Safeguarding Against Environmental Injustice: 1.5°C Scenarios, Negative Emissions, and Unintended Consequences

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Scenarios for limiting warming below 1.5°C require both drastic emissions reductions measures and the large-scale deployment of negative emissions technologies. Both of these measures carry the potential for major unintended consequences, particularly as we do not yet understand the full implications of negative emissions technologies. Historically, the unintended consequences of climate mitigation efforts have disproportionately been borne by already marginalised communities, and hence there is a potential for the unintended consequences of measures taken to limit warming below 1.5°C to result in environmental injustice. This article argues that environmental and climate justice concerns need to be accounted for in the design of policy measures for keeping warming below 1.5°C, and outlines policy guidance for safeguarding against unintended consequences.

I. Introduction

So far, all scenarios where global warming is limited to below 1.5°C, including those initially overshooting by a small amount but returning to below 1.5°C before 2100, consist of two elements: an aggressive reduction in greenhouse gas (GHG) emissions including decarbonisation of the global energy system by mid-century; and the deployment of negative emissions technologies, particularly in the second half of the twenty-first century. These scenarios differ from 2°C scenarios both in the scale and rapidity of the decarbonisation required, and in the volume of negative emissions necessary.

Research has shown that historically, the unintended consequences of climate mitigation and environmental protection efforts have disproportionately affected marginalised people, including low-income communities, indigenous groups, ethnic and racial minorities, and people living in the Global South. As with the impacts of climate change in general, not everyone is affected in the same way: environmental inequities intersect with existing patterns of oppression and marginalisation such that a minority tend to carry the burden of the unintended consequences of measures ostensibly taken to benefit the whole of humanity.

Given that strategies for limiting global warming below 1.5°C invariably involve significantly more aggressive emissions reductions and use of negative emissions technologies than under 2°C scenarios, and net emissions are required to peak even sooner, the potential for serious environmental injustice is high. This article argues that environmental and climate justice concerns need to be accounted for in the design of policy measures for achieving a 1.5°C future, and that states should aim to leave nobody behind in meeting the 1.5°C goal.

Section II first outlines the implications of current 1.5°C scenarios in terms of the need for emissions reductions alongside negative emissions, highlighting the potential for unintended consequences of both elements to cause environmental injustice. Then, section III sketches several guidelines for policymaking to safeguard against unintended consequences and environmental injustice under a 1.5°C pathway. I underline the need for (a) enhancing linkages in implementing the Paris Agreement and the Sustainable Development Goals; (b) mainstreaming human rights, indigenous rights, gender and local communities at all levels of implementation; (c) participation of affected stakeholders, again at all levels of

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implementation; and (d) increased discussion of the implications of negative emissions technologies in policy fora.

II. The 1.5°C Goal, Unintended Consequences, and Environmental Injustice

In outlining the problem which this article seeks to address, as a first step it is helpful to review the scientific literature on 1.5°C scenarios. It will be seen that this literature raises significant issues in terms of the unintended consequences of measures for both emissions reductions and negative emissions. By then exploring these unintended consequences through the lens of environmental justice, the nature of the problem will become apparent.

1. Implications of Scenarios for 1.5°C

Reviewing the scientific research to date reveals that according to meta-studies, all scenarios where global warming is limited to below 1.5°C (including those initially overshooting by a small amount but returning to below 1.5°C before 2100) reach a peak in global emissions around 2020, and reach negative CO2 emissions globally in the second half of this century.[2] These scenarios, therefore, require both (a) aggressive and rapid reductions in greenhouse gas (GHG) emissions, including decarbonisation of the global energy system by mid-century, and (b) the deployment of negative emissions technologies, particularly in the second half of the century. Each of these aspects are explored in turn.

First, 1.5°C scenarios, as compared with 2°C scenarios, require even earlier phase-out of fossil fuel energy systems and even faster renewable energy 'development and deployment on an unprecedented scale.[3] According to Rogeli et al:[4]

> Pursuing the limitation of warming to below 1.5°C by 2100 reduces the flexibility in mitigation choices almost completely … Achieving 1.5°C by 2100 will require immediate attention to push mitigation in every individual sector of the economy. This is strongly at odds with climate policy achievements over the past decade and thus requires a significant trend break.

Notably, current country commitments as contained in Nationally Determined Contributions (NDCs) under the Paris Agreement are not enough to stay within even the 2°C guardrail (with a probability of at least 66 per cent), let alone 1.5°C.[5] Rogelj et al found that there were no available scenarios consistent with both the NDCs and 1.5°C, predicting the 1.5°C goal to be exceeded sometime between 2030 and 2045.[6] This suggests that, while 1.5°C is not yet a 'geophysical impossibility', ambition needs to be significantly strengthened at the first opportunity.[7]

Second, current scenarios for 1.5°C require negative CO_2 emissions—that is, the removal of carbon dioxide from the atmosphere.[8] This is partly because some non-CO_2 emissions are unavoidable, meaning

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[2] C-F Schleussner et al, 'Science and policy characteristics of the Paris Agreement temperature goal' (2016) 6 Nature Climate Change 827, 831; J Rogelj et al, 'Energy system transformations for limiting end-of-century warming to below 1.5°C' (2015) 5 Nature Climate Change 519, 522.
[3] RJ Millar et al, 'Emission budgets and pathways consistent with limiting warming to 1.5°C' (2017) 10 Nature Geoscience 741, 745; Rogeli (ibid) 523; Schleussner (ibid) 831.
[4] Rogeli (ibid) 526.
[5] J Rogeli et al, 'Paris Agreement climate proposals need a boost to keep warming well below 2°C' (2016) 534 Nature 631, 635-636.
[6] Ibid 635.
[7] Millar (n 3) 746.
[8] Millar (n 3) 745; Rogelj (n 5) 636; K Anderson and G Peters, 'The trouble with negative emissions' (2016) 354 Science 182; SBSTA and SBI, 'Report on the Structured Expert Dialogue on the 2013-2015 Review: Note by the Co-Facilitators of the Structured Expert Dialogue', UN Doc FCCC/SB/2015/INF.1, 4 May 2015, 33.

that negative emissions are required to compensate.[9] Another factor is that even with the highest feasible emissions reductions, it appears to be impossible to reach 1.5°C (with a 50 per cent likelihood) without significant negative emissions.[10] Although negative emissions also feature strongly amongst 2°C scenarios, they are ubiquitous among 1.5°C pathways. Proposed negative emissions technologies include bio-energy with carbon capture and storage (BECCS), direct capture of CO_2 from the atmosphere, reforestation (an existing mitigation technique), enhanced weathering of minerals, biochar, and increasing ocean uptake of CO_2.[11]

An oft-noted problem with negative emissions technologies is that they are largely unproven or untested at scale.[12] The most developed of these technologies is BECCS—which works by combusting biomass for energy and capturing the released carbon for storage underground—but only one large-scale demonstration plant currently exists and even CCS itself has not been shown to be technically viable despite two decades of research.[13] Other negative emissions technologies 'have not moved beyond theoretical studies or small-scale demonstrations'.[14] This raises the justified "moral hazard" concern that future reliance on as yet-undemonstrated technologies leading to postponing emissions reductions and becoming locked in to a high-temperature pathway.[15]

Even more worrisome, for our purposes, is the possibility of side-effects of negative emissions technologies, in particular regarding food, water and energy security.[16] For instance, scenarios involving BECCS assume the use of a very large land area—one to two times the size of India[17]—which 'raises profound questions…about carbon neutrality, land availability, competition with food production, and competing demands for bioenergy'.[18] Research shows that the deployment of BECCS would lead to

[9] Rogelj (n 5) 636; Anderson (n 8) 182.
[10] Rogelj (n 2); Rogelj (n 5) 635. P Smith et al, 'Biophysical and economic limits to negative CO2 emissions' (2016) 6 Nature Climate Change 42, 48.
[11] M Tavoni and R Socolow, 'Modeling meets science and technology: an introduction to a special issue on negative emissions' (2013) 118 Climatic Change 1; P Smith, 'Soil carbon sequestration and biochar as negative emission technologies' (2016) 22 Global Change Biology 1315; Smith (n 10) 42. 11. P Williamson, 'Emissions reduction: Scrutinize Co2 removal methods' (2016) 530 Nature 153; DL Sanchez and DM Kammen, 'A commercialization strategy for carbon-negative energy' (2016) 1 Nature Energy 15002.
[12] Rogelj (n 5) 636; Schleussner (n 2) 831; Rogelj (n 2) 522. But note scenarios assume that NETs are viable: HJ Buck, 'Rapid scale-up of negative emissions technologies: social barriers and social implications' (2016) 139 Climatic Change 155. Though note conflicting industry views: see e.g. Global CCS Institute, 'Scaling up BECCS', https://hub.globalccsinstitute.com/publications/global-status-beccs-projects-2010/6-scaling-beccs, accessed 30 December 2017.
[13] Anderson (n 8) 182; DM Reiner, 'Learning through a portfolio of carbon capture and storage demonstration projects' (2016) 1 Nature Energy 15011.
[14] Anderson (n 8) 182.
[15] Rogelj (n 5) 636; Anderson (n 8) 182; NE Vaughan and C Gough, 'Expert assessment concludes negative emissions scenarios may not deliver' (2016) 11 Environmental Research Letters 095003 6; Smith (n 10) 48; J Rogelj et al, '2020 emissions levels required to limit warming to below 2°C' (2013) 3 Nature Climate Change 405; K Riahi et al, 'Locked into Copenhagen pledges – implications of short-term emission targets for the cost and feasibility of long-term climate goals (2015) 90 Technological Forecasting and Social Change 8.
[16] SBSTA and SBI, 'Report on the Structured Expert Dialogue on the 2013-2015 Review: Note by the Co-Facilitators of the Structured Expert Dialogue', UN Doc FCCC/SB/2015/INF.1, 4 May 2015, 33. Vaughan (n 16) 2. LR Boysen et al, 'Impacts devalue the potential of large-scale terrestrial CO2 removal through biomass plantations' (2016) 11 Environmental Research Letters 095010 8; R Amos, 'Bioenergy Carbon Capture and Storage in Global Climate Policy: Examining the Issues' (2016) Carbon & Climate L Rev 187, 188.
[17] Smith (n 10) 42
[18] Anderson (n 8) 182; Rogeli (n 5) 636; Schleussner (n 2) 831. Note that Schleussner et al found 'no conclusive evidence' that risks to global food security introduced by large-scale bioenergy deployment increase in 1.5°C scenarios as compared to 2°C scenarios.

pressure on food prices strongly correlated with carbon prices.[19] There would also be major concerns about biodiversity and other aspects of sustainability, with one study suggesting that the land-use impacts of BECCS could lead to terrestrial species losses equivalent to a 2.8°C temperature increase.[20] Similarly, research on the use of biomass plantations as carbon sinks demonstrates that the 1.5°C target 'could only be achieved by the most spatially extensive and far-fetched [biomass plantation scenarios] which would imply severe impacts on ecosystems and food production'.[21] Smith et al conclude that there is no negative emissions technology (or combination of technologies) that could meet even the 2°C goal without significantly impacting land, energy, water, nutrients, albedo, or cost.[22] For these reasons, Anderson labelled negative emissions technologies 'an unjust and high-stakes gamble', warning against adopting them as the basis of a mitigation agenda.[23]

2. Unintended consequences and environmental justice

Both aspects of 1.5°C scenarios—rapid and intense emissions reductions, and significant use of negative emissions technologies—have the potential for unintended consequences. Robert Merton, giving the first comprehensive treatment of unintended consequences, which he called 'unanticipated consequences of purposive social action', pointed out that purposeful actions to attempt to change a complex system will often produce unintended consequences.[24] Unintended consequences can be positive or negative, predictable or not. In this context, I am concerned with negative unintended consequences of actions taken for both emissions reduction and negative emissions.

Regarding emissions reduction, even mitigation measures to date have had negative unintended consequences. For instance, in a study of the US Clean Air Act and its amendments, Bell found that it had considerable negative side-effects on local people,[25] including the proliferation of coal preparation plants for washing and crushing coal and the increased toxicity of coal combustion waste after pollution-removing technology had been installed, both of which led to health and safety consequences for nearby communities (which tended to be low-income communities of colour). Bell also noted the potential for further unintended consequences from the hazardous waste that will exist in three decades time from solar panels currently being installed.[26] Bell described these negative effects as a 'cautionary tale for what can happen when environmental regulations are implemented without accounting for environmental justice concerns'.[27] In another example, researchers found significant unintended health consequences of improving energy efficiency in residential buildings in the UK, including due to indoor air quality problems associated with reduced ventilation, higher fuel prices leading to fuel poverty, and increased fire risks associated with efficiency refurbishments.[28]

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[19] M Muratori et al, 'Global economic consequences of deploying bioenergy with carbon capture and storage' (2016) 11 Environmental Research Letters 095004, 6, 8.
[20] Williamson (n 11).
[21] Boysen (n 16) 7.
[22] Smith (n 10) 48.
[23] Anderson (n 8) 183.
[24] R Merton, 'The Unanticipated Consequences of Purposive Social Action' (1936) 1 American Sociological Review 894. See also J Sterman, 'All models are wrong: reflections on becoming a systems scientist' (2002) 18 Systems Dynamics Review 501.
[25] SE Bell, 'Environmental Injustice and the Pursuit of a Post-Carbon World' (2017) 82 Brooklyn L Rev 529.
[26] ibid 555.
[27] ibid 533.
[28] M Davies and T Oreszczyn, 'The unintended consequences of decarbonising the built environment: a UK case study' (2012) 46 Energy and Buildings 80, 82.

In addition, concerns have been raised regarding negative unintended consequences of REDD+ programs and biofuels. REDD+ is a mechanism under the UNFCCC whereby developed countries pay developing countries for reductions in deforestation rates or increases in forest carbon stocks with respect to an established baseline. Risks of negative effects on the livelihoods of forest-dependent communities, and on biodiversity, have been noted.[29] Regarding bio-fuels, large-scale crop conversion has led to impacts including on food security, water quality, loss of biodiversity and associated ecosystems services, land rights, and associated effects on local communities and indigenous peoples.[30]

Negative emissions technologies, too, carry the potential for substantial unintended consequences. For instance, as outlined above, BECCS at the necessary scale could have substantial effects on food security and biodiversity, among other unintended environmental and socioeconomic impacts. And because negative emissions technologies are significantly less developed than existing emissions reduction technologies, it is possible that we do not know about all the potential unintended consequences yet.

These negative unintended consequences are particularly problematic when looked at through the lens of environmental justice. Research has demonstrated that those who most often bear the brunt of environmental hazards and pollution tend also to be disproportionately low-income and marginalized communities, indigenous peoples, and people living in low-income countries.[31] Global environmental inequality both reinforces and reflects 'other forms of hierarchy and exploitation along lines of class, race and gender'.[32] This has led researchers to define environmental justice as 'the fair treatment and meaningful involvement of all people regardless of race, colour, national origin, or income with respect to the development, implementation, and enforcement of environmental laws'[33]

It can be assumed from experience that environmental hazards and pollution due to the negative unintended consequences described above will similarly be borne by disproportionately poor and marginalized people. Thus unintended consequences of measures taken under a 1.5°C scenario have the potential to result in major environmental injustices: from the impacts of BECCS on indigenous rights and food security in the Global South, to the effects of hazardous waste from renewable energy in the coming decades.

To be sure, this is no reason to abandon the 1.5°C target. A main reason for opting for this goal instead of 2°C was precisely to avoid climate impacts on the most vulnerable, which would cause huge

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[29] See e.g. MM Bayrak and LM Marafa, 'Ten Years of REDD+: A Critical Review of the Impact of REDD+ on Forest-Dependent Communities' (2016) 8 Sustainability 620.

[30] See e.g. D Diop et al, 'Assessing the Impact of Biofuels Production on Developing Countries from the Point of View of Policy Coherence for Development', Final Report for the European Commission (2011); HL Welch et al, 'Unintended Consequences of Biofuels Production: The Effects of Large-Scale Crop Conversion on Water Quality and Quantity' (US Geological Survey Open-File Report 2010-1229, 2010); JM Melillo et al, 'Unintended Environmental Consequences of a Global Biofuels Program' (MIT Joint Program on the Science and Policy of Global Change, Report No. 168, January 2009) 12; JA Hazlewood, 'CO_2lonialism and the "Unintended Consequences" of Commoditizing Climate Change: Geographies of Hope Amid a Sea of Oil Palms in the Northwest Ecuadorian Pacific Region' (2012) 31 Journal of Sustainable Forestry 120; J Fairhead, M Leach and I Scoones, 'Green Grabbing: a new appropriation of nature?' (2012) 39 Journal of Peasant Studies 237.

[31] Bell (n 25) 532; A Szasz and M Meuser, 'Environmental Inequalities: Literature Review and Proposals for New Directions in Research and Theory' (1997) 45 Current Sociology 99, 111-112.

[32] Peter Newell, 'Race, Class and the Global Politics of Environmental Inequality' (2005) 5 Global Environmental Politics 70, 70; V Been, 'What's fairness got to do with it? Environmental justice and the siting of locally undesirable land uses' (1993) 78 Cornell L Rev 1001.

[33] J Bass, 'Evaluating environmental justice under the National Environmental Policy Act' (1998) 18 Environmental Impact Assessment Review 83; J Ikeme, 'Equity, environmental justice and sustainability: incomplete approaches in climate change politics' (2003) 13 Global Environmental Change 195, 197.

environmental injustices. But it is precisely because reaching the 1.5°C target is so important, and because of the potential of negative emissions technologies to result in positive socioeconomic co-benefits, that it is crucial to safeguard against environmentally unjust outcomes.[34] The point is to highlight justice concerns relating to unintended consequences of mitigation and negative emissions measures, which have so far received less attention.

Similarly, it is clear that many of these same concerns exist in relation to 2°C scenarios, most of which include a negative emissions element. However, the increased scale of negative emissions necessary under 1.5°C scenarios, as well as the rapidity of the required emissions reductions, means that unintended consequences concerns are significantly heightened.

III. Options for safeguarding against unintended consequences

In the face of the potential environmental justice issues arising from unintended consequences of measures for emissions reductions or negative emissions in a 1.5°C scenario, environmental justice concerns should be accounted for in the design of relevant laws, regulations and policy measures. States must leave nobody behind in pursuing a 1.5°C future.

How might this be done? I now turn to outlining policy suggestions to safeguard against unintended consequences of emissions reduction and negative emissions measures. I recommend (a) enhancing linkages in implementing the Paris Agreement and the Sustainable Development Goals; (b) mainstreaming human rights, indigenous rights, gender and local communities at all levels of implementation; (c) participation of affected stakeholders, again at all levels of implementation; and (d) increased discussion of the implications of negative emissions technologies in policy fora. As a caveat, what follows should be considered as a starting point: I sketch a broad outline of policy guidelines for safeguarding against unintended consequences in policymaking for 1.5°C, but more work is needed to make these fully operational.

1. Enhancing linkages in implementing the Paris Agreement and the Sustainable Development Goals

A first step is to enhance linkages and synergies between the implementation of the Paris Agreement and the implementation of the Sustainable Development Goals (SDGs). Although climate action has its own goal, SDG 13 (take urgent action to combat climate change and its impacts), there are also clear overlaps between climate and many other SDGs, including SDG 2 (zero hunger – food security and sustainable agriculture), SDG 6 (water availability and sustainable water management) SDG 7 (affordable and clean energy), SDG 11 (sustainable cities), and SDG 15 (natural resources and biodiversity). Eleven SDG targets explicitly address climate, and a further 27 specifically rely on climate action.[35]

The potential for synergies between Paris Agreement goals and SDGs is well recognised. Indeed, Article 2(1) of the Paris Agreement itself states that the Agreement's aim is to strengthen the global response to the threat of climate change, 'in the context of sustainable development and efforts to eradicate poverty'. Initial mapping exercises highlighting synergies between the (I)NDCs and the SDGs have taken place.[36]

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[34] Canadell (n 29) 1457.

[35] E Northrop et al, 'Examining the Alignment between the Intended Nationally Determined Contributions and Sustainable Development Goals' (World Resources Institute 2015), https://www.wri.org/sites/default/files/WRI_INDCs_v5.pdf, footnote 174.

[36] Northrop (ibid); A Dzebo et al, 'Exploring connections between the Paris Agreement and the 2030 Agenda for Sustainable Development' (Stockholm Environment Institute 2017); M Nilsson, D Griggs and M Visbeck, 'Policy: Map the interactions between Sustainable Development Goals' (2016) 534 Nature 320.

Many academics and NGOs have called for understanding the Paris Agreement in the context of sustainable development, and implementing the SDGs and the Paris Agreement through an integrated, coherent policy pathway.[37] Of course, such an approach has the advantages of avoiding duplication of effort, allocating budgets more efficiently, and avoiding conflicts between the two agendas. But because the SDGs incorporate considerations of food security, water, energy and gender, among others, this approach would also decrease the likelihood of negative unintended consequences of negative emissions and emissions reduction measures leading to environmental injustice.

Despite the recognition of the need to integrate the two implementation processes, they remain largely separate at national, regional and local levels due to separate specialized agencies and a lack of institutional coherence.[38] Much more needs to be done to enhance integration at all levels of implementation.[39] For instance, national development and climate planning processes should be integrated, the development of national climate laws needs to draw on sustainable development frameworks, and silos between relevant government ministries and SDG and NDC implementing institutions need to be broken down. Moreover, analysis needs to happen regarding trade-offs between large-scale deployment of negative emissions technologies and the SDGs.[40] As Brandi, Dzebo and Janetschek note, 'a sustainable development lens is indispensable for a climate policy with a human face'.[41] Hence, sustainable development considerations are central for avoiding environmental injustice arising from unintended consequences of pursuing a 1.5°C pathway.

2. Centring human rights, gender, indigenous peoples and local communities

Centring human rights, gender, indigenous rights and local communities in the implementation of the Paris Agreement constitutes another safeguard against unintended consequences. For instance, considerations of protecting local communities and indigenous peoples would tend to militate against adopting a BECCS programme with significant negative effects on these communities.

There has long been recognition of the intersections between climate change and human rights,[42] climate change and gender[43], and climate change and indigenous peoples.[44] Academics and NGOs have advocated

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[37] See e.g. F Sindico, 'Paris, Climate Change and Sustainable Development' (2016) 6 Climate Law 130, 140; Dzebo (ibid) 4; Von Stechow et al, '2°C and SDGs: united they stand, divided they fall?' (2016) 11 Environmental Research Letters 034022; C Brandi, A Dzebo and H Janetschek, 'The Case for Connecting the Implementation of the Paris Climate Agreement and the 2030 Agenda for Sustainable Development', Briefing Paper 21/2017, German Development Institute.
[38] Brandi (ibid) 1.
[39] Sindico (n 37); Northrop et al (n 35) 45-46; Brandi (n 37).
[40] Anderson (n 8) 182.
[41] Brandi (n 37) 4.
[42] See e.g. A Sinden, 'Climate Change and Human Rights' (2007) 27 J Land Resources & Env L 255; JH Knox, 'Climate Change and Human Rights Law' (2009) 50 Va J Int'l L 163; D Bodansky, 'Introduction: Climate Change and Human Rights: Unpacking the Issues' (2010) 38 Ga J Int'l & Comp L 511; Office of the UN High Commissioner for Human Rights, 'The Effects of Climate Change on the Full Enjoyment of Human Rights' (30 April 2015); Center for International Environmental Law and CARE International, 'Climate change: tackling the greatest human rights challenge of our time' (February 2015).
[43] See e.g. L Wanjiru, 'Gender, Climate Change and Sustainable Development' (2012) 23 Fordham Env L Rev 1; E Skinner, 'Gender and Climate Change: Overview Report' (Institute of Development Studies, November 2011); R Masika (ed), *Gender, Development, and Climate Change* (Oxfam 2002).
[44] See e.g. R Tsosie, 'Indigenous Peoples and Environmental Justice: The Impact of Climate Change' (2007) 78 U Colo L Rev 1625; RS Abate and EA Kronk, 'Commonality Among Unique Indigenous Communities: An Introduction to Climate Change and Its Impacts on Indigenous Peoples' (2013) 26 Tulane Env LJ 179;

for consideration of these interlinkages in the UNFCCC since its inception.[45] The inclusion of human rights language in the Cancun Agreements signified a major success for civil society.[46] Building on this, the Paris Agreement notably included in its preamble the first specific reference to human rights in a climate treaty:

> parties should…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…

Human rights advocates noted that this was an important signal of the international community's recognition that climate action must comply with human rights obligations, although the deletion of human rights from draft Article 2 of the Paris Agreement was a missed opportunity.[47]

Further progress was seen at COP 23 with the operationalisation of the Local Communities and Indigenous Peoples' Platform, a platform for exchanging experiences and sharing best practices on mitigation and adaptation in a holistic and integrated manner that had been established at COP 21.[48] In addition, COP 23 adopted the Gender Action Plan which concerns the representation of women in all aspects of the UNFCCC process and mainstreaming gender throughout Paris Agreement goals.[49] However, again, there is more work to be done on mainstreaming human rights, gender, indigenous rights and local communities in implementing the Paris Agreement at all levels.[50] In general, governments must take precautions to ensure that actions to address climate change do not violate human rights.[51] Some authors suggest that the large-scale implementation of BECCS would be 'inherently risky and present a categorical threat to human rights', meaning that governments should minimise its role in climate mitigation.[52] At the very least, appropriate safeguards need to be developed in the implementation of BECCS projects.

3. Participatory approaches

Participation is another key safeguard. A contributing factor to environmental injustice is that people affected by a given decision are often not involved in the decision-making process. At a broader level, in international law and global governance the problem of "disregard" has been well understood.[53]

If those most liable to be affected by negative unintended consequences of emissions reductions and negative emissions measures—who, experience demonstrates, are most often societally marginalised, as

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[45] S Atapattu, 'Climate Change, Human Rights, and COP 21: One Step Forward and Two Steps Back or Vice Versa?' (2016) 17 Georgetown J Int'l Affairs 47, 47.
[46] Decision 1/CP.16, recital 8.
[47] ibid 49; UN Human Rights Council, 'Report of the Special Rapporteur on the Issue of Human Rights Obligations Relating to the Enjoyment of a Safe, Clean, Healthy and Sustainable Environment', 19 February 2017, A/HRC/34/49. Cf B Mayer, 'Human Rights in the Paris Agreement' (2016) 6 Climate Law 109.
[48] Decision 1/CP.21 [135]. See SBSTA, 'Local communities and indigenous peoples platform: Draft conclusions proposed by the Chair', 15 November 2017, FCCC/SBSTA/2017/L.29.
[49] SBI, 'Gender and climate change: Draft conclusions proposed by the Chair', FCCC/SBI/2017/L.29, 13 November 2017.
[50] S Duyck et al, 'Delivering on the Paris Promises: Combating Climate Change while Protecting Rights: Recommendations for the Negotiations of the Paris Rule Book' (Center for International Environmental Law 2016).
[51] S Duyck, 'The Paris A Rights inagreement and the Protection of Human Rights in a Changing Climate' (2016) 26 YIEL 3, 23.
[52] ibid 24-28.
[53] RB Stewart, 'Remedying Disregard in Global Regulatory Governance: Accountability, Participation, and Responsiveness' (2014) 108 AJIL 211.

discussed above—are able to participate in the relevant policymaking processes, it is more likely that these negative unintended consequences will be avoided. At the core of emissions reduction and negative emissions efforts must be an inclusive, transparent and participatory policy development and implementation process.[54] Again, this must happen at all levels of implementation—international, national, regional and local.

There is a broader conversation occurring regarding participation and procedural rights, which I can do no more than mention here. Notably, in the UNFCCC process this conversation is being advanced through the agenda item on Action for Climate Empowerment, which encompasses stakeholder participation on the national level.[55]

4. A greater research and policy focus on negative emissions

Finally, more research and policy analysis of negative emissions technologies would be useful to avoid their potential negative unintended consequences. As discussed above, these technologies are at various stages of development. Their long-term systems effects, as well as the ethical questions they raise, are not well understood. Recently, researchers have pointed out that there is not enough discussion of negative emissions in the UNFCCC process or in the public sphere,[56] and urged more research particularly in the humanities and social sciences.[57] The large-scale deployment of negative emissions technologies will certainly raise political issues regarding, among other matters, differentiation and burden-sharing.[58]

IV. Conclusions

This article has addressed the question of how to safeguard against unintended consequences arising from pursuing a 1.5°C pathway. The scientific literature shows that under 1.5°C scenarios, both emissions reductions and substantial negative emissions are required. Negative emissions measures, especially, present risks of unintended consequences leading to environmentally unjust outcomes. These unintended consequences have so far not been considered in a systematic way, and climate law and policy face a challenge in addressing them.

Four key recommendations are outlined here. First, there is a need to enhance linkages in implementing the Paris Agreement and the Sustainable Development Goals. Second, it is necessary to mainstream human rights, indigenous rights, gender and local communities. Third, the participation of affected stakeholders is critical. Finally, there must be increased discussion of the implications of negative emissions technologies in policy fora. These things need to happen at all levels of implementation, from global to local. While all of these approaches are admittedly necessary for the 2°C goal, they gain a heightened importance under 1.5°C.

More research and analysis are needed into the effects of negative emissions technologies and the precise trade-offs between negative emissions and other societal objectives. This will allow the relationship between 1.5°C and the Sustainable Development Goals to be more fully understood, and will also lead to

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[54] Northrop (n 35) 46
[55] UNESCO and UNFCCC, 'Action for Climate Empowerment: Guidelines for accelerating solutions through education, training and public awareness' (2016), http://unesdoc.unesco.org/images/0024/002464/246435e.pdf.
[56] GP Peters and O Geden, 'Catalysing a political shift from low to negative carbon' (2017) 7 Nature Climate Change 619; The Economist, 'What they don't tell you about climate change', https://www.economist.com/news/leaders/21731397-stopping-flow-carbon-dioxide-atmosphere-not-enough-it-has-be-sucked-out, 16 November 2017.
[57] JC Minx et al, 'Fast growing research on negative emissions' (2017) 12 Environmental Research Letters 035007.
[58] Peters (n 54) 619.

a better understanding of how environmental injustice due to unintended consequences of mitigation measures can be avoided. These steps constitute a foundation from which policymakers can work towards meeting the 1.5°C goal while leaving nobody behind.