



Climate justice in higher education: a proposed paradigm shift towards a transformative role for colleges and universities

Alaina Kinol¹ · Elijah Miller¹ · Hannah Axtell² · Ilana Hirschfeld¹ · Sophie Leggett² · Yutong Si¹ · Jennie C. Stephens¹

Received: 23 August 2022 / Accepted: 12 January 2023 / Published online: 9 February 2023
© The Author(s) 2023, corrected publication 2023

Abstract

Moving beyond technocratic approaches to climate action, climate justice articulates a paradigm shift in how organizations think about their response to the climate crisis. This paper makes a conceptual contribution by exploring the potential of this paradigm shift in higher education. Through a commitment to advancing transformative climate justice, colleges and universities around the world could realign and redefine their priorities in teaching, research, and community engagement to shape a more just, stable, and healthy future. As inequitable climate vulnerabilities increase, higher education has multiple emerging opportunities to resist, reverse, and repair climate injustices and related socioeconomic and health disparities. Rather than continuing to perpetuate the concentration of wealth and power by promoting climate isolationism's narrow focus on technological innovation and by prioritizing the financial success of alumni and the institution, colleges and universities have an opportunity to leverage their unique role as powerful anchor institutions to demonstrate climate justice innovations and catalyze social change toward a more equitable, renewable-based future. This paper explores how higher education can advance societal transformation toward climate justice, by teaching climate engagement, supporting impactful justice-centered research, embracing non-extractive hiring and purchasing practices, and integrating community-engaged climate justice innovations across campus operations. Two climate justice frameworks, Green New Deal-type policies and energy democracy, provide structure for reviewing a breadth of proposed transformational climate justice initiatives in higher education.

Keywords Climate policy · Climate justice · Higher Education · Green New Deal · Energy democracy · Climate transformation

✉ Alaina Kinol
boyle.al@northeastern.edu

¹ Northeastern University School of Public Policy and Urban Affairs, Boston, MA, USA

² Northeastern University College of Science, Boston, MA, USA

1 Introduction

Higher education leaders often claim that their institutions, through research and teaching, contribute to addressing humanities biggest challenges (Gamoran 2018; Stewart and Valian 2018). In practice, however, it is unclear to what extent higher education is contributing to the transformative changes that society needs to confront the intersecting crises of worsening climate change, growing economic injustice, and increasing health disparities. In this new era of cascading and intersecting catastrophes, a cumulative polycrisis (Tooze 2022), new opportunities, and responsibilities are emerging for the role of higher education in society (Homer-Dixon and Rockström 2022). Globally, the higher education sector is being challenged to respond and innovate to contribute more to climate justice and global sustainability (Steele and Rickards 2022; UNESCO 2022), yet as the climate crisis intensifies, it is increasingly clear that higher education's commitment to climate justice is insufficient (UNESCO 2022). When the climate action plans and policies of universities focus on technology-based mitigation which, like the climate action plans of so many other organizations and jurisdictions, fail to consider equity and systemic change, climate injustices are exacerbated. With the continued concentration of wealth and power among individuals and organizations who are already privileged, public support for higher education is being reduced, and the priorities of higher education institutions are increasingly aligned with the priorities of the rich and powerful rather than focusing on the public good. Unfortunately, most of the richest individuals and organizations with strong affiliations with higher education institutions are resisting, rather than investing in, a transformative response to the climate crisis and other intersecting crises (Kenner 2019; Stephens 2020). With growing recognition that the climate crisis is a symptom of larger socioeconomic and political dysfunction, a climate justice approach embraces a transformative lens focused on social and financial innovation, which is a paradigm shift from the more mainstream technocratic way of conceptualizing climate "solutions" (Sultana 2022).

The urgent need for societal transformation to simultaneously address worsening economic and health inequities and growing climate vulnerabilities has become more obvious since the wealthiest billionaires in the world more than doubled their wealth since the beginning of the pandemic (Ahmed et al. 2022). Acknowledging the injustice of these unsustainable trends, higher education has the potential and opportunity to leverage substantial intellectual, financial, physical, and labor resources to advance transformation and reduce devastating human suffering from economic and climate injustices. Through diverse mechanisms, the higher education sector has multiple opportunities to explore, support, and advance transformative social change toward a more just and stable future. Most universities, however, are not yet wielding their influence and impact to encourage and prioritize social innovations and social change for climate justice (Kelly et al. 2022a; Steele and Rickards 2022). Unfortunately, many university practices discourage and devalue social innovations toward climate justice (Patel 2021).

Moving beyond technocratic approaches to climate action, climate justice articulates a paradigm shift in how organizations think about their response to the climate crisis. Climate justice broadens responsibility to redress the legacy of injustice and exploitation resulting from systemic practices, policies, and priorities that perpetuate inequities in climate vulnerabilities—locally, regionally, and globally (Sultana 2022; Stephens 2020; Yeampierre 2020). Advancing climate justice, therefore, necessitates not only directing resources away from fossil fuels and carbon emissions, but also actively engaging with systemic changes that disrupt the structures that have emboldened corporate influence and decades

of climate obstruction of climate policy. Grassroots behavior changes alone are insufficient to address climate injustices, and are definitely an inadequate approach to minimizing the climate impacts of higher education (Eichhorn et al. 2022). To facilitate and support systemic changes, colleges and universities have an opportunity to reimagine their internal and external initiatives to prioritize direct engagement and investment in transformative social change toward more just systems locally, regionally, nationally, and internationally (Rempel and Gupta 2022).

As a concerned, collaborative group of graduate student researchers, undergraduate students, and a professor, we draw on our collective knowledge and experiences to offer a novel framework to considering how higher education can contribute to societal transformation for climate justice. In this paper, we make a conceptual contribution by exploring the potential of a paradigm shift in higher education; through a commitment to advancing transformative climate justice, colleges and universities around the world could realign and redefine their priorities in teaching, research, and community engagement to shape a more just, stable, and healthy future. Our methodological approach includes (1) a synthesis of our collective empirical knowledge and experiences engaging with and reviewing climate action planning processes at multiple colleges and universities, and (2) application of two climate justice frameworks, the Green New Deal and energy democracy, to explore how higher education can advance and accelerate a transformative climate justice response to humanity's intersecting crises. This paper is primarily a conceptual contribution because despite our engaged analysis of university sustainability initiatives and despite focused efforts to systematically review current university climate commitments, we have not been able to identify empirical examples to demonstrate the novel paradigm shift that we are proposing. To complement our conceptual proposal, we have reviewed and synthesized a breadth of specific actionable initiatives aligned with this paradigm shift that we present within two compatible climate justice frameworks.

This paper first reviews climate justice literature to explain how a commitment to climate justice is a paradigm shift in higher education. Then, to explore the transformative potential of specific higher education climate justice initiatives, we apply two climate justice frameworks to our empirical assessment of innovative opportunities in higher education. We end with conclusions and recommendations.

2 Higher education and climate justice

More frequent and extreme disruptive climatic events are adversely impacting water access, food production, physical and mental health, and physical and economic infrastructure—particularly for vulnerable communities around the world (IPCC 2022). In this new era of multiple intersecting globally connected crises (Tooze 2022), it is more critical than ever before that higher education's commitments to climate action are directly linked to social justice and economic justice (Chankseliani and McCowan 2021; Harlan et al. 2015). Because of the inequities of climate impacts, i.e. the devastation of the climate crisis is being experienced very differently among more vulnerable people, communities, and places, transformative climate action requires conceptually and empirically linking the climate crisis with social injustices, economic inequities, and health disparities (Cappelli et al. 2021; Singer 2018). The interconnected impacts of climate disasters, air and water pollution, food scarcity, substandard healthcare, and other climate-related hazards plague lower-income, under-invested-in communities

disproportionately (Angelsen and Dokken 2018; World Health Organization 2021). Furthermore, the inequities of environmental vulnerabilities including racial and gender disparities are a symptom of systemic injustices linked to the history of racial injustice in policies and investments within established governing bodies and decision-making processes (Bullard and Johnson 2000; Roberts-Gregory 2021). The unequal distribution of harm is not an accident and is not isolated to one country or region; in many places, including the USA (Bullard and Johnson 2000), industrial facilities for fossil fuel extraction, refining, and distribution have been intentionally relegated to poorer communities and communities of color by policymakers at all levels of government (McLeod 2007). Around the world, disadvantaged communities with less access to political power, resources, and information have less capacity to mobilize against the allocation of disproportionate environmental burdens (Banzhaf et al. 2019).

Disparities in current and predicted climate impacts exist at multiple levels, including global inequities, within-country inequalities, and regional inequities, particularly across differences in race, class, gender, and disability (Frosch et al. 2018). These relationships are characterized by reinforcing vicious cycles: initial inequality causes the disadvantaged groups to suffer disproportionately from the adverse effects of climate change, resulting in greater subsequent inequalities (Sultana 2022; Islam and Winkel 2017). The global injustice of those countries that have contributed the least to the climate crisis are among the most vulnerable is now widely acknowledged (Watts et al. 2021). It is unjust that countries with virtually no contribution to the climate crisis are more quickly and intensely falling victim to temperature rise, increasingly unpredictable weather disrupting livelihoods and food production, limited resources exacerbating armed conflict, and forced climate migration caused by the consumption and pollution of industrialized nations (United Nations Meetings Coverages and Press Releases 2019). Many of these inequitable exposures and vulnerabilities directly result from colonial legacies of violently coopting environments and resources from communities for unsustainable extraction (Howitt 2020). Given the pervasiveness of these injustices, a transformative climate justice lens is imperative for effective climate action (Sultana 2022).

2.1 A paradigm shift: moving beyond climate isolationism toward climate justice in higher education

The inadequacy of humanity's response to the climate crisis over the past 30 years can be attributed, at least in part, to climate isolationism, the common framing of climate change as an isolated, discrete, scientific problem in need of economic and technological solutions (Fig. 1) (Stephens 2020, 2022a). In the first generation, before the 2000s, climate policy was dominated by denial and investment in climate science research to better understand the problem. In the second generation, between 2000 and 2018, narrow technocratic approaches dominated including market-based approaches and technological innovation. The third generation expands to include calls for transformative public investment in climate justice. Large-scale investments in climate justice can be considered a third generation of climate policy, following the early era of denying or largely ignoring climate change and recent market and technology-based efforts, which featured some more effective approaches (renewable energy development and standards) than others (carbon capture and offsets).

Non-transformative approaches to climate policy extend beyond governmental policy and are also widespread in institutional decision-making. Policymakers and organizations

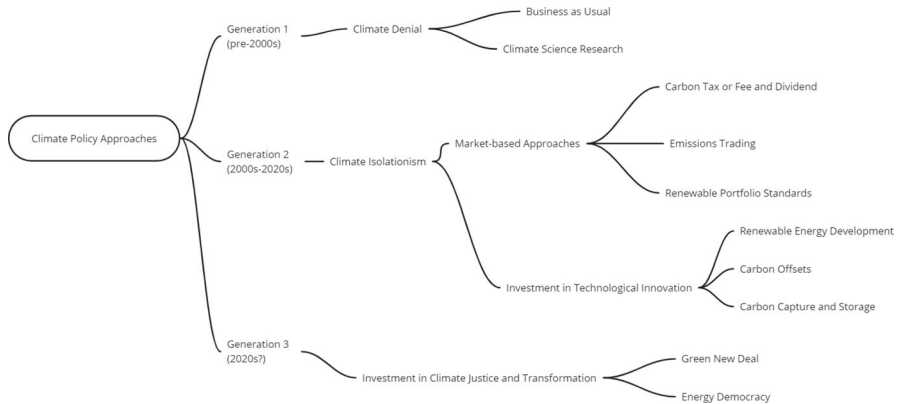


Fig. 1 Institutional approaches to climate policy. Three generations of climate policies have evolved over time. The generations are additive, in that climate denial and climate isolationism remain the most common approaches to climate policy into the 2020s. What distinguishes the third generation is that it features investment in addressing the underlying social drivers of climate change and vulnerabilities thereto

leaders working on climate mitigation and adaptation within a lens of climate isolationism often focus on quantitative greenhouse gas emission reductions and temperature change while inadvertently ignoring the societal complexities and potential social innovations associated with goals defined by these quantitative measures. Climate isolationism diminishes the potential for transformative social change by understating the relevance of investing in social innovation, social infrastructure, and social justice (Anderson and Peters 2016). When the climate crisis is framed as a scientific problem in need of a technological fix, public discourse and imagination on changing the underlying societal and economic structures is constrained. Climate isolationism is a form of climate obstruction (Ekberg et al. 2022; Lamb et al. 2020) because it delays climate action by obfuscating links between the worsening climate crisis and the concentration of wealth and power among those profiting from maintaining fossil fuel reliance who are resisting transformative change (Stephens 2020, 2022b).

The silos of higher education have perpetuated climate isolationism by emphasizing and supporting physical science and technological innovation to address climate change. Despite efforts to diversify science and engineering, persistent racial, gendered, and economic injustices of our economy and educational systems perpetuate exclusive access to science and engineering (Valantine and Collins 2015). The lack of diversity within the fields of physical science and engineering limits the scope of inquiry and constrains the types of connections that are made among science, technology, and society (Stephens 2020). Many colleges and universities sustain patriarchal leadership structures as they promote technocratic individualistic goals prioritizing the future financial success of their students and alumni and partnerships that serve corporate interests. The financialization of higher education has limited institutional commitments to prioritizing the public good and civic engagement. The problematic influence of the private sector and corporate interests in higher education is clear when one considers how and why fossil fuel companies have strategically supported higher education research since the 1950s (Westervelt 2021). The influence of the Koch family on higher education research (Leonard 2019) is the most widely recognized higher education funding source to promote climate denial and strategically resist climate action, but

a larger network of climate change counter movement (CCCM) has focused providing financial support to colleges and universities to strategically resist climate action and efforts to reduce fossil fuel reliance (McKie 2021; Westervelt 2021). Because higher education has been prioritizing private interests rather than the public good by accepting funds to amplify climate denial and promoting climate isolationism, transformational changes in how higher education functions and interacts with corporate interests, the public sector, and marginalized communities are needed.

While technology is an essential part of a transition toward a more just, equitable, and climate stable future, investments in physical science and technological innovation have not yet been adequately balanced with investments in social science, social infrastructure, social innovations, and social justice (Overland and Sovacool 2020). This lack of investment has failed to strengthen social ties, thereby reducing community resilience—our ability to collectively cope with and recover from crises (Aldrich 2012). The lack of investment in social innovation and social justice has also constrained our imaginations about the role and potential impact of higher education in society. This narrow approach has begun to shift as there is growing recognition that addressing climate change will require investing in transformative social, institutional, financial, and political changes (Overland and Sovacool 2020). Still, data on research grants and funding shows that higher education continues to emphasize natural science and technology-based climate research rather than climate social sciences (Overland and Sovacool 2020). If social science research and social innovation were prioritized and funded at a higher level, the technological innovation would be coupled more effectively with research to accelerate the accompanying social change. As influential innovative institutions, higher education has an opportunity to lead by example and change the discourse from a climate isolationist approach to a more holistic and integrated climate justice commitment across campus functions and initiatives.

Moving beyond climate isolationism in higher education also requires recognizing that colleges and universities shape the communities in which they are located. Providing good jobs and economic vitality is often an assumed role of higher education institutions in their local communities, however “town-gown” interactions and relationships are often contentious, particularly when the college or university seems to be extracting from rather than contributing to the local community (Mtawa and Wangenge-Ouma 2022). As community engaged research and experiential learning are increasingly encouraged in higher education, colleges and universities are reckoning directly with the potential for exploitative and extractive relationships with local communities (Riccio et al. 2022). In the USA, the public good of higher education is recognized through its tax-exempt status, which has become increasingly controversial because local municipalities are disadvantaged by the lower tax base (Baldwin 2021b). Some universities end up contributing more economic benefits to the private sector than they do to local communities (Baldwin 2021b; Quigley 2018). A PILOT (payment in lieu of taxes) assessment program, where universities voluntarily contribute to local municipalities, has been established in some places to make up for the loss in tax revenue. PILOT is designed to facilitate a direct economic contribution from the university to the local community; however, many universities contribute much less than the amount recommended in the PILOT assessment (Quigley 2018). Expanding direct investments by higher education toward funding public infrastructure used by both the campus and surrounding community could simultaneously advance multiple goals including climate justice goals. Examples include higher education investing in fare-free public transit, upgrading local water infrastructure, building efficiency, installing

community-based clean energy microgrids, and contributing to community resilience initiatives in anticipation of more frequent and intense climate disruptions.

2.2 Climate justice and antiracist leadership in higher education

Embracing a paradigm shift through a climate justice commitment within higher education would represent an integrated way to demonstrate antiracist leadership and operationalize antiracist principles. Growing understanding since the 1960s that sources of local pollution inequitably distribute environmental burdens to communities of color and poorer communities has underscored the need for environmental policies to acknowledge, prevent, and compensate for the legacy of ongoing environmental injustice (Bullard and Johnson 2000; Kimmell et al. 2021). Racial and environmental injustice are intricately linked to climate injustice: a legacy of extractive colonialism has culminated in point sources of environmental pollutants, including from fossil fuel extraction and refinement, intentionally disproportionately located in and near communities of color (Johnson and Wilkinson 2021). These same communities are more vulnerable to the impacts of climate change despite having historically contributed least to greenhouse gas emissions (Yeampierre 2020). The pattern of marginalized communities facing higher exposure to climate hazards holds true across scales, recognition of which brought climate justice to the international climate policy agenda at COP6 in 2000 (Schlosberg and Collins 2014). Educational transformation is an essential component of addressing the intersecting crises of racial injustice, economic precarity, and climate disruptions (Crow and Dabars 2015). If higher education institutions are committed to racial justice, they also need to commit themselves to climate justice: the two are inextricably linked.

There is growing concern that higher education may be exacerbating rather than ameliorating the interconnected crises of our time, by failing to advance pro-democratic civil discourse and reduce racial inequities and gender disparities (Abreu 2020; Crow 2008; Fitzpatrick 2019; Gardner et al. 2021; Hooks 2003). Within the USA, higher education has been upholding racism and white supremacy by claiming “racelessness” and failing to critically reflect on the role of structural racism in the establishment and functioning of knowledge production processes (Patton 2016). Many scholars have argued that rather than exemplifying diverse, inclusive enlightenment, higher education remains a colonized space where upholding scholarship with European origins and economic aims is prioritized and institutional resources are geared toward building corporate and military capacity without consideration for social repercussions (Grande 2008; Kelley 2018; paperson 2017; Patel 2021). Many institutions of higher education are constantly undergoing physical territorial expansion. The growth of land-grant universities in the USA exemplifies the role of higher education in expropriation and violent colonization of indigenous lands; the federal government gave indigenous land to universities igniting a process of profit and capital accumulation (Lomawaima et al. 2021; paperson 2017). The capital accumulated by expropriated land may otherwise be considered stolen from the communities from whom that land was taken; a theft compounded by the continued failure of higher education to fulfill their PILOT contribution commitment to local communities (Ahtone and Lee 2021; Fernandez 2016).

The inadequacy of how most universities are responding to both racism and the climate crisis demonstrates how higher education is reinforcing rather than disrupting the concentration of wealth and power (including white supremacy and the influence

of fossil fuel interests). To advance a just societal transition away from worsening climate suffering, the dominant knowledge paradigms on which current societal systems were built must be challenged (Ojha et al. 2022). Recent efforts by US colleges and universities to establish courses and curriculum centering diversity, equity, and inclusion demonstrate how these efforts are largely oriented toward the experiences of white people (Abrica et al. 2021; Gonzales et al. 2021). Despite claimed commitments to diversity, these do not challenge existing power structures or approaches to academic knowledge production that maintain systemic racism, instead neutralizing the concept without effecting change (Patton 2016). In parallel, while fossil fuel divestment has been adopted in some colleges and universities (Stephens et al. 2018), higher education generally continues to perpetuate reliance on fossil fuels in their own campus energy systems, endowments, and the retirement investments of their faculty and staff (Healy and Debski 2017; McLaughlin and Pell 2022; Stephens et al. 2017).

2.3 Distinguishing climate justice action from climate action

The inadequacy of the last decade of climate action suggests that a more holistic approach is essential for transformation. Climate justice relates to both the root causes and impacts of climate change as they uphold or limit human rights and justice (Robinson and Shine 2018). By centering justice in efforts to address the climate crisis, climate justice expands far beyond the climate isolationist approach of simple greenhouse gas emissions reductions and decarbonization. Rather, it emphasizes actions to address the underlying causes and extent to which vulnerable frontline communities face disproportionate impacts of climate change and fossil fuel pollution, aspiring to “fair treatment of all people and [seeking] to rectify the environmental burdens posed by discriminatory policies and systems, and by climate change” (Grady-Benson and Sarathy 2015). Climate justice helps to frame understanding of the benefits and burdens of greenhouse gas mitigation, responsibility and capacity to respond to climate change, and how to minimize the burden of adaptation on the world’s most vulnerable (Jenkins 2018).

Climate justice includes several dimensions of justice; procedural and distributional justice are most frequently considered. Procedural justice refers to participation and engagement in decision making. Distributive or distributional justice focuses on the distribution of or access to impacts/burdens and resources/responses across groups (Hurlbert 2011). Climate justice can also include recognition justice, understanding, and fairly representing difference in culture and perspectives (Martin et al. 2016)—and intergenerational justice—ensuring the protection of nature for and limiting risk pushed on future generations (Newell et al. 2021). Reparational justice, sometimes described as restorative justice, is a component of climate justice that seeks to redress past injustices and prevent future injustices (Táíwò 2022).

Climate justice is also aligned with and synergistic with energy justice. Energy justice can be considered an integral subset of climate justice that typically focuses on reducing disparities and inequities in energy system outcomes and processes at a local or regional grid level (McCauley and Heffron 2018). Energy justice addresses many of the same tensions between social and environmental dynamics of transformation as climate justice with a focus on the power dynamics within energy systems. Energy justice emphasizes the need to address and prevent harms that result from unevenly distributed burdens and benefits of the ways energy is generated and distributed (Baker 2021). Although energy justice is specifically concerned with energy resource flows, the environmental and health impacts of these flows closely link

energy justice to environmental justice. Energy justice scholars recognize the reproduction of extractive colonial dynamics in the inequitable placement of pollution burdens and energy costs on marginalized, colonized, and racialized people (De Onis 2021). With increasing awareness of energy injustices and how many climate and energy policies are exacerbating inequities by disproportionately benefiting wealthy individuals and communities, policy attention has shifted recently to expand energy investments in low-income households (Bednar and Reames 2020; Jenkins et al. 2020; Reames 2016; Si and Stephens 2021).

Climate justice also requires large and integrated investment in climate adaptation (Barrett 2013; Weinrub and Giancattarino 2015). To reduce suffering for the most vulnerable households and communities, large direct investments are needed in building resilience including food access, clean water, and education in frontline communities. Climate justice requires “radical shifts in how we (a) build and sustain relationships, (b) manage uncertainty, disruption, grief, and shock, and (c) redistribute wealth, opportunity, risk, and accountability” (Roberts-Gregory 2021). To prioritize innovative climate justice initiatives that move beyond climate isolation, higher education must diversify and value integration of other kinds of expertise, experiences, and perspectives.

Another distinguishing factor is that climate justice integrates labor justice. Fair compensation for dignified work and the economic empowerment that accompanies it are essential components of climate justice. To be clear, fair pay alone is unlikely to overcome inequities based in structural legacies of centuries of—at best—discriminatory exclusion from economic and professional opportunity and economic predation. However, higher education cannot claim to have achieved climate justice or be working toward a just transition without essential components of climate justice including healthy working conditions, fair, livable pay, and benefits for all people working on campus (Ayele 2020; Gunn-Wright and Hockett 2019). A climate just future necessarily will feature different modalities and dynamics of labor than those associated with the extractive past (Bouzarovski 2022). People of color, women, and people from other marginalized groups are more likely to earn poverty-level wages, a vicious cycle that reduces future opportunities for economic security and harms mental and physical health (Cooper 2018; Pillay-van Wyk and Bradshaw 2017). People who are not impoverished are less vulnerable to the impacts of climate change (IPCC 2022). Many institutions of higher education outsource work such as in food service to contractors, which allows the institution to claim that all employees are paid above a living wage and benefits floor despite data showing that contract workers are paid below the living wage without health benefits or the same protections as employees—a tension that was particularly pronounced during the COVID-19 pandemic when workers including food service staff and janitors at some universities were laid off without pay (Burke 2020).

2.4 Disrupting financial assumptions and structures

Investing in climate justice in higher education requires disrupting mainstream financial assumptions about higher education and how colleges and universities are funded. For higher education to reclaim its focus on the common good and restructure to prioritize the public good, public funding has to increase. Underfunding of higher education and of sustainability incentives both limit the capacity of higher education to implement climate justice (Eichhorn et al. 2022). The paradigm shift we are proposing requires a renewed commitment to public support for higher education, so that colleges and universities are no longer beholden to wealthy students, alumni, and donors and corporate interests.

Navigating the challenges and the opportunities for higher education to advance climate justice requires collective resourcefulness, innovative teaching and learning, networked strategizing, and a compelling vision for the future. To leverage the potential of higher education, institutional creativity and resourcefulness will be needed among those within institutions of higher education and also among political leaders and education advocates outside of colleges and universities. Higher education leaders and advocates need to reinvent and reimagine a role that does not require continuing to profit from and reinforce current systems. For example, universities have begun to prioritize the influx of money from private entities, turning into so-called real estate companies and modern-day company towns (Baldwin 2021a). Fossil fuel companies have been strategically funding college and university research for decades to advance research to protect their industry (Brulle and Dunlap 2021; Healy and Debski 2017; Pang 2021).

A collective resistance to the financialization and privatization of higher education is critical (Washburn 2005). With the pattern in recent decades of devastating reductions in public support for higher education, colleges and universities have become increasingly reliant on the private sector and philanthropic donations. Like many other aspects of society, higher education has become increasingly “financialized” in the USA and other parts of the world (Sörlin 2007; Stephens et al. 2008). The financialization of higher education has contributed to increased economic inequities; from exorbitant tuition prices that result in huge student debt burdens to universities’ contracting out staff for food services, custodial services, parking services, and other facilities management (Banerji 2018), universities have privatized many basic services. By prioritizing climate justice, higher education leaders would have a framework to resist the privatization and corporatization of higher education. Rather than further privatization, climate justice principles justify major increases in public funding for higher education for public benefit. This proposed paradigm shift requires simultaneous efforts within and outside higher education to align public investments with a renewed commitment to advancing climate justice as a public good.

3 Applying climate justice frameworks to assess transformative opportunities in higher education

This section provides a review of specific actionable initiatives and opportunities within higher education that we have identified that are aligned with transformative climate justice. To present the broad range of different kinds of initiatives that are aligned with advancing climate justice, we use two climate justice policy frameworks. Because a commitment to climate justice in higher education is complex, interconnected, and broad, these initiatives do not fit easily into traditional ways of thinking about the role of higher education in society. But by applying two climate justice policy frameworks that are not generally linked to higher education, we provide a novel approach to structure consideration of specific opportunities and initiatives for advancing climate justice in higher education. The two policy frameworks that align the processes and objectives of climate justice are the Green New Deal (GND) and GND-type policies and energy democracy (Fig. 2). GND-type policies link large public investments in clean energy with investments in labor, health, and education to strengthen community sustainability and resilience, building justice beyond more narrow conventional climate policies (Fig. 1) (Boyle et al. 2021). Energy democracy focuses on the main driver of climate change—dependence on fossil fuel energy and the power dynamics that underlie it—as a movement to resist fossil fuels, reclaim energy decision-making, and restructure energy systems for more equitable and renewable power (Burke and Stephens 2017).

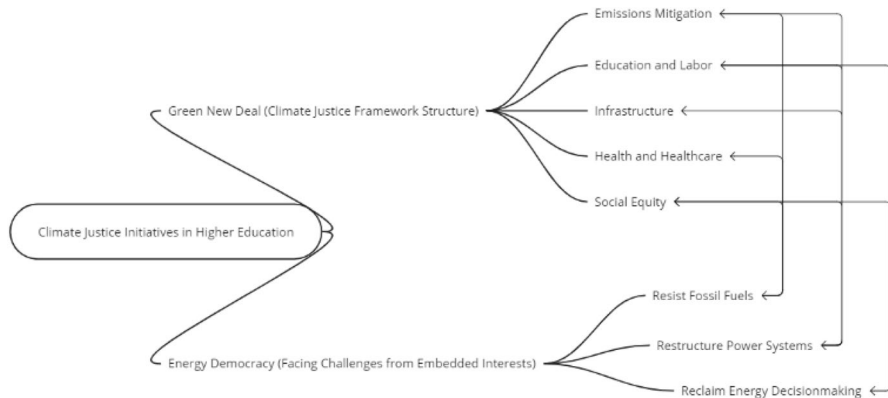


Fig. 2 Conceptualizing climate justice frameworks for higher education. Applying two climate justice policy frameworks for higher education: (1) GND-based structure composed of five key interlinking topical areas, and (2) an Energy Democracy approach focuses on realigning power imbalances

The GND policy framework has inspired climate justice policies at all levels of governance—Indigenous, municipal, state, national, and regional—in many parts of the world, including in Europe, Canada, and South Korea (Boyle et al. 2021). Beyond the highly politicized Green New Deal proposal at the Federal level in the USA introduced in 2019, GND-like policies have emerged as climate justice policies because they acknowledge that climate change is an urgent crisis demanding rapid, transformative public investments that prioritize the advancement of social justice, racial justice, and economic justice rather than continuing to exacerbate social and economic disparities (Dalzell 2021). GND-type policies represent a new generation of climate policy focused on multi-systemic, transformational change that, crucially, centers social equity (Boyle et al. 2021). GND-type policies involve simultaneous large public investment in the future, including in renewable energy, public health, and just job creation and training (Fig. 1). In Table 1, we outline and describe these topical areas addressed in GND-type policies and how they apply to higher education.

Energy democracy embraces the idea that transformation away from centralized fossil fuel-based energy systems to a distributed renewable-based future can also redistribute power—political and economic power as well as electric power (Burke 2018; Feldpausch-Parker et al. 2022; Stephens 2019). Three kinds of innovative activities are central to the energy democracy movement: (1) resist centralized and concentrated fossil fuel based power, (2) reclaim decision-making in energy systems for the public good, and (3) restructure to encourage and support distributed renewable power (Burke and Stephens 2017). A key feature of energy democracy is the recognition that “how” renewable energy is deployed—that is, who is included, who is excluded, and how the benefits are distributed—matters a lot. Similarly to Table 1, in Table 2, we describe the three elements of energy democracy and how each applies to higher education.

The climate justice policy frameworks of both the GND and energy democracy provide a valuable structure for considering the broad range of institutional initiatives that could advance climate justice in higher education.

Table 1 Applying the Green New Deal policy framework to higher education

Topical area	Description	Application to higher education
Climate mitigation	Includes: <ul style="list-style-type: none"> • renewable energy standards and emissions goals for sectors Includes: <ul style="list-style-type: none"> • education and retraining for a just transition, green job development, and labor rights 	Set renewable energy and emissions reductions goals for university buildings, transportation, and heat and power <ul style="list-style-type: none"> • Prioritize creating good jobs for workers from under-invested-in communities • Pay all employees a living wage with competitive benefits – end subcontracting lower-paid workers • Provide all employees with training to do their jobs effectively and sustainably • Incorporate sustainability and equity into curricula
Infrastructure investment	Framed as: <ul style="list-style-type: none"> • creating jobs or • spurring emissions reductions through clean energy References: <ul style="list-style-type: none"> • negative impacts of climate change on human health • the harms experienced by frontline communities • deficiencies in the healthcare system exposed by COVID-19 	Invest in renewable energy and retrofit projects for the institution that provide good jobs to community members and may serve as learning and/or research opportunities for students and faculty <ul style="list-style-type: none"> • Identify the university's role in community health (as a medical school or benefit-providing employer) • Ensure that all members of the university community and neighborhood have access to adequate and equitably delivered healthcare • Actively prevent or mitigate health harms such as from exposure to air pollution or other environmental toxins
Health outcomes & healthcare		
Social equity	Addressed by mechanisms including: <ul style="list-style-type: none"> • reparations • empowerment in local investment decision-making • focused investment in a just transition for frontline communities • prioritized allocation of infrastructure investment and clean energy benefits to disadvantaged communities • procurement and contracting that prioritizes underrepresented communities 	<ul style="list-style-type: none"> • Prioritize involvement, feedback, and where appropriate, leadership from representatives of under-invested-in communities including neighborhood community leaders • Co-design and co-develop projects and commit to equitable procurement and investment for infrastructure, research, hiring, and enrollment

Table 2 Applying the energy democracy framework to higher education

Energy democracy activity	Application to higher education
Resisting the legacy energy agenda that continues to support fossil fuels	Resist carbon-intensive energy: <ul style="list-style-type: none"> • divesting endowment from fossil fuels • refusing fossil fuel industry research funding • restricting fossil fuel industry representation on the board
Reclaiming energy decision-making so that the public interest is prioritized over corporate interests	Reclaim the energy system through genuine partnership with neighboring communities to develop community renewable energy options that meet the needs of the community and the university
Restructuring energy systems to maximize distributed local and regional benefits	Restructure the university's unique role as a hub of innovation to co-design and co-produce <ul style="list-style-type: none"> • local renewable energy projects • microgrids • virtual power plants • demand management programs • other experimental clean energy projects

4 Novel university initiatives aligned with transformative climate justice

This section reviews a broad range of proposed university initiatives that would align with an institutional commitment to advancing climate justice. These proposed initiatives are based on a review of the literature on connections between the core elements of each climate justice policy framework and institutions of higher education. We detail specific potential climate justice initiatives first within the GND policy framework (Table 3) and then within the energy democracy framework (Table 4).

4.1 Investing in transformation: initiatives compatible with the GND framework

In Table 3, we detail specific potential initiatives GND-like policies based on literature review of actions that institutions of higher education could incorporate in a climate justice plan. Several organizations, including the University and College Union in the UK and collegiate hubs of the Sunrise Movement, have begun organizing to support the implementation of GND principles in higher education; these efforts have included declaring a climate emergency and practicing ethical investment, in higher education: a GND for Universities (University and College Union 2021). These efforts lay the foundation for expanding the conception of the higher education sector as a key player in advancing social justice and transformative social change. The work of these organizations provides resources for colleges and universities so they do not need to develop an institutional climate justice plan from scratch. Building on the Sunrise Movement's work, Table 3 provides innovative examples of climate justice initiatives in the five GND topical areas: (1) climate mitigation, (2) education, labor, and workforce training, (3) infrastructure investment, (4) health outcomes and healthcare, and (5) social equity. Initiatives in these areas can be integrated in and aligned with higher education's basic functions of teaching, research, campus operations, financial resource management, and community engagement (Fig. 3) (McCowan 2020). The capacity of higher education community

Table 3 Potential higher education climate justice initiatives within the GND framework

Topical area	Motivations	Actions in higher education
Climate mitigation	Fossil fuels are the core cause of climate change, and climate justice necessitates cessation of these activities (Newell and Simms 2020; Piggot et al. 2020; Strauch et al. 2020; Welsby et al. 2021)	<ul style="list-style-type: none"> End fossil fuel reliance in energy, transportation, food systems, and infrastructure: <ul style="list-style-type: none"> emissions standards for new buildings and inputs thereto (Röck et al. 2020; Eichhorn et al. 2022) retrofit old buildings for efficiency (Shen et al. 2019; Hao et al. 2020; Akkose et al. 2021; Rodrigues and Freire 2021) eliminate fossil fuel inputs in campus landscaping and maintenance (Habib and Al-Ghamdi 2020) limiting water and other resource consumption (Poland and Dooris 2010) invest in renewable energy production and storage (Mathiesen et al. 2011; IPCC 2018) use solely electric vehicles and promoting walking, cycling, etc. (Lutsey 2015) limit air travel for presentations and conferences (Eichhorn et al. 2022; Kelly et al. 2022a) initiate public advocacy efforts for climate policy by university government affairs offices and supporting academics in climate advocacy efforts (Kelly et al. 2022a, b)
Education, labor, and workforce training	A shift in curriculum and funding toward sustainability, climate justice and social justice education will be a large part of universities' contribution to a greener future that includes economic justice (Muttitt and Kartha 2020). Unionization provides crucial protection of worker rights and is a worker right in itself. The concept of a just transition originates in the labor movement, in recognition of the need for good, green, healthy livelihoods to replace fossil fuel-driven jobs (McCauley and Heffron 2018). People who are healthy and not impoverished are more resilient and able to adapt to climate change and manage other hardships (Newell and Mulvaney 2013; D'Alessandro et al. 2020; Omann et al. 2020). Implementing climate justice requires not only addressing historic injustices, but eliminating ongoing and preventing future inequities and vulnerabilities (Sovacool et al. 2019)	<p>Job Training:</p> <ul style="list-style-type: none"> offer transdisciplinary classes that pertain to high-skilled green jobs, from renewable energy engineering to sustainability policy teach civic engagement and advocacy build partnerships to develop training and re-training programs for a broader range of green jobs across skill levels – available at lower costs to more people (Trencher et al. 2017; Hoimle et al. 2021) University of Vermont, for example, created a sustainability requirement—all students must take a general education course involving sustainability (The University of Vermont 2021) engage with diverse pedagogies including Indigenous knowledge and the arts (Kelly et al. 2022b) <p>Labor:</p> <ul style="list-style-type: none"> pay all employees a livable wage for the area's cost of living provide fair benefits hire employees directly rather than sub-contracting to avoid paying living wages and benefits allow (or encourage) unionization of all kinds of staff (McCauley and Heffron 2018)

Table 3 (continued)

Topical area	Motivations	Actions in higher education
Infrastructure investment	Physically increasing green space provides a benefit to the community in and around the university (McFarland et al. 2008). Renewable energy and reduced impact consumption of all kinds is possible on campuses. Plants are not only beneficial to the aesthetic quality of universities and mental health of the community members; they mitigate climate change by moderating the heat island effects and air pollution at the local level and by sequestering carbon (Edmondson et al. 2016; Willis and Petrokofsky 2017)	Invest in renewable energy and retrofit projects that provide community-accessible good jobs and learning and/or research opportunities <ul style="list-style-type: none"> utilize campus rooftops as green spaces and building “living buildings” (Alfieri et al. 2009; Whittinghill and Rowe 2012; Köhler and Kaiser 2021) provide resources to transport people to natural spaces outside of campus to increase the benefits of student engagement with the natural environment (Hartig et al. 1991; Benfield et al. 2015)
Health outcomes & healthcare	Universities can prioritize health equity in student and employee healthcare, which addresses both health injustice and environmental health injustices more specifically (Poland and Doors 2010; Braveman et al. 2011). Community member health is also driven by access to sustainable and nutritious food. Universities can contribute to changing food access patterns and reducing food apartheid nearby (Brones 2018)	<ul style="list-style-type: none"> Monitor and remediate issues in environmental health indicators like air and water quality in tandem with sustainability upgrades, such as through a weatherization plus health initiative that increases building energy efficiency (Underhill 2018; Tonn et al. 2021) Address health injustices in the wider community by opening health services to the public (e.g. free, walk-in, or mobile health clinics) or offering price reductions in services for community members (Yu et al. 2017) Work with farmers and local food distributors to make the university food system more sustainable by supporting local, sustainable producers on campus (Stahlbrand 2018) Offer free or reduced-price meal plans at a fair sliding scale would address food inequities (El Zein et al. 2019) Fund urban farms and gardens with local leaders that can function as educational tools as well Apply behavioral psychology such as defaulting to vegetarian options in cafeterias and for catered events and placing vegetarian menu items at the top of menus. This can be highly effective in reducing carbon-intensive food consumption in cafeterias (Gravert and Kurz 2021)

Table 3 (continued)

Topical area	Motivations	Actions in higher education
Social equity	Universities have a history of gentrifying (or “studen- dentifying” (Anderson 2015)) the areas around them, pushing out low-income residents of color; an injustice that must be acknowledged and addressed if committed to social justice. Higher education is often physically sited on land stolen from indig- enous peoples; this land is considered capital that has accumulated for the institution at the expense of the original guardians of the land (paperson 2017; Lomawaima et al. 2021)	<ul style="list-style-type: none"> • Support resilient neighboring communities and engage to avoid gentrification • Acknowledge and making reparations to Indigenous tribes whose land was stolen to develop universities, and address local needs with university capital (Garton 2020; Lee and Athone 2020) • Invest in mixed-use buildings, affordable housing within off-campus buildings, and most importantly, listening to the surrounding neighborhoods as part of a full community engagement initiative before siting a new project (Evans et al. 2007; Garton 2020; Kopp 2021) • Build and maintain strong, restorative relationships with local communities and indig- enous tribes on whose land a university is situated (Johnson et al, 2016)

Table 4 Higher education climate justice initiatives within the energy democracy framework

Action type	Motivations	Actions in higher education
Resist	<p>Resistance includes efforts to delegitimize the fossil fuel industry, to reduce the political influence of fossil fuel interests, and to halt investments in fossil fuel infrastructure that are perpetuating fossil fuel reliance</p> <ul style="list-style-type: none"> Universities hold large endowments in the form of mixed investment portfolios. These investments are often directly or indirectly in the fossil fuel sector, such that the university is literally betting that the fossil fuel and its subsidiary industries will continue to prosper (through resource extraction and the life-threatening externalities it produces including climate change, air pollution, and water pollution) and is directly supporting it in doing so 	<ul style="list-style-type: none"> Fossil fuel divestment of institutional financial portfolios Fossil fuel divestment of employee retirement account End activities associated with expansion of fossil fuel production including divesting from fossil fuel-based companies such as the plastics and industrial agriculture industries Refuse research and educational funding from fossil fuel interests, and restrict fossil fuel interests in university governance including board of trustees
Reclaim	<p>Information transparency may include providing straightforward access to organized environmental data. Accessible data on sustainability efforts, achievement, and planning is vital for informed decision-making (Ferrer-Balas et al. 2010)</p> <ul style="list-style-type: none"> Mechanisms to hold the administration accountable are limited, and the board of trustees often self-perpetuates a cycle of member election, unclear criteria for board member conduct, and lack of meaningful opportunities for governance by student and faculty governing boards (Thelin 2003; Lubash 2015). Students, faculty, and staff also lack legal standing to hold universities accountable for achieving their stated mission Corporations that make substantial donations to the university have a say in decision-making and strategy, given corporate ties to the board of directors (Barringer and Riffe 2018; Scott 2018). Trustees often lack academic experience as educators and staff, instead coming from corporate backgrounds with profit maximization mindsets (Queeney 2021) 	<ul style="list-style-type: none"> STARS reporting Social justice data sharing like the Just program Share more accessible financial statements Empower the community to participate in decision-making discussions Create clear behavior standards for members of university governance, in particular associations with fossil fuel and other extractive, unsustainable industries
Restructure	<p>Increase public funding for higher education so institutions not reliant on corporate support and influence</p> <p>Socially responsible investing, particularly as part of divestment from fossil fuels, is a legitimate financial strategy that may produce returns at a higher rate over the long term than unethical or non-socially responsible investing (Sanzillo et al. 2018). The fossil fuel industry is continually weakening, losing its place at the forefront of effective investment strategy</p>	<p>Reinvest in green energy, social and economic justice, and community development</p> <ul style="list-style-type: none"> Ensure 100% renewable energy on campus and beyond Invest divested funds in just and community-based enterprises



Fig. 3 Higher education roles in climate justice. Internally, colleges and universities are composed of four primary constituents: Administration, Staff, Faculty, and Students/Alumni. These groups collectively engage in and are responsible for initiatives and programs in which climate justice (see Tables 3 and 4) can be embedded

members to meaningfully engage with and connect to the broader community is cross-cutting; all groups' activities influence and are influenced by social and policy change (Fig. 3). Given that most higher education institutions, whether public or private, are supported by both public and private funding, a substantial increase in public funding is required to reduce the impact and reliance on corporate interests and private sector actors whose priorities may not be aligned with climate justice goals. Among those advocating for transformative increases in public funding for higher education, Scholars for a New Deal in Higher Education emphasize how generous government funding and fair, inclusive governance of higher education is a necessary foundation for a democratic, equitable, and just society (SFNDHE 2022).

4.2 Rebalancing power: initiatives compatible with the energy democracy framework

While the GND framework provides a structure to consider the potential of climate justice initiatives by linking climate and energy with jobs, health, infrastructure and equity,

the energy democracy framework provides a conceptual structure to consider how climate justice initiatives challenge existing power dynamics (Fig. 2, Table 4). Vested interests benefit from the status quo, so the biggest challenge to implementing climate justice in higher education is managing fallout from disruptions to business as usual. Fossil fuel divestment, for example, has been contentious on many campuses because powerful forces do not want to lose profit from the continuation of a fossil fuel-based economy (Stephens et al. 2018). Resistance to fossil fuel interests, a key dimension of the energy democracy framework, is increasingly acknowledged as essential to combatting climate change and advancing climate justice (Newell et al. 2021). Resisting the dominant legacy of fossil-fuel-based energy systems includes resisting processes, technologies, and institutional and cultural norms (Newell et al. 2022; Stephens 2019). Given how fossil fuel interests have been strategically investing in higher education for decades as part of their effort to deny and delay transformative climate action, resisting fossil fuel interests in colleges and universities is an essential part of climate justice. Recognizing how challenging it is to shift power dynamics in higher education, this section explores potential climate justice implementation in higher education by discussing each component of energy democracy—resist, reclaim, and restructure.

4.2.1 Resist

Resisting fossil fuel interests in higher education is a critically important part of a commitment to climate justice (UnKoch My Campus 2020). Colleges and universities have been an important focus in the growing social movement to divest institutional endowments from fossil fuels (Stephens et al. 2018). A variety of educational organizations, philanthropic foundations, faith-based organizations, public pension funds, and non-governmental organizations have committed to divestment, and thousands of individuals have removed fossil fuel companies from their retirement and investment accounts (Stephens et al. 2018). Divestment is a tactic to target the fossil fuel industry through institutional investors, a key pillar of support upholding the industry's political and economic dominance (Grady-Benson and Sarathy 2015). Divestment in US higher education derives from a student group at Swarthmore College in Pennsylvania—Swarthmore Mountain Justice—launching the first campaign for fossil fuel divestment in 2011 (Grady-Benson and Sarathy 2015). In September 2021, Harvard University, the most-endowed university in the world, divested from fossil fuels (Treisman 2021). Harvard had already eliminated direct investments in fossil fuels, so its new pledge will end the indirect investments that make up 2% of its (\$42 billion) endowment. While divestment plays a role in delegitimizing the fossil fuel industry, divestment alone does not address fossil fuel connections in research funding and employee retirement funds.

Resisting the influence of fossil fuel investments in research and teaching in higher education is connected to transformative climate justice in many ways including prioritizing the fundamental knowledge creation and knowledge dissemination roles of higher education. With expanding research highlighting how strategic research funding by fossil fuel interests has been promoting misinformation and public ignorance rather than knowledge dissemination (Supran et al. 2023; Franta and Supran 2017; Oreskes 2019), a commitment to climate justice requires higher education leaders to resist fossil fuel interests. Growing research on agnotology, the intentional creation of ignorance, shows how powerful industries strategically deploy misinformation to create ignorance, confusion, and uncertainty such as by funding research that aligns with their priorities and suppressing research that does not (Corneliussen 2014; Hess 2020; Lewandowsky et al. 2015). These tactics are particularly relevant to climate research and advocacy, where the fossil fuel industry has funded climate science denial to delay environmental

and climate action and suppress regulatory support for environmental social movements for decades (Hess and Belletto 2022; Oreskes and Conway 2011; Proctor 2010).

4.2.2 Reclaim

Another challenge is the lack of transparency and community-driven governance in most higher education institutions. The power and influence of faculty governance in higher education has been in decline, as senior administrators increasingly make strategic decisions without the input of faculty or students (Fitzpatrick 2019; Vican et al. 2020). Reclaiming decision-making to build climate justice institutions and infrastructure requires inclusive governance processes, including community accountability for leaders. Universities have an opportunity to innovate and demonstrate how to create just processes for decision-making. To implement meaningful justice and equity into a climate justice policy, universities should strive for transparent and inclusive governance systems (UnKoch My Campus 2020). Climate justice policies in higher education could take many forms with social justice at the core of planning and investments. Policy creation must incorporate procedural justice, meaning all stakeholders—not only wealthy investors—have a say. Successful climate justice requires changes in practice with tangible benefits.

4.2.3 Restructure

In addition to resisting corporate interests including fossil fuels and reclaiming decision-making, a restructuring of higher education incentives, financing, and purpose is needed to reorient the mission toward the public good and climate justice. Restructuring the way research projects and campus energy infrastructure projects are designed and conducted, to include co-design and co-development with non-academic communities, creates opportunities for building local relationships and prosperity. For example, universities as anchor institutions can link more closely their intellectual and practical innovations with external communities and partners (Brown and Bozuwa 2017). Higher education could partner with the Fossil Fuel Non-Proliferation Treaty initiative, a network of hundreds of civil society organizations with thousands of academic signatories, formed in recognition of the importance of committing to phasing out fossil fuels and reinvesting in a just transition beyond international commitments such as under the Paris Agreement to advance research, learning, and innovation toward this goal (Newell et al. 2022; Treaty 2022).

Restructuring higher education toward advancing societal goals of transformative climate justice clearly requires change and innovation at multiple levels including changes beyond what can be achieved at any individual college or university. Broader innovations in educational policy and public funding for higher education are essential for the paradigm shift that we are exploring here. There is a growing movement calling for a new scale of transformative public investment for higher education, i.e., Scholars for New Deal for Higher Education (SFNDHE 2022).

5 Conclusions

As the climate crisis continues to exacerbate vulnerabilities around the world, a paradigm shift in how higher education engages with transformative social change could alter policy options for a more just and climate stable future. Higher education is a critical sector of society that is so-far under-leveraged in terms of preparing for the future.

This conceptual contribution suggests that unless and until climate justice is prioritized and embraced within higher education, colleges and universities are not only sustaining the status quo, but are further reinforcing climate vulnerabilities and exacerbating and perpetuating climate injustices.

Universities are critically important places of knowledge production, knowledge perpetuation, and knowledge dissemination, so during this era of climate disruption and instability they can apply this knowledge capacity to advance systemic social change (Stephens et al. 2008). By leveraging their resources, including their intellectual resources, their human capital, and their physical resources, higher education institutions can become both exemplars of social change and agents for change. As anchor institutions, colleges and universities are among the most stable and forward-looking organizations in many communities (Sladek 2019). To reimagine what is possible, the climate crisis must be addressed within higher education in conjunction with systemic change for social justice and structural change focused on economic justice, racial justice, and energy justice.

A commitment to climate justice provides an intersectoral and interdisciplinary approach to identifying research priorities, training students, interacting with local governments and communities, and supporting employees. Campus operations including renewable energy generation and procuring equipment and food provide other opportunities for demonstrating innovations. This opportunity for leadership in reprioritizing educational and research goals toward transformative structural change for climate justice is amplified among institutions with large endowments who have more financial flexibility in demonstrating and catalyzing change.

To achieve their missions of advancing the common good through learning and innovation, colleges and universities can leverage their resources and reprioritize and reorient their educational and research initiatives toward building transformational climate justice in society. New kinds of strategic collaborative relationships and partnerships with non-academic partners at multiple scales are critical to expanding beyond traditional siloed academic work. New kinds of collaborations may include co-producing climate justice knowledge with community partnerships, expanding international, global research partnerships particularly among interdisciplinary teams in the global north and global south, and growing intergenerational research such as early career and graduate training opportunities, and cross-cutting curricula linking climate justice across disciplines, programs, departments, and schools.

Prioritizing climate justice is an opportunity for colleges and universities to commit to leading the way in ending fossil fuel reliance including shifting how they invest endowments and eliminating unethical petrochemical funding sources. To realize this potential, higher education institutions need to resist corporate influence and recommit to advancing the cutting edge of research and practice for the public good.

Many universities—even those that have made ambitious climate commitments—have not yet leveraged the opportunity to lead the transformation toward a climate just society. Courage and a commitment to advancing social justice are necessary for universities to overcome the many challenges of innovating for climate justice (Bartlett 2021). Climate justice requires a community-engaged approach that expands beyond the individual institution of higher education. A paradigm shift in how higher education is funded is also a key part of enabling and empowering colleges and universities to prioritize climate justice and embrace a transformative lens to better address the interconnected crises of our time.

Author contribution A. K. and J.C.S. conceived the idea for this manuscript. All authors wrote and edited the manuscript text, with major contributions from E.M. to work on current climate action in higher education and I.H. to work on financialization of higher education.

Funding Open access funding provided by Northeastern University Library. This work was supported by the Northeastern University College of Social Science and Humanities Multi-Generational Research Teams Program.

Data availability The authors confirm that the data supporting the findings of this study are available within the article and its supplementary materials.

Declarations

Competing interests The authors declare no competing interests.

Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

References

- Abreu J (2020) Why U.S. colleges are failing at justice education. *The Crime Report*. <https://thecrimereport.org/2020/08/25/why-u-s-colleges-are-failing-at-justice-education/>. Accessed 8 Jul 2022
- Abrica EJ, Hatch-Tocaimaza D, Rios-Aguilar C (2021) On the impossibilities of advancing racial justice in higher education research through reliance on the campus climate heuristic. *J Divers High Educ*. <https://doi.org/10.1037/dhe0000323>
- Ahmed N, Marriott A, Dabi N, Lowthers M, Lawson M, Mugehera L (2022) Inequality Kills: The unparalleled action needed to combat unprecedented inequality in the wake of COVID-19. *Oxfam International Report*. <https://policy-practice.oxfam.org/resources/inequality-kills-the-unparalleled-action-needed-to-combat-unprecedented-inequal-621341/>. Accessed 8 Jul 2022
- Ahtone T, Lee R (2021) Looking forward from Land-Grab universities. *Native American and Indigenous Studies* 8(1):176–182. <https://muse.jhu.edu/article/784832>
- Akkose G, Akgul CM, Dino IG (2021) Educational building retrofit under climate change and urban heat island effect. *Journal of Building Engineering* 40:102294. <https://doi.org/10.1016/j.jobbe.2021.102294>
- Aldrich DP (2012) Social, not physical, infrastructure: the critical role of civil society after the 1923 Tokyo earthquake. *Disasters* 36(3):398–419. <https://doi.org/10.1111/j.1467-7717.2011.01263.x>
- Alferi T, Damon D, Smith Z (2009) From living buildings to living campuses. *Plan High Educ* 38(1):41–50
- Anderson J (2015) Studentification. *Human geography: Cultural geography and space*. https://www.cardiff.ac.uk/_data/assets/pdf_file/0003/348510/studentification.pdf. Accessed 8 Jul 2022
- Anderson K, Peters G (2016) The trouble with negative emissions. *Science* 354(6309):182. <https://doi.org/10.1126/science.aah4567>
- Angelsen A, Dokken T (2018) Climate exposure, vulnerability and environmental reliance: a cross-section analysis of structural and stochastic poverty. *Environ Dev Econ* 23(3):257–278
- Ayele YG (2020) Effective change management for sustainable development in higher education institutions. *European Journal of Business and Management* 12(10). <https://doi.org/10.7176/EJBM/12-10-01>
- Baker S (2021) *Revolutionary power: an activist's guide to the energy transition*. Island Press, Washington DC
- Baldwin DL (2021a) For whose humanity. *Yale Daily News*. <https://yaledailynews.com/blog/2021a/10/11/baldwin-for-whose-humanity/>. Accessed 8 Jul 2022
- Baldwin DL (2021b) *In the shadow of the ivory tower: how universities are plundering our cities*. Bold Type Books, New York
- Banerji A (2018) Financialization of higher education: interest swaps and their consequences. *J Collective Bargaining Acad* 15. <https://doi.org/10.58188/1941-8043.1758>

- Banzhaf S, Ma L, Timmins C (2019) Environmental justice: the economics of race, place, and pollution. *J Econ Perspect* 33(1):185–208
- Barrett S (2013) The necessity of a multiscale analysis of climate justice. *Progress Hum Geogr* 37(2):215–233. <https://doi.org/10.1177/0309132512448270>
- Barringer SN, Riffe KA (2018) Not just figureheads: Trustees as microfoundations of higher education institutions. *Innov High Educ* 43(3):155–170
- Bartlett T (2021) Why are colleges so cowardly? *The Chronicle of Higher Education*. <https://www.chronicle.com/article/why-are-colleges-so-cowardly>. Accessed 8 Jul 2022
- Bednar DJ, Reames TG (2020) Recognition of and response to energy poverty in the United States. *Nat Energy* 5(6):432–439
- Benfield JA et al (2015) Classrooms with nature views: Evidence of differing student perceptions and behaviors. *Environ Behav* 47(2):140–157
- Bouzarovski S (2022) Energy and labour: thinking across the continuum. *Progress Human Geogr*. <https://doi.org/10.1177/03091325211051478>
- Boyle AD, Leggat G, Morikawa L, Pappas Y, Stephens JC (2021) Green New Deal proposals: comparing emerging transformational climate policies at multiple scales. *Energy Res Soc Sci* 81:102259
- Braveman PA et al (2011) Health disparities and health equity: the issue is justice. *Am J Public Health* 101(S1):S149–S155
- Brones A (2018) Karen Washington: It's not a food desert, it's food apartheid. *Guernica Magazine*. <https://www.guernicamag.com/karen-washington-its-not-a-food-desert-its-food-apartheid/>. Accessed 8 Jul 2022
- Brown D, Bozuwa J (2017) Renewable energy is preventative medicine. *The Next System Project*. <https://thenextsystem.org/learn/stories/renewable-energy-preventative-medicine>. Accessed 8 Jul 2022
- Brulle RJ, Dunlap RE (2021) A sociological view of the effort to obstruct action on climate change. *Footnotes* 49(3). <https://www.asanet.org/sociological-view-effort-obstruct-action-climate-change>. Accessed 8 Jul 2022
- Bullard RD, Johnson GS (2000) Environmental justice grassroots activism and its impact on public policy decision making. *J Soc Issues* 56(3):555–578. <https://doi.org/10.1111/0022-4537.00184>
- Burke MJ (2018) Shared yet contested: energy democracy counter-narratives. *Frontiers in Communication* 3. <https://doi.org/10.3389/fcomm.2018.00022>
- Burke L (2020) The staffing divide. *Inside Higher Ed*. <https://www.insidehighered.com/news/2020/03/26/policies-protect-college-staff-members-amid-crisis-contractors-are-left-out>. Accessed 8 Jul 2022
- Burke MJ, Stephens JC (2017) Energy democracy: goals and policy instruments for sociotechnical transitions. *Energy Res Soc Sci* 33:35–48
- Cappelli F, Costantini V, Consoli D (2021) The trap of climate change-induced “natural” disasters and inequality. *Glob Environ Chang* 70:102329
- Chankseliani M, McCowan T (2021) Higher education and the sustainable development goals. *High Educ* 81(1):1–8
- Cooper D (2018) Workers of color are far more likely to be paid poverty-level wages than white workers. *Econ Policy Inst*. <https://www.epi.org/blog/workers-of-color-are-far-more-likely-to-be-paid-poverty-level-wages-than-white-workers/>. Accessed 8 Jul 2022
- Corneliussen ST (2014) Agnotology: “a neologism signifying the study of the cultural production of ignorance.” *Phys Today*. <https://doi.org/10.1063/PT.5.8040>
- Crow MM (2008) Hope, change, and affirmation: new values to guide institutional innovation in American higher education (Lecture). College Board Forum, Houston, Texas
- Crow MM, Dabars WB (2015) *Designing the new American university*. Johns Hopkins University Press, Baltimore, Maryland
- D'Alessandro S et al (2020) Feasible alternatives to green growth. *Nat Sustain* 3(4):329–335
- Dalzell, N. (2021). Two years later, legislators reintroduce green new deal bills. *Climate Xchange*. <https://climate-xchange.org/2021/05/13/two-years-later-legislators-reintroduce-green-new-deal-bills/>. Accessed 8 Jul 2022
- De Onis CM (2021) *Energy islands: metaphors of power, extractivism, and justice in Puerto Rico*. Univ California Press, Oakland, California
- Edmondson JL et al (2016) Soil surface temperatures reveal moderation of the urban heat island effect by trees and shrubs. *Sci Rep* 6(1):33708
- Eichhorn A et al (2022) Towards climate sustainability of the academic system in Europe and beyond. ALLEA Report. <https://doi.org/10.26356/climate-sust-acad>
- Ekberg K, Forchtnr B, Hultman M, Jylhä KM (2022) *Climate obstruction: how denial, delay and inaction are heating the planet*. Routledge

- El Zein A et al (2019) Prevalence and correlates of food insecurity among US college students: a multi-institutional study. *BMC Public Health* 19(1):1–12
- Evans G et al (2007) The generation of diversity: mixed use and urban sustainability. In: Thwaites K, Porta S, Romice O, Greaves M (eds) *Urban sustainability through environmental design: Approaches to time people-place responsive urban spaces* (pp 95–101). Taylor & Francis, London. <https://doi.org/10.4324/9780203934470>
- Feldpausch-Parker AM, Endres D, Peterson TR, Gomez S (eds) (2022) *Routledge Handbook of energy democracy*. Routledge, New York
- Fernandez M (2016) The question of the tax-exempt university. *Inside Higher Ed*. <https://www.insidehighered.com/views/2016/10/13/economic-vs-civic-role-tax-exempt-colleges-university-pennsylvania-play>. Accessed 8 Jul 2022
- Ferrer-Balas D et al (2010) Going beyond the rhetoric: system-wide changes in universities for sustainable societies. *J Clean Prod* 18(7):607–610
- Fitzpatrick K (2019) *Generous thinking: a radical approach to saving the university*. Johns Hopkins University Press
- Fossil Fuel Non-Proliferation Treaty (2022) History. <https://fossilfueltreaty.org/history>. Accessed 30 Nov 2022
- Franta B, Supran G (2017) The fossil fuel industry's invisible colonization of academia. *The Guardian*. <https://www.theguardian.com/environment/climate-consensus-97-per-cent/2017/mar/13/the-fossil-fuel-industrys-invisible-colonization-of-academia>. Accessed 30 Nov 2022
- Frosch RM, Pastor M, Sadd J, Shonkoff S (2018) The climate gap: Inequalities in how climate change hurts Americans and how to close the gap. In: Infield EMH, Abunnasr Y, Ryan RL (eds) *Plan Clim Chang*. Routledge, New York, pp 138–150. <https://doi.org/10.4324/9781351201117>
- Gamoran A (2018) The future of higher education is social impact. *Stanford Social Innovation Review*. https://ssir.org/articles/entry/the_future_of_higher_education_is_social_impact. Accessed 8 Jul 2022
- Gardner CJ, Thierry A, Rowlandson W, Steinberger JK (2021) From Publications to public actions: the role of universities in facilitating academic advocacy and activism in the climate and ecological emergency. *Front Sustain* 2(679019). <https://doi.org/10.3389/frsus.2021.679019>
- Garton P (2020) *Universities and urban development: The effects of anchor institution initiatives on Gentrification*. [Doctoral Dissertation, Michigan State University]. <https://doi.org/10.25335/bdav-tz06>
- Gonzales LD, Hall K, Benton A, Kanhai D, Núñez A-M (2021) Comfort over change: a case study of diversity and inclusivity efforts in US higher education. *Innov High Educ* 46(4):445–460
- Grady-Benson J, Sarathy B (2015) Fossil fuel divestment in US higher education: student-led organising for climate justice. *Local Environ* 21(6):661–681. <https://doi.org/10.1080/13549839.2015.1009825>
- Grande S (2008) Red pedagogy: The Un-Methodology. In NK Denzin, YS Lincoln, LT Smith (eds) *Handbook of critical indigenous methodologies*. SAGE, Thousand Oaks, California, pp 233–254
- Gravert C, Kurz V (2021) Nudging à la carte: a field experiment on climate-friendly food choice. *Behav Public Policy* 5(3):378–395
- Gunn-Wright R, Hockett RC (2019) The green new deal: mobilizing for a just, prosperous, and sustainable economy. *Cornell Legal Stud Res Paper No.* 19–09. <https://s49srn.com/abstract=33424>. Accessed 30 Nov 2022
- Habib S, Al-Ghamdi SG (2020) Estimation of atmospheric carbon mitigation through urban landscaping in Arid areas using native species. In Ahmad S, Murray R (eds) *World Environmental and Water Resources Congress 2020: Groundwater, Sustainability, Hydro-Climate/Climate Change, and Environmental Engineering*. American Society of Civil Engineers, Reston. <https://doi.org/10.1061/9780784482940>
- Hao L et al (2020) What are the implications of climate change for retrofitted historic buildings? A literature review. *Sustainability* 12(18):7557
- Harlan SL, Pellow DN, Roberts JT, Bell SE, Holt WG, Nagel J (2015) Climate justice and inequality. In Dunlap R, ER J. Brulle (Eds.). *Clim Chang Soc: Sociol Perspect* (pp 127–163). Oxford: Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199356102.001.0001>
- Hartig T, Mang M, Evans GW (1991) Restorative effects of natural environment experiences. *Environ Behav* 23(1):3–26
- Healy N, Debski J (2017) Fossil fuel divestment: implications for the future of sustainability discourse and action within higher education. *Local Environ* 22(6):699–724
- Hess DJ (2020) The sociology of ignorance and post-truth politics. *Sociol Forum* 35(1). <https://doi.org/10.1111/socf.12577>
- Hess DJ, Belletto K (2022) Knowledge conflicts: the strategic use and effects of expertise in social movements. *Sociol Inq*. <https://doi.org/10.1111/soin.12508>

- Hoinle B, Roose I, Shekhar H (2021) Creating Transdisciplinary Teaching Spaces. Cooperation of Universities and Non-University Partners to Design Higher Education for Regional Sustainable Transition. *Sustainability* 13(7):3680
- Homer-Dixon and Rockström J (2022) What happens when a cascade of crises collide? *New York Times*. <https://www.nytimes.com/2022/11/13/opinion/coronavirus-ukraine-climate-inflation.html>. Accessed 30 Nov 2022
- hooks b (2003) *Teaching community: A pedagogy of hope*. Routledge, New York and London
- Howitt R (2020) Decolonizing people, place and country: nurturing resilience across time and space. *Sustainability* 12(15):5882
- Hurlbert MA (2011) Evaluating climate justice – attitudes and opinions of individual stakeholders in the United Nations Framework Climate Change Convention Conference of the Parties. *J Integr Environ Sci* 8(4):267–286. <https://doi.org/10.1080/1943815x.2011.599812>
- IPCC (2018) Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp 3–24. <https://doi.org/10.1017/9781009157940.001>
- IPCC (2022) Summary for Policymakers [H.-O. Pörtner, D.C. Roberts, E.S. Poloczanska, K. Mintenbeck, M. Tignor, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem (eds.)]. In: *Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp 3–33. <https://doi.org/10.1017/9781009325844.001>
- Islam SN, Winkel J (2017) Climate change and social inequality. DESA working paper No. 152. United Nations Department of Economic & Social Affairs. www.un.org/esa/desa/papers/2017/wp152_2017.pdf. Accessed 8 Jul 2022
- Jenkins K (2018) Setting energy justice apart from the crowd: lessons from environmental and climate justice. *Energy Res Soc Sci* 39:117–121. <https://doi.org/10.1016/j.erss.2017.11.015>
- Jenkins KEH, Stephens JC, Reames TG, Hernández D (2020) Towards impactful energy justice research: Transforming the power of academic engagement. *Energy Res Soc Sci* 67:101510. <https://doi.org/10.1016/j.erss.2020.101510>
- Johnson JT et al (2016) Weaving Indigenous and sustainability sciences to diversify our methods. *Sustain Sci* 11(1):1–11
- Johnson AE, Wilkinson KK (Eds.) (2021) *All we can save*. Routledge, New York
- Kelley RDG (2018) Black study, black struggle. *Ufahamu: J Afr Stud* 40(2). <https://doi.org/10.5070/F7402040947>
- Kelly O Illingworth S Butera F Dawson V White P Blaise M Martens P Schuitmea G Huynen M Bailey S Cowman S (2022a) Education in a warming world: Trends, opportunities and pitfalls for institutes of higher education. *Front Sustain* 3. <https://doi.org/10.3389/frsus.2022.920375>
- Kelly O Illingworth S Butera F Steinberger J Blaise M Dawson V Huynen M Martens P Bailey S Savage G White P Schuitmea G Cowman S (2022b) Tertiary Education in a Warming World: Reflections from the field. *Worldw Univ Netw*. https://wun.ac.uk/wp-content/uploads/Education-In-A-Warming-World_WUN-UCD_Final_04-22.pdf. Accessed 30 Nov 2022
- Kenner D (2019) *Carbon inequality: the role of the richest in climate change*. New York, New York: Routledge
- Kimmell K, Boyle A, Si Y, Sotolongo M (2021) A user's guide to environmental justice: theory, policy, & practice. <https://cssh.northeastern.edu/policyschool/wp-content/uploads/sites/2/2021/07/Users-Guide-to-Environmental-Justice-6.22.21-clean.pdf>. Accessed 8 Jul 2022
- Köhler M, Kaiser D (2021) Green Roof Enhancement on Buildings of the University of Applied Sciences in Neubrandenburg (Germany) in Times of Climate Change. *Atmosphere* 12(3):382
- Kopp RE (2021) Land-grant lessons for Anthropocene universities. *Clim Change* 165(1):28
- Lamb WF, Mattioli G, Levi S, Roberts JT, Capstick S, Creutzig F, Minx JC, Müller-Hansen F, Culhane T, Steinberger JK (2020) Discourses of climate delay. *Global Sustain* 3:e17. <https://doi.org/10.1017/sus.2020.13>
- Lee R, Ahtone T (2020) Land-grab universities. *High Country News* 52(4). <https://www.hcn.org/issues/52.4/indigenous-affairs-education-land-grab-universities>. Accessed 30 Nov 2022

- Leonard C (2019) *Kochland: the secret history of Koch Industries and corporate power in America*. Simon & Schuster, New York
- Lewandowsky S, Oreskes N, Risbey JS, Newell BR, Smithson M (2015) Seepage: climate change denial and its effect on the scientific community. *Glob Environ Chang* 33:1–13
- Lomawaima KT, McDonough K, O'Brien JM, Warrior R (2021) Editors' introduction: reflections on the Land-Grab universities project. *J Nativ Am Indigenous Stud Assoc (NAIS)* 8(1):89–97
- Lubash A (2015) The rise of unaccountable power: The fight for self-determination at the University of Oregon. [BS Thesis, Univ Oregon]. <http://hdl.handle.net/1794/19153>. Accessed 8 Jul 2022
- Lutsey N (2015) Global climate change mitigation potential from a transition to electric vehicles. *Int Counc Clean Transp*. <https://theicct.org/publication/global-climate-change-mitigation-potential-from-a-transition-to-electric-vehicles/>. Accessed 8 Jul 2022
- Martin A, Coolsaet B, Corbera E, Dawson NM, Fraser JA, Lehmann I, Rodriguez I (2016) Justice and conservation: the need to incorporate recognition. *Biol Cons* 197:254–261
- Mathiesen BV, Lund H, Karlsson K (2011) 100% Renewable energy systems, climate mitigation and economic growth. *Appl Energy* 88(2):488–501
- McCauley D, Heffron R (2018) Just transition: integrating climate, energy and environmental justice. *Energy Policy* 119:1–7
- McCowan T (2020) The impact of universities on climate change: a theoretical framework. *Climate-U Transforming Universities for a Changing Climate Working Paper Series no. 1*. <https://discovery.ucl.ac.uk/id/eprint/10108599/1/Working%20paper,%20final.pdf>. Accessed 30 Nov 2022
- McFarland A, Waliczek T, Zajicek J (2008) The relationship between student use of campus green spaces and perceptions of quality of life. *HortTechnology* 18(2):232–238
- McKie RE (2021) Obstruction, delay, and transnationalism: examining the online climate change counter-movement. *Energy Res Soc Sci* 80:102217. <https://doi.org/10.1016/j.erss.2021.102217>
- McLaughlin T, Pell M (2022) U.S. colleges talk green. But they have a dirty secret. *Reuters*. <https://www.reuters.com/investigates/special-report/usa-pollution-universities/>. Accessed 30 Nov 2022
- McLeod JS (2007) Unmasking the processes and justifications that lead to environmental racism: a critique of judicial decision-making, political and public ambivalence, and the disproportionate placement of environmental and land use burdens in communities of color. *Va J Soc Pol'y* 115:545
- Mtawa NN, Wangenge-Ouma G (2022) Questioning private good driven university-community engagement: a Tanzanian case study. *Higher Ed* 83(3):597–611. <https://doi.org/10.1007/s10734-021-00685-9>
- Muttitt G, Kartha S (2020) Equity, climate justice and fossil fuel extraction: principles for a managed phase out. *Clim Policy* 20(8):1024–1042
- Newell P, Mulvaney D (2013) The political economy of the 'just transition.' *Geogr J* 179(2):132–140
- Newell P, Simms A (2020) Towards a fossil fuel non-proliferation treaty. *Climate Policy* 20(8):1043–1054
- Newell P, Srivastava S, Naess LO, Torres Contreras GA, Price R (2021) Toward transformative climate justice: an emerging research agenda. *WIREs Clim Chang* 12(6):e733. <https://doi.org/10.1002/wcc.733>
- Newell P, van Asselt H, Daley F (2022) Building a fossil fuel non-proliferation treaty: key elements. *Earth Syst Gov* 14:100159. <https://doi.org/10.1016/j.esg.2022.100159>
- Ojha H, Nightingale AJ, Gonda N, Muok BO, Eriksen S, Khatri D, Paudel D (2022) Transforming environmental governance: critical action intellectuals and their praxis in the field. *Sustain Sci* 17:621–635. <https://doi.org/10.1007/s11625-022-01108-z>
- Omman I et al (2020) Assessing opportunities for scaling out, up and deep of win-win solutions for a sustainable world. *Clim Change* 160(4):753–767
- Oreskes N (2019) *Why trust science*. Princeton University Press, Princeton, New Jersey
- Oreskes N, Conway EM (2011) *Merchants of doubt: how a handful of scientists obscured the truth on issues from tobacco smoke to global warming*. Bloomsbury Publishing, New York
- Overland I, Sovacool BK (2020) The misallocation of climate research funding. *Energy Res Soc Sci* 62:101349
- Pang E (2021) Conflict of interests: fossil fuel money in environmental research at Stanford. *Stanford Politics*. <https://stanfordpolitics.org/2021/01/31/conflict-of-interests-fossil-fuel-money-in-environmental-research-at-stanford/>. Accessed 8 Jul 2022
- paperperson I (2017) *A third university is possible*. University of Minnesota Press, Minneapolis, Minnesota
- Patel L (2021) *No study without struggle: confronting settler colonialism in higher education*. Beacon Press, Boston
- Patton LD (2016) Disrupting postsecondary prose: toward a critical race theory of higher education. *Urban Ed* 51(3):315–342
- Piggot G et al (2020) *Curbing fossil fuel supply to achieve climate goals*. Taylor & Francis.
- Pillay-van Wyk V, Bradshaw D (2017) Mortality and socioeconomic status: the vicious cycle between poverty and ill health. *Lancet Glob Health* 5(9):e851–e852

- Poland B, Dooris M (2010) A green and healthy future: the settings approach to building health, equity and sustainability. *Crit Public Health* 20(3):281–298
- Proctor RN (2010) Manufactured ignorance [Review of the book *Merchants of Doubt* by N. Oreskes and E. M. Conway]. *Am Sci* 98(5):424–426. <https://www.jstor.org/stable/27859571>
- Queeney K (2021) What are they thinking? Inside higher ed. <https://www.insidehighered.com/views/2021/12/16/how-and-why-understand-businesspeople-college-boards-opinion>. Accessed 8 Jul 2022
- Quigley J (2018) Payments in lieu of trouble: nonprofit pilots as extortion or efficient public finance? *NYU Environ Law J* 26(2):272–296
- Reames TG (2016) Targeting energy justice: exploring spatial, racial/ethnic and socioeconomic disparities in urban residential heating energy efficiency. *Energy Policy* 97:549–558. <https://doi.org/10.1016/j.enpol.2016.07.048>
- Rempel A, Gupta J (2022) Equitable, effective, and feasible approaches for a prospective fossil fuel transition. *WIREs Clim Chang* 13(2):e756. <https://doi.org/10.1002/wcc.756>
- Riccio R, Mecagni G, Berkey B (2022) Principles of anti-oppressive community engagement for university educators and researchers. Northeastern University Social Impact Lab White Paper. <http://hdl.handle.net/2047/D20432837>. Accessed 8 Jul 2022
- Roberts-Gregory F (2021) Climate justice in the wild n' dirty south: an autoethnographic reflection on ecowomanism as engaged scholar-activist praxis before and during COVID-19. In KMQ Hall and G Kirk (eds) *Mapping gendered ecologies: Engaging with and beyond ecowomanism and ecofeminism*. Lexington Books, Lanham, pp 125–146
- Robinson M, Shine T (2018) Achieving a climate justice pathway to 1.5 °C. *Nature Clim Chang* 8(7):564–569. <https://doi.org/10.1038/s41558-018-0189-7>
- Röck M et al (2020) Embodied GHG emissions of buildings—The hidden challenge for effective climate change mitigation. *Appl Energy* 258:114107
- Rodrigues C, Freire F (2021) Environmental impacts and costs of residential building retrofits—What matters? *Sustain Cities Soc* 67:102733
- Sanzillo T, Hipple K, Williams-Derry C (2018) The financial case for fossil fuel divestment. Institute for Energy Economic and Financial Analysis. <https://ieefa.org/resources/financial-case-fossil-fuel-divestment>. Accessed 8 Jul 2022
- Schlosberg D, Collins LB (2014) From environmental to climate justice: climate change and the discourse of environmental justice. *Wires Clim Chang* 5(3):359–374. <https://doi.org/10.1002/wcc.275>
- Scott RA (2018) *How university boards work: A guide for trustees, officers, and leaders in higher education*. JHU Press, Baltimore. <https://muse.jhu.edu/book/57382>
- Scholars for a new deal for higher education (SFNDHE) (2022) A New Deal for Higher Education. <https://scholarsforanewdealforhighered.org/a-new-deal-for-higher-education/>. Accessed 30 Nov 2022
- Shen P, Braham W, Yi Y (2019) The feasibility and importance of considering climate change impacts in building retrofit analysis. *Appl Energy* 233:254–270
- Si Y, Stephens JC (2021) Energy justice through solar: constructing and engaging low-income households. *Front Sustain Cities* 3:632020
- Singer M (2018) *Climate change and social inequality: the health and social costs of global warming*. Routledge, Abingdon
- Sladek E (2019) The transformative power of anchor institutions. *Metrop Univ* 30(1). <https://doi.org/10.18060/22919>
- Sörlin S (2007) Funding diversity: performance-based funding regimes as drivers of differentiation in higher education systems. *High Educ Pol* 20(4):413–440
- Sovacool BK et al (2019) Decarbonization and its discontents: a critical energy justice perspective on four low-carbon transitions. *Clim Chang* 155(4):581–619
- Stahlbrand L (2018) Can values-based food chains advance local and sustainable food systems? Evidence from case studies of university procurement in Canada and the UK. *Int J Sociol Agric Food* 24(1):77–95
- Steele W, Rickards L (2022) *The sustainable development goals in higher education: a transformative agenda?* Cham, Switzerland: Palgrave Macmillan. <https://link.springer.com/book/10.1007/978-3-030-73575-3>
- Stephens JC (2019) Energy democracy: redistributing power to the people through renewable transformation. *Environ: Sci Policy Sustain Dev* 61(2):4–13. <https://doi.org/10.1080/00139157.2019.1564212>
- Stephens JC (2022a) Beyond climate isolationism: a necessary shift for climate justice. *Curr Clim Chang Rep*. <https://doi.org/10.1007/s40641-022-00186-6>
- Stephens JC (2022b) Feminist, antiracist values for climate justice: moving beyond climate isolationism. In Engle J, Agyeman J, Chung-Tiam-Fook T (eds) *Sacred civics: building seven generation cities*. Routledge; London, pp 177–189. <https://doi.org/10.4324/9781003199816-17>

- Stephens JC, Frumhoff P, Yona L (2018) The role of college and university faculty in the fossil fuel divestment movement. *Elem: Sci Anthropocene* 6(1):41. <https://doi.org/10.1525/elementa.297>
- Stephens JC (2020) *Diversifying power: why we need antiracist, feminist leadership on climate and energy*. Island Press, Washington DC
- Stephens J, Hernandez M, Román M, Graham A, Scholz R (2008) Higher education as a change agent for sustainability in different cultures and contexts. *Int J Sustain High Ed* 9. <https://doi.org/10.1108/14676370810885916>
- Stephens J, Palchak E, Reese B (2017) Divestment and investment: strategic financial decisions in higher education to promote societal change toward sustainability. In Filho WL, Skanavis C, do Paco A, Rogers J, Kuznetsova O, Castro P (eds) *Handbook of theory & practice of sustainable development in Higher Education*, vol 2, pp 305–315. Cham, Switzerland. <https://doi.org/10.1007/978-3-319-47889>
- Stewart AJ, Valian V (2018) *An inclusive academy: achieving diversity and excellence*. MIT Press
- Strauch Y, Dordi T, Carter A (2020) Constraining fossil fuels based on 2 C carbon budgets: The rapid adoption of a transformative concept in politics and finance. *Clim Change* 160(2):181–201
- Sultana F (2022) Critical climate justice. *Geogr J* 188(1):118–124. <https://doi.org/10.1111/geoj.12417>
- Supran G, Rahmstorf S, Oreskes N (2023) Assessing ExxonMobil's global warming projections. *Science* 379(6628). <https://doi.org/10.1126/science.abk0063>
- Táiwò OO (2022) *Reconsidering reparations*. Oxford Univ Press, Oxford
- The University of Vermont (2021) Rationale for sustainability requirement. <https://www.uvm.edu/generaleducation/sustainability>. Accessed 8 Jul 2022
- Thelin JR (2003) Higher education's best-made plans: A historical perspective. *Rev High Educ* 26(2):267–274
- Tonn B et al (2021) Income, housing and health: Poverty in the United States through the prism of residential energy efficiency programs. *Energy Res Soc Sci* 73:101945
- Tooze A (2022) Welcome to the world of the polycrisis: today disparate shocks interact so that the whole is worse than the sum of the parts. *Financ Times*. October 28, 2022, <https://www.ft.com/content/498398e7-11b1-494b-9cd3-6d669dc3de33>.
- Treisman R (2021) Harvard University will stop investing in fossil fuels after years of public pressure. npr. <https://www.npr.org/2021/09/10/1035901596/harvard-university-end-investment-fossil-fuel-industry-climate-change-activism>. Accessed 8 Jul 2022
- Trencher G et al (2017) Implementing sustainability co-creation between universities and society: A typology-based understanding. *Sustainability* 9(4):594
- Underhill LJ (2018) *Energy efficiency, indoor air quality, & health: a simulation study of multifamily housing in Boston, Massachusetts*. [Doctoral Dissertation, Boston University]. <https://hdl.handle.net/2144/33047>
- UNESCO (2022) Knowledge-driven actions: transforming higher education for global sustainability. <https://unesdoc.unesco.org/ark:/48223/pf0000380519>. Accessed 8 Jul 2022
- United Nations Meetings Coverages & Press Releases. (2019). Unprecedented impacts of climate change disproportionately burdening developing countries, delegate stresses, as second committee concludes general debate. www.un.org/press/en/2019/gaef3516.doc.htm. Accessed 8 Jul 2022
- University and College Union (2021) Green New Deal. <https://www.ucu.org.uk/green-new-deal>. Accessed 8 Jul 2022
- UnKoch My Campus (2020) About unKoch my campus. <http://www.unkochmycampus.org/about-2>. Accessed 30 Nov 2022
- Valantine HA, Collins FS (2015) National Institutes of Health addresses the science of diversity. *Proc Natl Acad Sci* 112(40):12240–12242. <https://doi.org/10.1073/pnas.1515612112>
- Vican S, Friedman A, Andreasen R (2020) Metrics, money, and managerialism: faculty experiences of competing logics in higher education. *J High Ed* 91(1):139–164
- Washburn J (2005) *University Inc.: The corporate corruption of higher education*. Basic Books, New York
- Watts N, Amann M, Arnell N, Ayeb-Karlsson S, Beagley J, Belesova K, Boykoff M, Byass P, Cai W, Campbell-Lendrum D (2021) The 2020 report of the Lancet Countdown on health and climate change: responding to converging crises. *The Lancet* 397(10269):129–170
- Weinrub A, Giancatarino A (2015) *Toward a climate justice energy platform: democratizing our energy future* (Report). Local Clean Energy Alliance and Center for Social Inclusion. <http://www.localcleanenergy.org/files/Climate%20Justice%20Energy%20Platform.pdf>. Accessed 8 Jul 2022
- Welsby D et al (2021) Unextractable fossil fuels in a 1.5° C world. *Nature* 597(7875):230–234
- Westervelt A (2021) If you fund the research, you can shape the world. *The Nation*. <https://www.thenation.com/article/environment/university-oil-influence/>. Accessed 30 Nov 2022
- Whittinghill LJ, Rowe DB (2012) The role of green roof technology in urban agriculture. *Renew Agric Food Syst* 27(4):314–322

- Willis KJ, Petrokofsky G (2017) The natural capital of city trees. *Science* 356(6336):374–376
- World Health Organization (2021) Using multidimensional poverty and vulnerability indices to inform equitable policies and interventions in health emergencies (Research Brief). <https://www.who.int/publications/i/item/9789240031852>. Accessed 8 Jul 2022
- Yeampierre E (2020) Unequal Impact: the deep links between racism and climate change [Interview]. <https://e360.yale.edu/features/unequal-impact-the-deep-links-between-inequality-and-climate-change>. Accessed 8 Jul 2022
- Yu SWY Hill C Rick ML Bennet J Oriol N (2017) The scope and impact of mobile health clinics in the United States: a literature review. *Int J Equity Health* 16(1):1–12. <https://doi.org/10.1186/s12939-017-0671-2>

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.