution to Sustainable Management of Global Resources,* 29 Land Use Pol'y 224, 228 (2012).
71. Cotula et al., *supra* note 64, at 14.
72. Marcus Vinicius Alves Finco & Werner Doppler, *Bioenergy and Sustainable Development: The Dilemma of Food Security and Climate Change in the Brazilian Savannah*, 14 Energy Sustainable Dev. 194, 198 (2010).
73. Helmut Haberl et al., *Global Bioenergy Potentials From Agricultural Land in 2050: Sensitivity to Climate Change, Diets, and Yields*, 35 Biomass & Bioenergy 4753, 4762 (2011).

B. BECCS and the Human Right to Water

Several human rights instruments recognize the human right to water.[74] The Committee on Economic, Social, and Cultural Rights (CESCR) in Comment 14 provides that the States' duty to respect the right to water requires refraining from interfering with the enjoyment of that right, and to protect the right by adopting measures to restrain third parties from interfering with the right.[75]

In 2010, the United Nations General Assembly also officially recognized the "right to water and sanitation."[76] The United Nations Human Rights Council subsequently adopted HRC Resolution 15/9, which "affirms that the rights to water and sanitation are part of existing international law and confirms that these rights are legally binding" on States Parties to the ICESCR.[77] A number of regional courts have found that the right to safe drinking water and sanitation derives from other human rights, such as the rights to life, health, and adequate housing,[78] even though the right is not explicitly mentioned in regional human rights instruments.[79]

BECCS could imperil the right to water in some regions of the world given its "very large water footprint" when implemented at a scale of between 1.1 and 3.3 Gt of CO_2-eq per year.[80] By 2100, BECCS feedstock production at scale could require approximately 10% of the cur-

74. *See, e.g.*, Convention on the Elimination of All Forms of Discrimination Against Women, *supra* note 48, at art. 14(2); CRC, *supra* note 48, at arts. 24, & 27(3); International Labour Organization Convention No. 161 Concerning Occupational Health Services, June 25, 1985, 71st I.L.C. Sess., at art. 5, http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_INSTRUMENT_ID:312306; Additional Protocol to the American Convention on Human Rights, Inter-Am. C.H.R. Basic Documents Pertaining to Human Rights in the Inter-American System, OAS/ser.L/V/II.82, Doc. 6 rev. 1 (1992), at art. 11(1), http://www.oas.org/juridico/english/treaties/a-52.html; Arab Charter on Human Rights, May 22, 2004, *reprinted in* 12 Int'l Hum. Rts. Rep. 893 (2005) (entered into force Mar. 15, 2008), at art. 39, https://www1.umn.edu/humanrts/instree/loas2005.html.

75. *Substantive Issues Arising in the Implementation of the International Covenant on Economic, Social, and Cultural Rights, General Comment No. 15: The Right to Water (Arts. 11 and 12 of the Covenant)*, U.N. ESCOR Comm. on Economic, Social, and Cultural Rights, 29th Sess., at paras. 21, 23, U.N. Doc. E/C.12/2002/11 (2003).

76. The Human Right to Water, G.A. Res. 64/292, U.N. GAOR, 64th Sess., U.N. Doc. A/RES/64/292 (2010), http://www.un.org/es/comun/docs/?symbol=A/RES/64/292&lang=E.

77. United Nations Human Rights Council Res. 15/9, Human Rights and Access to Safe Drinking Water and Sanitation, 15th Sess., U.N. Doc. A/HRC/RES/15/9 (2010).

78. United Nations et al., Fact Sheet No. 35: The Right to Water 6 (2010), http://www.ohchr.org/Documents/Publications/FactSheet35en.pdf.

79. *See, e.g.*, European Social Charter, 529 U.N.T.S. 89, http://www1.umn.edu/humanrts/euro/z31escch.html; American Convention on Human Rights, OASTS No. 6, at 1, OEA/ser.K/XVI/1.1, Doc. 65 rev. 1 corr. 2 (1970), *reprinted in* 9 I.L.M. 673 (1970), http://www.oas.org/dil/treaties_B-32_American_Convention_on_Human_Rights.pdf, and the African Charter on Human and Peoples' Rights.

80. Pete Smith, *Soil Carbon Sequestration and Biochar as Negative Emission Technologies*, 22 Global Change Biology 1315, 1321 (2016).

rent evapotranspiration from all global cropland areas,[81] or of the same magnitude as *all current total agricultural water withdrawals*.[82] Moreover, water consumption for energy generation and carbon capture could have "intensive localized effects."[83] In a world of growing food demand, this could have serious implications, as maximum crop yields are only possible under conditions where water supplies are not restricted.[84] There is also concern that BECCS operations might contaminate underground sources of drinking water.[85]

C. BECCS and Potential Contravention of Other Human Rights

The right to health is included in a large number of human rights treaties and soft law instruments.[86] It is most comprehensively established in the ICESCR as "the right of everyone to the enjoyment of the highest attainable standard of physical and mental health."[87]

The ICESCR Committee interprets the right to health in General Comment No. 14 to include "a wide range of socio-economic factors that promote conditions in which people can lead a healthy life, and extends to the underlying determinants of health, such as . . . a healthy environment."[88] General Comment 14 further states that the right to health includes "a right to the enjoyment of a variety of facilities, goods, services and conditions necessary

81. Smith et al., *supra* note 53, at 47.
82. Markus Bonsch et al., *Trade-offs Between Land and Water Requirements for Large-Scale Bioenergy Production*, 8 GCB Bioenergy 11, 12 (2014). *See also* Vaibhav Chaturvedi et al., *Climate Mitigation Policy Implications for Global Irrigation Water Demand*, 20 Mitigation Adaptation Strategies for Global Change 389, 396 (2015).
83. Lydia J. Smith & Margaret S. Torn, *Ecological Limits to Terrestrial Biological Carbon Dioxide Removal*, 118 Climatic Change 89, 92 (2013).
84. B.J. Legg, Yields of Farmed Species: Constraints and Opportunities in the 21st Century 31–50 (R. Sylvester-Bradley & Julian Wiseman eds., 2005).
85. Kelsi Bracmort & Richard K. Lattanzio, Geoengineering: Governance and Technology Policy 12 (Congressional Research Service 2013), https://www.fas.org/sgp/crs/misc/R41371.pdf.
86. Universal Declaration of Human Rights, *supra* note 48, at art. 25; International Convention on the Elimination of All Forms of Racial Discrimination, Dec. 21, 1965, 660 U.N.T.S. 195, http://www.refworld.org/docid/3ae6b3940.html; CRC, *supra* note 48, at art. 24; Convention on the Elimination of All Forms of Discrimination Against Women, *supra* note 48, at arts. 11(1)(5), 12, 14(2)(b); International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families, G.A. Res. 45/158, U.N. GAOR, 45th Sess., Supp. No. 49A, Annex, arts. 28, 43(e), and 45(c), at 262, U.N. Doc. A/45/49 (1990), https://www1.umn.edu/humanrts/instree/n8icprmw.htm; African Charter on Human and Peoples' Rights, *supra* note 48, at art. 16; Additional Protocol to the American Convention on Human Rights, *supra* note 74, at art. 10; Constitution of the World Health Organization July 22, 1946, pmbl., 14 U.N.T.S. 185.
87. International Covenant on Economic, Social and Cultural Rights, *supra* note 49, at art. 12.
88. *CESCR General Comment No. 14: The Right to the Highest Attainable Standard of Health (Art. 12)*, U.N. ESCOR Comm. on Economic, Social, and Cultural Rights, U.N. Doc. HR1.GEN/1/REV.9 (Vol. I) (1984), http://www.ohchr.org/Documents/Issues/Women/WRGS/Health/GC14.pdf.

for the realization of the highest attainable standard of health."[89] To the extent that food production might be adversely impacted by deployment of BECCS, as outlined above, it would undermine one of the "underlying determinants of health."[90]

BECCS could "vastly accelerate the loss of primary forest and natural grassland."[91] This could result in habitat loss for many species and, ultimately, "massive" changes in species richness and abundance.[92] Indeed, Phil Williamson concluded that large-scale deployment of BECCS could result in a greater diminution of terrestrial species than temperature increases of 2.8°C above pre-industrial levels.[93]

Loss of biological diversity could undermine the right to health by leading to an increase in the transmission of infectious disease, such as hantavirus, Lyme disease, and schistosomiasis.[94] Moreover, products and services derived from biodiversity are a critical economic resource for many of the world's poor, including indigenous peoples.[95] Diminution of biodiversity through deployment of geoengineering options could undermine the right to livelihood,[96] which in turn is intimately linked to the human right to life and an adequate standard of living for health and well-being of individuals and families.[97] Loss of biodiversity could also undermine the right of indigenous peoples to access to such resources.[98]

89. *Id*.
90. *Id*. at para. 11.
91. Williamson, *supra* note 53, at 154.
92. Andrew Wiltshire & T. Davies-Barnard, Planetary Limits to BECCS Negative Emissions 15 (Mar. 2015), http://avoid-net-uk.cc.ic.ac.uk/wp-content/uploads/delightful-downloads/2015/07/Planetary-limits-to-BECCS-negative-emissions-AVOID-2_WPD2a_v1.1.pdf. *See also* Gough & Vaughan, *supra* note 12, at 15; Secretariat of the Convention on Biological Diversity, *supra* note 67, at 38.
93. Williamson, *supra* note 53, at 154.
94. *Report of the Special Rapporteur on the Issue of Human Rights Obligations Relating to the Enjoyment of a Safe, Clean, Healthy, and Sustainable Environment*, *supra* note 7, at 9.
95. Roubina Bassous/Ghattas, Biodiversity and Human Rights From a Palestinian Perspective (The Applied Research Institute–Jerusalem/Society n.d.), http://www.arij.org/files/arijadmin/biodiversity.pdf; Tim Hayward, *Biodiversity, Human Rights, and Sustainability*, Botanic Gardens Conservation Int'l, July 2001, http://www.bgci.org/education/article/0423.
96. Universal Declaration of Human Rights, *supra* note 48, at art. 25(1).
97. Ryan Hartzell & C. Balisacan, *Harmonizing Biodiversity Conservation and the Human Right to Livelihood: Towards a Viable Model for Sustainable Community-based Ecotourism Using Lessons From the Donsol Whale Shark Project*, 57 Ateneo L.J. 423, 438 (2012).
98. Convention Concerning Indigenous and Tribal Peoples in Independent Countries, June 27, 1989, art. 15(1), 28 I.L.M. 1382, http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C169; United Nations Declaration on the Rights of Indigenous Peoples, U.N. ESCOR, Comm. on Hum. Rts., 11th Sess., Annex I, U.N. Doc. E/CN.4/Sub.2 (1993), at art. 8(2)(b), http://www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf.

III. Operationalizing Human Rights Protections Under the Paris Agreement in the Context of BECCS/ Climate Geoengineering

The Paris Agreement calls on its Parties to take human rights into account "when taking action to address climate change . . . ."[99] This section will suggest how the Parties might give effect to this language in the context of climate geoengineering.

A. The Contours of a Human Rights-Based Approach

The suggested framework is known as a "human rights-based approach" (HRBA). The hallmark of the HRBA is a focus "on the relationship between the rights-holder and the duty-bearer and revealing gaps in legislation, institutions, policy and the possibility of the most vulnerable to influence decisions that have impact on their lives."[100] An HRBA establishes a normative framework "for addressing systematic and structural injustices, social exclusions and human rights repressions . . . ."[101] The HRBA has been embraced by international, national, and subnational governmental, and nongovernmental organizations in a wide array of contexts, including, health, development, and environmental protection.[102]

Drawing on guidelines developed by human rights and development institutions,[103] applying the HRBA to the consideration of BECCS as a climate geoengineering option should include the elements discussed below.

99. *Paris Agreement*, *supra* note 1.
100. Alessandra Lundström Sarelin, *Human Rights-Based Approaches to Development Cooperation, HIV/AIDS, and Food Security*, 29 Hum. Rts. L.Q. 460, 479 (2007), http://courses.arch.vt.edu/courses/wdunaway/gia5434/sarelin07.pdf.
101. Damilola S. Olawuyi, *Advancing Climate Justice in International Law: An Evaluation of the United Nations Human Rights-Based Approach*, 11 Fla. A&M U. L. Rev. 1, 9 (2016).
102. Aled Dilwyn Fisher, A Human-Rights Based Approach to the Environment and Climate Change, GI-ESCR Practitioner's Guide (2014), http://globalinitiative-escr.org/wp-content/uploads/2014/03/GI-ESCR-Practitioners-Guide-Human-Rights-Environment-and-Climate-Change.pdf; Leslie London, *What Is a Human-Rights Based Approach to Health and Does It Matter?*, 10 Health & Hum. Rts. 65–80 (2008), https://www.researchgate.net/profile/Leslie_London/publication/46287024_What_is_a_human-rights_based_approach_to_health_and_does_it_matter/links/54de290d0cf23bf2043af813.pdf; Andrea Cornwall & Celestine Nyamu-Musembi, *Putting the "Rights-Based Approach" to Development Into Perspective*, 25 Third World Q. 1415–37 (2004), http://courses.arch.vt.edu/courses/wdunaway/gia5434/cornwall.pdf. For a detailed discussion of the HRBA in the climate justice context, see Chapter 1 of this volume.
103. International Human Rights Law Clinic et al., *supra* note 9, at 15; United Nations High Commissioner for Refugees, Climate Change, Natural Disasters, and Human Displacement: A UNHCR Perspective 11 (2009).

1. Human Rights Impact Assessments

The HRBA would facilitate a process to identify the specific potential impacts of BECCS and associated potential human rights considerations, as well as the specific groups likely to be impacted. A reliable method to effectuate this goal would be to mandate the preparation of a human rights impact assessment (HRIA) for individual BECCS programs, and on a programmatic basis.

HRIAs are assessment protocols that assess the consistency of policies, legislation, projects, and programs with human rights.[104] It is a particularly appropriate instrument in the context of emerging high-risk technologies such as geoengineering in that its focus is not on past violations, but rather on developing tools to avoid violations of rights in the future.[105]

An HRIA process in the context of BECCS should include the following elements:

- *A scoping process that would identify rights-holders and duty-bearers, and develop relevant indicators to use in the process to help assess potential impacts and their relevance to the human rights interests of rights-holders*

  In identifying rights-holders, the HRBA focuses on protection of the rights of excluded and marginalized populations, including those whose rights are most likely to be threatened.[106] Indicators should be designed to assess State intent to comply with human rights mandates, measure State implementation of human rights obligations, and measure State human rights performance.

- *An evidence gathering process to help assess the potential impacts of deployment of BECCS*

  One critical requirement of the HRBA process would be greatly enhanced scientific understanding of the impacts of large-scale deployment of BECCS, including regional impacts that might adversely impact specific potential rights-holders.

104. World Bank & Nordic Trust Fund, Human Rights Impact Assessment: A Review of the Literature, Differences With Other Forms of Assessments and Relevance for Development 1 (2013), http://siteresources.worldbank.org/PROJECTS/Resources/40940-1331068268558/HRIA_Web.pdf.
105. *Id.*
106. Office of the U.N. High Commissioner for Human Rights, Frequently Asked Questions, *supra* note 44, at 16.

- *An ex ante deliberative process between rights-holders and duty-bearers that would help identify specific concerns of rights-holders and duty-bearers*

  An essential component of any potential governance architecture for climate geoengineering is engagement of populations in regions where impacts are likely to be most extreme, especially in developing countries.[107] This participatory component of the HRIA process could help promote this objective by operationalizing procedurally oriented human rights provisions, including the right to information and the right to public participation.

  In developing this component of the HRIA, efforts should be made to go beyond merely soliciting public opinion on geoengineering issues, usually characterized as public communication or public consultation,[108] to the establishment of large-scale public deliberative processes. Public deliberative processes seek to afford citizens, or a representative subset thereof, the opportunity to discuss, exchange arguments, and deliberate on critical issues,[109] as well as to seek to persuade one another of the judiciousness of their solutions.[110]

2. Analysis and Recommendations

This element of the HRIA process should include assessment of the human rights impacts of BECCS proposals, and an assessment of State responsibilities to respect, protect, and fulfill human rights in this context. This step should also include the critical element of developing recommendations to avoid or ameliorate potential impacts on human rights, or alternative means to achieve climate mitigation goals that would avoid human rights violations. This obligation discussing mitigation and alternative options is also

107. Nick Pidgeon, *Deliberating Stratospheric Aerosols for Climate Geoengineering and the SPICE Project*, 3 Nature Climate Change 451, 454 (2013).

108. For example:

> In public communication, information is conveyed from the sponsors of the initiative to the public . . . In public consultation, information is conveyed from members of the public to the sponsors of the initiative, following a process initiated by the sponsor. Significantly, no formal dialogue exists between individual members of the public and sponsors. The information elicited from the public is believed to represent currently held opinions on the topic in question.

Gene Rowe & Lynn J. Frewer, *A Typology of Public Engagement Mechanisms*, 30 Sci. Tech. & Hum. Values 251, 254–55 (2005), http://www.academia.edu/214234/A_typology_of_public_engagement_mechanisms.

109. Paul Anderson, *Which Direction for International Environmental Law?*, 6 J. Hum. Rts. & Env't 98, 121 (2015).

110. J. Dryzek, *Ecology and Discursive Democracy*, *in* Is Capitalism Sustainable?: Political Economy and the Politics of Ecology 176 (M. O'Connor ed., 1994); Anderson, *supra* note 109, at 121.

an important component of environmental impact assessments at both the international and national levels.[111]

- *Assessment of the capacity of rights-holders to exercise their rights and duty-bearers to fulfill their respective obligations, as well as strategies to bolster capacities*

  Capacity, broadly defined, is a critical consideration in determining the ability of duty-bearers to meet their obligations and rights-holders to claim their rights.[112] In the context of a human rights assessment of BECCS, this should include an assessment of human and economic capacity of duty-bearers to protect human rights interests. It should also involve an assessment of rights-holders' capacities, including access to pertinent information, especially for marginalized or traditionally excluded groups, and ability to obtain redress.[113]

- *Establishment of a program to monitor and evaluate both outcomes and processes, guided by human rights standards and principles*

  Implementation of a human rights monitoring program in the context of BECCS should include the use of role and capacity analysis to assess the obligations of institutions at the international and national levels to monitor the impacts of geoengineering, as well as their capacity and analysis of existing information systems and networks to assess critical

111. The Pew Charitable Trusts, High Seas Environmental Assessments: The Importance of Evaluation in Areas Beyond National Jurisdiction (2016), http://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2016/03/high-seas-environmental-impact-assessments; Neil Craik, The International Law of Environmental Impact Assessment 67 (2008); Convention on Environmental Impact Assessment in a Transboundary Context, Feb. 25, 1991, art. 5(a), 1989 U.N.T.S. 310 (1997), 30 I.L.M. 800 (1991) (entered into force Sept. 10, 1997), http://www.unece.org/fileadmin/DAM/env/eia/documents/legaltexts/Espoo_Convention_authentic_ENG.pdf; National Environmental Policy Act, 42 U.S.C. §§4321–4347, at §4332, http://elr.info/sites/default/files/docs/statutes/full/nepa.pdf; National Wildlife Fed'n v. National Marine Fisheries Serv., 2016 WL 2353647, at *59 (D. Or. 2016); Directive 2014/52/EU of the European Parliament and Council of Apr. 16, 2014, amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, 2014 O.J. L124/1, at art. 5(1)(d), Annex IV.4.

112. Food and Agriculture Organization of the United Nations, Methods to Monitor the Human Right to Adequate Food Volume II 38 (2008), http://www.fao.org/3/a-i0351e.pdf; Urban Jonsson, Human Rights Approach to Development Programming 15 (UNICEF 2003), http://www.unicef.org/rightsresults/files/HRBDP_Urban_Jonsson_April_2003.pdf.

113. United Nations Development Programme Capacity Development Group, Applying a Human Rights-Based Approach to Development Cooperation and Programming: A UNDP Capacity Development Resource 8 (2006), http://waterwiki.net/images/e/ee/Applying_HRBA_To_Development_Programming.pdf.

information gaps to be effectively monitored by decisionmakers, rights-holders, and rights-bearers.[114]

Monitoring could be particularly effective in terms of deployment of BECCS. Projections of potentially sustainable levels of bioenergy deployment are "systematically optimistic" and not based on empirical observations or practical experience.[115] Raphael Slade et al. suggest fostering "learning by doing" by close monitoring of incremental efforts to expand the role of biomass in energy production.[116] Close monitoring of the first few exajoules[117] of energy crops would help realistically assess purported benefits of integrated crop and energy production, and the sustainability of energy crop extension into allegedly marginalized, degraded, and deforested lands.

- *Ensure that programs are informed by recommendations from international human rights bodies and mechanisms*

  The UNFCCC would benefit from collaboration with human rights bodies, including United Nations bodies, such as the Office of the United Nations High Commissioner for Human Rights; the United Nations Human Rights Council; human rights treaty bodies, such as the Human Rights Committee and the Committee on the Rights of the Child; regional bodies, such as the Inter-American Commission on Human Rights and the African Commission on Human and People's Rights; and nongovernmental organizations, such as Human Rights Watch and the International Red Cross. Collaboration should also be explored with other organizations that may help inform the process, such as the Global Bioenergy Partnership (GBEP), comprised of both State and non-State actors. The GBEP has developed a set of sustainability indicators intended to inform

114. Maarten Immink & Margaret Vidar, *Monitoring the Human Right to Adequate Food at Country Level*, *in* International Human Rights Monitoring Mechanisms 322 (Gudmundur Alfredsson et al. eds., 2d. ed. 2009).
115. Raphael Slade et al., *Global Bioenergy Resources*, 4 Nature Climate Change 99, 103 (2014).
116. *Id.*
117. An exajoule (EJ) is a metric unit of energy that is often used in the context of global energy production. It is equivalent to 947.817 trillion British Thermal Units (BTUs). A BTU, in turn, is defined as the amount of heat required to raise the temperature of 1 lb of water by 1°F. Russ Rowlett & the University of North Carolina at Chapel Hill, *How Many? A Dictionary of Units of Measurement*, https://www.unc.edu/~rowlett/units/dictE.html (last visited Aug. 22, 2016). Projections for energy production from BECCS range from 30–600 EJ annually in the period of 2050–2100, dependent on the assumptions made in terms of factors such dietary trends, crop yields, population growth, and land use, Guy Lomax et al., *Investing in Negative Emissions*, 5 Nature Climate Change 498, 498 (2015); Raphael Slade et al., *Global Bioenergy Resources*, 4 Nature Climate Change 99–105 (2014).

decisionmaking and foster sustainability, including in the context of socioeconomic considerations.[118]

B. *Implementing the HRBA for Climate Geoengineering Within the Paris Agreement*

The optimal method to facilitate the HRBA process under the Paris Agreement would be to establish a human rights subsidiary body comprised of human rights and development experts. This body could be tasked, inter alia, with developing HRBA architecture, advising the Conference of the Parties (COP) on relevant human rights standards, and reporting on best national practices.[119]

Alternatively, the most appropriate existing institutions for operationalizing the HRBA process under the Paris Agreement would be its Subsidiary Body for Implementation (SBI) and Subsidiary Body for Scientific and Technological Advice (SBSTA). At the 17th COP, the Parties to the UNFCCC established a "forum on the impact of the implementation of response measures," which was mandated to meet twice annually under the rubric of the SBI and SBSTA.[120] The forum, whose mandate was subsequently extended, is tasked, inter alia, with assessment of the impacts of climate response measures, and engendering cooperation on response strategies.[121] It provides a platform to facilitate assessment of the potential impacts of implementation responses, and seeks to recommend specific plans of action.[122]

The forum would thus be an appropriate mechanism to implement the HRBA on behalf of the Parties to the Paris Agreement, or the Kyoto Protocol. It could establish an ad hoc technical expert group with expertise on both technological aspects of geoengineering, as well as experts in the field

118. GBEP, The Global Bioenergy Partnership Sustainability Indicators for Bioenergy (1st ed. 2011), http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/Indicators/The_GBEP_Sustainability_Indicators_for_Bioenergy_FINAL.pdf. *See also* Yoshiko Naiki, *Trade and Bioenergy: Explaining and Assessing the Regime Complex for Sustainable Bioenergy*, 27 Eur. J. Int'l L. 129, 142–44 (2016).

119. Naomi Roht-Arriaza, *Human Rights in the Climate Change Regime*, 1 J. Hum. Rts. & Env't 211, 232 (2010).

120. UNFCCC, *Forum on the Impact of the Implementation of Response Measures*, http://unfccc.int/cooperation_support/response_measures/items/7418.php (last visited Aug. 2 2016).

121. *Id.*

122. *Report of the Conference of the Parties on Its Twenty-First Session, Held in Paris From 30 November to 13 December 2015—Addendum, Part Two: Action Taken by the Conference of the Parties at Its Twenty-First Session, Decisions Adopted by the Conference of the Parties*, UNFCCC, 21st Sess., Decision 11/CP.21, at 25, U.N. Doc. FCCC/CP/2015/10/Add.1 (2016), http://unfccc.int/resource/docs/2015/cop21/eng/10a02.pdf.

of human rights law.[123] Under the terms of reference for the forum, it could develop guidance to the Parties and the subsidiary bodies for development of HRBAs, as well as facilitating ongoing sharing of information.[124]

This framework may also prove helpful in assessing the human rights implications of mitigation and adaptation options. To date, consideration of the human rights implications of adaptation responses has been "peripheral."[125] Similar concerns have been raised in the context of mitigation responses, including the Clean Development Mechanism of the Kyoto Protocol[126] and efforts to reduce deforestation (REDD+).[127]

Conclusion

The Paris Agreement provides a framework for taking human rights into account in responding to climate change. This chapter has proposed a framework for operationalizing this broad mandate in the context of one climate geoengineering option.

The Paris Agreement may ultimately be viewed as a major breakthrough in the field of climate policymaking, as well as a powerful force for defending the human rights of the most vulnerable in our society from environmental change. The emerging field of climate geoengineering affords an opportunity to develop a framework to make human rights more than merely an aspiration in the context of climate policymaking.

123. Center for International Environmental Law, Human Rights and Climate Change: Practical Steps for Implementation 29 (2009), http://www.ciel.org/Publications/CCandHRE_Feb09.pdf.
124. *Report of the Conference of the Parties on Its Twenty-First Session*, *supra* note 122, at 25–26.
125. Human Rights and Equal Opportunity Commission, Human Rights and Climate Change 14 (2008), https://www.humanrights.gov.au/papers-human-rights-and-climate-change-background-paper.
126. International Bar Association, *supra* note 61, at 50; Roht-Arriaza, *supra* note 119, at 215–16; MISEREOR, CIDSE & Carbon Market Watch, Human Rights Implications of Climate Mitigation Actions 17–18 (2d ed. 2016), http://carbonmarketwatch.org/wp-content/uploads/2016/05/NC-HUMAN-RIGHTS-IMPLICATIONS-OF-CLIMATE-CHANGE-MITIGATION-ACTIONS-VERSION-02-MAY-2016-OK-WEB-spread-page-.pdf.
127. Kirsty Gover, *REDD+, Tenure, and Indigenous Property: The Promise and Peril of a "Human Rights-based Approach," in* Research Handbook on REDD+ and International Law 249–83 (2016); Annalisa Savaresi, *The Role of REDD in the Harmonisation of Overlapping International Obligations*, *in* Climate Change and the Law 391, 414 (E.J. Hollo ed., 2013).