Higher Education (2024) 87:165–183
https://doi.org/10.1007/s10734-023-00999-w

Universities confronting climate change: beyond sustainable development and solutionism

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Accepted: 16 January 2023 / Published online: 2 February 2023

Abstract
This article reflects on recent calls for universities to deepen their commitments to sustainability in the face of climate change. It suggests that because climate change is a "wicked problem" that is hyper-complex, lacks clear solutions, and affects multiple communities in different ways, universities are unlikely to achieve consensus around a single approach to sustainability. The article reviews emerging critiques of existing university sustainability efforts, including critiques of greenwashing, climate colonialism, and (techno)solutionism. It also offers a social cartography of three different approaches to sustainability: mainstream sustainability, critical sustainability, and beyond sustainability. Rather than advocate for one particular approach, the article suggests that if universities are to maintain their relevance in the context of wicked problems like climate change, they will need to foster spaces for critically informed, complexity-based, and socially and ecologically accountable conversations about the role of higher education institutions in pluralizing possible futures on a shared, living planet.

Keywords Climate change · Sustainability · Sustainable development · Wicked problems · Colonialism

In response to growing social and scholarly consensus that climate change, biodiversity loss, and other forms of ecological degradation challenge the stability of our social, political, and economic systems, universities have woven commitments to sustainability into their core activities of teaching, research, and service, as well as campus planning and community engagements (Ralph & Stubbs, 2014). There is broad agreement that "higher education institutions have an essential role in sustainability" (Žalėnienė & Pereira, 2021, p. 99) and have "unique potential to catalyze and/or accelerate the societal transition toward sustainability" (Jones, 2012, p. 631). However, universities are also being called upon to take bolder action in light of the urgency and magnitude of ecological challenges (Fazey et al., 2021). Students have been especially vocal in calling for deeper, more justice-oriented commitments (Healy & Debski, 2017; Murray, 2018).

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These calls for action and the institutional changes that follow encompass different perspectives about what constitutes "sustainability" and how universities should respond to climate change. For instance, some express concern that universities have not adequately implemented (McCowan et al., 2021) or assessed (Koehn & Uitto, 2014) their existing sustainability commitments, while for others, the primary concern is that these commitments are largely symbolic and reproduce the status quo (Green, 2021; Jones, 2012). In this conceptual article, I suggest that one way of navigating these different perspectives is by approaching climate change as a "wicked problem," which means it is complex and multi-layered; involves many unknowns; can only be addressed through partial, imperfect solutions that offer no guaranteed outcomes and can create new problems; and affects communities in different ways, and hence there are different (often conflicting) notions of what should be done to address it (Rittel & Webber, 1973; van Berkel & Manickam, 2020). Climate change may be even be considered a "super wicked problem," that is, a problem for which: time is running out; those who cause the problem are the ones seeking to solve it; there is a weak or non-existent central authority to address it; and many responses discount future impacts (Levin et al., 2012).

Given the complex and contentious nature of a (super) wicked problem like climate change, there is more than one way to approach it in higher education. While much of the existing literature has sought to either describe universities' existing sustainability efforts or prescribe a particular approach to sustainability, I offer something different: an invitation to engage with some of the complexities, uncertainties, tensions, and contradictions that are emerging as campus communities contemplate different possible responses to climate change.

I begin the article by reviewing existing sustainability efforts in higher education, with a particular emphasis on the growing focus on aligning with the UN Sustainable Development Goals. Next, I review some of the emerging critiques about the limits of these efforts, focusing on three primary concerns: greenwashing; climate colonialism; and (techno)solutionism. Following this, I outline a social cartography of three different approaches to sustainability in higher education and their assumptions and implications: mainstream sustainability; critical sustainability; and beyond sustainability. Rather than advocate for one of these approaches, I consider how each may "enhance or constrain possibilities for the future university" (Cuesta-Claros et al., 2022, p. 526). I conclude by suggesting universities will increasingly be considered "behind the curve" if their approaches to sustainability are not perceived as sufficiently responsive to the difficult realities and deep inequities of the current moment, particularly in ways that are critically engaged, complexity-based, and accountable to current and future generations of both human and other-than-human beings.

Before I proceed, I offer a note on terminology. Linguists have pointed out that words are polysemic, which means they have multiple contested, contextually relevant meanings; meanings also tend to proliferate in contexts of hyper-complexity (Stein, 2021). In addition to different meanings that are ascribed to terms like "sustainability," there has also been a growth of terms used to describe institutional efforts to address climate change, including the recent popularization of the term "climate action," which in some cases is used to replace the term "sustainability" and in other cases is used alongside it. However, in this article, I primarily use the term sustainability, reflecting its widespread use in the higher education sector. Similarly, many people have noted that "climate change" is insufficient to describe the suite of ecological crises across the globe, sometimes collectively called "the climate and nature emergency." In this paper, for the sake of brevity, I primarily use the term "climate change" as shorthand to encompass the fuller range of ecological crises.

As would be the case with any chosen terminology, the use of these terms is provisional, imperfect, and contextual.

Existing responses to climate change

Universities first made commitments to sustainability in the 1970s, with an intensification of efforts in the 1990s (Cuesta-Claros et al., 2022), and another renewed push over the last decade. However, existing literature emphasizes that until very recently, many institutional sustainability efforts in higher education have been piecemeal and individually driven, rather than systemic and transformational (Bieler & McKenzie, 2017; McKenzie & Wilson, 2022). Other scholars express concern that sustainability has been unevenly addressed in different areas of the university, with an outsized focus on efforts to "green" campus operations (e.g. recycling, LEED building certification, and waste reduction) and insufficient attention to other university activities, including teaching (e.g. incorporating sustainability into curricula), knowledge production (e.g. more funding for climate-related research), service (e.g. community engagement around climate change), and fostering public debate (McCowan, 2020).

As the realities of climate change become more tangible, several higher education institutions have responded by emphasizing their commitments to sustainability. In particular, it has become increasingly common for universities to develop their sustainability efforts in reference to the United Nations Sustainable Development Goals (UN SDGs) (Cuesta-Claros et al., 2022). While only one of the 17 SDGs specifically articulates the importance of higher education, some have called on universities to take on a more significant role in enabling global society to meet all SDG targets. This role was framed as a natural outgrowth of universities' position as leading sites of education, innovation, and social change (Association of Commonwealth Universities, 2015).

Although the SDGs were released in 2015, in their introduction to a recent special issue of this journal about higher education and the SDGs, Chankseliani and McCowan (2021) found scarce literature on the topic. Yet in the past few years, more institutions have articulated commitments to the SDGs. Some have conducted voluntary reviews about their progress in addressing the SDGs (e.g., UC Davis; University of Geneva) or framed their sustainability strategies around the SDGs (e.g., Simon Fraser University, 2020; University of Saskatchewan, 2021), while others have incorporated the goals into their university-wide strategic plans (e.g., York University, 2020). It has been suggested both that the SDGs need universities, given universities' role in producing knowledge and training future workers and leaders, and that universities need the SDGs, given that the SDGs offer opportunities for universities to demonstrate their social impact and relevance, build new partnerships, and access new funding streams (SDSN Australia/Pacific, 2017).

It is notable how quickly the landscape of university sustainability has shifted toward embracing the SDG framework. For instance, although York University in Canada did not name the SDGs at all in its 2017 Sustainability Strategy, the SDGs are named as a key guiding frame for its 2020–2025 academic plan. And it was only in 2019 that *Times Higher Education* launched a new global ranking system, "Impact Rankings," dedicated to assessing universities against the SDGs, yet they are already understood to be an "objective" assessment of progress toward achieving the goals (University of Saskatchewan, 2021). This indicates a rapid pace of change in the landscape of social and institutional responses to climate change.

Despite a general trend toward universities making more substantive commitments to sustainability and a particular emphasis on aligning these efforts with the SDGs, there is no consensus about what this should look like. Different approaches to sustainability come with different assumptions and implications. For instance, the idea of "sustainable development is nested in a set of political, moral, and epistemic assumptions that are not shared by all—in particular, enlightenment notions of progress and the continuing existence of global capitalism" (Chankseliani & McCowan, 2021, p.2). Certain approaches to sustainability hold more institutional power than others. Ruiz-Mallen and Heras (2020) note the dominance of discourses of sustainability that presume the continuity of existing social, political, and economic systems. Critically engaged scholars have therefore emphasized the need to ask: Who decides what we should sustain and how we should sustain it? In whose name? For whose benefit? At whose expense? And how have universities themselves contributed to *un*sustainability? (Stein et al., 2019). Therefore, it is perhaps not surprising that at the same time that universities have intensified their commitments to sustainability, they have also been questioned on the nature and impacts of these commitments. In the following section, I review some emerging critical responses to universities' approaches to sustainability.

Emerging critical responses to climate change in higher education

While there are many different ways to confront and address wicked problems like climate change, researchers in the fields of global citizenship, sustainability, international development, and decolonial studies have emphasized that approaching these problems in relevant, rigorous, and responsible ways requires identifying the socio-historical systems that have led to these problems and developing an awareness of the challenges and complexities involved in trying to respond to these problems. Without power-conscious systemic analyses, responses to wicked problems tend to unintentionally reproduce: (1) unequal, extractive, and paternalistic relationships between dominant and marginalized populations, (2) simplistic solutions to complex problems, and (3) ethnocentric imaginaries of justice, responsibility, sustainability, and change (Andreotti et al., 2018; Kapoor, 2020; Santos, 2007).

These scholars also argue that prevailing responses to wicked problems like climate change are shaped by the same Eurocentric paradigms of progress, development, and innovation that helped create these problems in the first place. This concern was raised in a May 2022 open letter from 100 scientists, teachers, and experts from 37 countries that called on the UN to replace the SDGs, and asked, "If the way modern societies work causes the problems the SDGs seek to address, can we be surprised that the same systems are unable to fix them?".

In this section, I review three emerging critiques that have been articulated by students, scholars, and activists about the limits of existing university responses to climate change, including the often-narrow focus on sustainable development: greenwashing; climate colonialism; and (techno)solutionism. Frequently, these critiques are articulated alongside each other, but for the sake of clarity, I have addressed them as distinct concerns.

Greenwashing

A growing number of people, especially students, have accused universities of "greenwashing" (Cownie, 2021; Facer, 2020; Gayle & Sundaravelu, 2019). The term greenwashing

was coined over 35 years ago to characterize efforts that suggest an organization's actions or products are environmentally sustainable when in reality they continue to engage in unsustainable practices, particularly those premised on perpetual economic growth and profit.

For instance, Robertson (2022) writes, "At the University of Sydney, a culture of greenwashing becomes evident in the stark contrast between public posturing about sustainability and the reality of its unpublished $3.41 billion investment portfolio." Wazer (2022) notes that even universities that have received public recognition for their sustainability efforts (e.g., through the Impact Rankings or the Sustainable University Green Metric) may still participate in activities that perpetuate climate change, such as investing their endowments in, or accepting donations from, fossil fuel companies. Meanwhile, Facer (2020) uses greenwashing more broadly to describe the superficial and symbolic nature of many sustainability efforts, suggesting we can no longer "just throw money at greenwashing our activities—a few fair-trade coffees and a little bit of offsetting of flights for conferences—and think this constitutes an adequate response to the changed world we now inhabit" (p. 29).

Students, scholars, and other critics have suggested that responses to climate change that do not challenge the capitalist paradigm of economic growth will result in the continuity of "business as usual, but greener" (Baskin, 2019), which has also been described as green capitalism. These critiques question the hegemony of sustainable development as a horizon of hope and change, given the perceived contradiction between infinite economic growth and consumption, and a finite planet (Hickel, 2019). Sustainable development, along with many other mainstream climate solutions, promises that through technological advances, greenhouse gas emissions can be decoupled from economic growth, allowing us to continue or even expand existing levels of consumption. Yet Wiedmann and colleagues (2020) note that consumption and economic growth have outpaced the efficiencies enabled by technological innovation in the past several decades. Furthermore, while this economic growth has increased affluence for certain people, it has also "led to enormous increases in inequality, financial instability, resource consumption, and environmental pressures on vital earth support systems" (p. 3). This has prompted some to argue for reducing consumption and economic growth and redistributing existing wealth and resources rather than merely "greening" existing levels of consumption and growth (Hickel, 2019; Hickel & Kallis, 2020; Schröder & Storm, 2020; Sultana, 2022).

While most sustainability strategies frame universities as benevolent actors, a growing number of critiques draw attention to the ways universities themselves are directly involved in and indirectly benefit from the growth-based economic infrastructures and systems that are creating climate change in the first place (Stein, 2019). As McCowan (2020) notes,

> While university-based scientists contribute to understanding of greenhouse gases and development of renewable energy, they are also implicated in development of the science and technology that is enabling continuing exploitation and usage of fossil fuels. Universities also contribute significantly to emissions through their own energy usage, their investments, and the extensive travel of their staff and students. (p. 5–6)

In other words, it is important to consider how universities are part of the problem of climate change rather than only purveyors of solutions to it. Concern about their complicity in climate change has led some academics to sign "no-fly" pledges to reduce or eliminate academic-related air travel and support low-carbon research and conferences (Pasek, 2020). Student-led campaigns and even lawsuits have led over 1000 universities worldwide

to pledge to divest their endowments from fossil fuel companies, although thousands more remain invested. Institutions in locations where oil is a significant part of the economy are particularly slow to divest (Leahy, 2021; Whitford, 2021). In 2021, 10 universities in the UK signed a student-led declaration that goes beyond divestment to set minimum commitments related to ensuring the sustainable investment of their endowment funds (Higgins, 2021). However, others point out that just because an investment is deemed "sustainable," this does not preclude it from having negative social and ecological impacts (UBC Climate Emergency Task Force, 2021).

Beyond endowment fund investments, students and other institutional critics also note that many large institutional donors have ties to the fossil fuel industry (Kaufman, 2022), as do many members of university governing boards (Leahy, 2021; Rowe et al., 2020). Fossil fuel companies that donate to universities have been accused of their own greenwashing, seeking to improve their public image by associating with educational institutions. Ironically, many universities' climate and energy research programs are funded by oil and gas companies (Tabuchi, 2022). This led faculty at Cambridge University to propose a vote on whether the university should stop accepting research funding from or undertaking other collaborations with coal, oil, and gas companies (Hennessey, 2022a). Notably, this vote was delayed by the Cambridge University Council, which cited the need to "explore and give proper consideration to the full implications of these changes" (Hennessey, 2022b).

Recent developments in sustainability on university campuses go beyond more modest efforts like encouraging recycling and seeking LEED certification of campus buildings. For instance, over 1000 universities and colleges from nearly 70 nations have signed the UN Race to Zero pledge, thereby committing to cut their greenhouse gas emissions in half by 2030 and to have net zero emissions by 2050 (UN Environmental Program, 2021). Yet others point out that many net zero emissions plans do not simply cut consumption or seek green sources of energy; they also commit to carbon offsetting, which some argue does not actually reduce carbon emissions (Kaufman, 2022; Lyons & Westoby, 2014). This relates to the next critique, which is about the reproduction of colonialism in climate change, reviewed below.

Climate colonialism

While the role of colonialism in climate change was recognized in the latest IPCC (2022) report, Indigenous peoples and other critical voices have long identified colonialism as a root cause and driver of climate change. These critiques suggest colonialism is also reproduced in many proposed climate solutions. This has been variously called climate colonialism, climate coloniality, or climate apartheid. According to Zografos and Robbins (2020), "climate colonialism involves the deepening or expanding of domination of less powerful countries and peoples through initiatives that intensify foreign exploitation of poorer nations' resources or undermine the sovereignty of native and Indigenous communities in the course of responding to the climate crisis" (p. 543). Meanwhile, Sultana (2022) suggests "climate coloniality occurs where Eurocentric hegemony, neocolonialism, racial capitalism, uneven consumption, and military domination are co-constitutive of climate impacts experienced by variously racialized populations who are disproportionately made vulnerable and disposable" (p. 4). As a result of these dynamics, communities that have contributed the least to climate change are expected to bear the costs of climate mitigation, adaptation, decarbonization, and various

other climate solutions, many of which have been deemed "false solutions" that perpetuate green colonialism (Hickel & Slamersak, 2022; Huni Kui, 2022; McGregor et al., 2020).

In the context of the university, climate colonialism is often critiqued using climate justice frameworks that problematize how mainstream sustainability efforts fail to account for and be accountable for the fact that the whiter, wealthier parts of the world bear disproportionate responsibility for creating climate change while the rest of the world pays the highest costs and is left with few material resources to interrupt and address its impacts (Sultana, 2022). Some have even called on universities to incorporate climate justice into their climate actions (Healy & Debski, 2017; UBC Climate Emergency Task Force, 2021), though others warn that climate justice has become a buzzword that is increasingly co-opted by corporate interests.

Critics of climate colonialism invite deeper engagements with the risks that proposed climate solutions will reproduce colonialism through the following:

- *ahistorical and depoliticized analyses* of the root causes and driving forces of climate change that invisibilize how it is "inevitably tied to, and symptomatic of, ongoing processes of colonialism, dispossession, capitalism, imperialism/globalization, and patriarchy" (McGregor et al., 2020, p. 36);
- *epistemic Eurocentrism* in the creation and dissemination of knowledge about climate change and efforts to address it, especially favoring western scientific and technical knowledge over other kinds of knowledge, especially non-western;
- *paternalistic "solutions"* imposed by the Global North onto the South and by non-Indigenous people onto Indigenous people, particularly solutions that primarily benefit the former at the expense of the latter and thereby reproduce patterns of expropriation, dispossession, and unequal power;
- *growth-based development* as the only sanctioned pathway forward, despite the fact that it is premised on the reproduction and expansion of extractive and exploitative socio-economic relations and ecological degradation.

Carbon offsetting, which is part of many universities' net-zero carbon emissions plans, has been identified as an example of climate colonialism. Carbon offsetting refers to "reducing emissions or removing carbon dioxide from the atmosphere in one place to make up for emissions in another" (Reeve, 2021). Many individuals or organizations in the Global North purchase carbon offsets in the Global South. Although this arrangement has been framed by its champions as a "win–win," critics suggest that it not only allows the Global North to continue its current, it unsustainable levels of consumption and emissions, but it also leads to the displacement of Indigenous and other systemically marginalized communities in the Global South from their lands and livelihoods (Eberle et al., 2019; Huni Kui, 2022).

In sum, critiques of climate colonialism argue that "without confronting colonial norms within our institutions and disciplines…climate action risks replicating the oppressive structures of power that got us into this mess in the first place" (Hunt, 2022, p. 136). Thus, students, scholars, and activists argue that decarbonization and other forms of climate action must be accompanied by decolonization, with both material and epistemic implications (McGregor et al., 2020). For instance, they call for proposed climate solutions to be led by communities most directly and negatively affected by climate change (4 Rs Youth Movement & Youth Climate Lab, 2022; Whyte, 2018; Táíwò & Talati, 2022). They also advocate for the Global North to accept responsibility for its outsized greenhouse gas emissions (both historically and today) and its colonization of the atmosphere by both reducing

its own consumption and enacting climate reparations by transforming existing geopolitical and economic structures and offering material restitution for the lands, labor, and resources stolen through colonialism and slavery. This, in turn, can support Indigenous communities, Black communities, and frontline communities in the Global South to continue caring for their territories and leading their own climate responses (4 Rs Youth Movement & Youth Climate Lab, 2022; Sultana, 2022).

In the context of higher education, critiques of climate colonialism emphasize the need to connect institutional commitments to sustainability with commitments to Indigenization and decolonization and to go beyond treating climate change as a depoliticized "technical problem," as reviewed below.

(Techno)solutionism

Critiques of (techno)solutionism combine elements of the two previous critiques. While the emphasis on the limits of technological solutions is particularly prominent, critics have also identified solutionism in general as an issue. Technosolutionism is exemplified by Jeffrey Sachs (2015), a key figure in the development of the UN SDGs and the Millennium Development Goals that preceded them, who argues:

> We can use the global network of universities…to be an active "solutions network" to help governments, businesses, and civil society to chart out the pathways to successful sustainable development and also to be the incubators for the rapid development and rapid fusion of sustainable development technologies. Universities… should be in the lead of helping society to find the technical solutions to achieve these goals (p. 61).

Critics problematize at least three interrelated assumptions in framings like Sachs', each of which I unpack in turn: (1) all problems have clearly identifiable, discrete "solutions"; (2) universities, particularly universities in the Global North, should create these solutions for the entire world; (3) these solutions are primarily found in (western) technological innovations. Together, these assumptions falsely frame the climate solutions developed by western scientific experts and policymakers as objective, apolitical, universally valuable, and benevolent.

First, the notion that wicked problems like climate change have definitive, "discoverable" solutions ignores the inherent complexity of these problems, treating them instead as if they were "tame" problems: discrete, predictable, and easily solvable with existing knowledge and practices (Bauman, 2011; Stein, 2021; Whyte & Thompson, 2012). It also ignores that these problems can be understood and addressed in multiple different ways, each of which will be partial and limited. Critics point out that while treating wicked problems as tame problems and offering simple solutions may offer an immediate sense of hope and certainty, in the long-term this is not sustainable because, when complexities, contradictions, and conflicts inevitably emerge, people may feel unprepared and thus immobilized and overwhelmed.

The search for clear solutions can also lead to ignoring or oversimplifying problems that do not have simple answers or overlooking responses that are more complex, nuanced, and provisional. That is why, instead of simple solutions, some emphasize the need to develop the stamina to stay with what is difficult and uncertain, knowing that each context is constantly shifting and that all possible responses to wicked problems like climate change will be partial, imperfect, and likely lead to new, unforeseen problems (Andreotti et al., 2018).

This is not a reason not to respond, but rather a reason to respond with more honesty, humility, and self-reflexivity about the limits of any one response and to craft responses that consider the insights of different disciplines, sectors, and knowledge systems and that assess the implications for multiple communities, particularly those who are already systemically marginalized.

This points to the second identified issue with (techno)solutionism, which is the assumption that it is at universities (especially those in the Global North) where solutions should be identified and then exported elsewhere (Stein et al., 2019). This may lead to the reproduction of paternalistic patterns of relationship between dominant and marginalized communities, and of existing political, economic, and epistemic hegemonies. These patterns are especially salient in sustainability efforts organized around the UN SDGs. For instance, the Canadian Bureau of International Education's (2020) report "Advancing the Sustainable Development Goals at Canadian Universities" suggests universities in Canada "are able to build capacity in lower-middle-income countries and island states by supporting businesses and developing solutions to positively address challenges in local and global communities" (p. 6). This statement assumes the universal and objective value of expert knowledge originating in universities in the Global North, which in turn are framed as benevolent. Yet critics of (techno)solutionism argue that responses to climate change are always "embedded within the politics of whose interests are prioritized and whose knowledge are considered legitimate" (Nightingale et al., 2020, p. 347).

This leads to a final issue with (techno)solutionism identified by critics: the politics of knowledge that presume the exceptionalism and universalism of western science and technology (Nightingale et al., 2020). This presumption is captured in the headline from the research magazine of Boston University (2022): "as climate change gets worse, science provides hope and possibility." Focusing narrowly on technical solutions tends to reduce climate change to a purely technical problem, which invisibilizes its social, political, and economic dimensions. When western scientific and technical knowledge is framed as uniquely valuable for addressing climate change, this devalues non-western knowledges, as well as nonscientific western knowledges, and their role in addressing climate change (Nxumalo et al., 2022; Sultana, 2022; Wilkens & Datchoua-Tirvaudey, 2022). Indigenous scholars and communities, and scholars and communities in the Global South are often extractively treated as sources of raw "data" for non-Indigenous and Northern climate researchers, but rarely are they treated as equal producers of climate knowledge in their own right (Schipper et al., 2021), and rarely are they invited to set the research agenda or granted adequate funds to direct their own climate research projects. It is important to note that most critiques of the presumed exceptionalism of western science and technology do not dismiss their value entirely, but suggest the need to provincialize them and emphasize that they are just two of the many knowledges that are needed in order to ethically and effectively confront climate change in different contexts across the globe.

Social cartography of sustainability in higher education

Emerging critiques of sustainability efforts suggest that if universities seek to demonstrate their relevance, they will need to rethink how they invite engagements with climate change. To support the work of pluralizing the available possibilities, in this section I present a social cartography of three different approaches to sustainability in higher education: mainstream sustainability, critical sustainability, and beyond

sustainability. Because the latter is the least developed and dominant, I offer an extended discussion of its elements and implications.

Social cartographies map different approaches to shared issues of concern, which make them particularly useful for holding space for multiple analyses of and proposed responses to wicked problems like climate change that lack simple solutions and affect multiple communities in different ways. The maps produced through social cartography offer something distinct from either a description of what is or a prescription about what should be; they offer instead an invitation to sit with the challenges and complexities involved in navigating different understandings of a particular issue without seeking to identify or impose coherence, consensus, or quick resolutions (Andreotti et al., 2016; Suša & de Oliveira Andreotti, 2019). Thus, the maps do not tell people what to do or think but rather support people to identify possibilities, acknowledge different perspectives, and assess which choices will be most relevant and responsible in their current context.

In reviewing each approach to sustainability in higher education, I map how each diagnoses the root causes of climate change, as well as questions that guide this approach to sustainability and the perceived role of university research, education, and administration. I also offer illustrative examples of each. Finally, I use the metaphor of "the curve" to situate different approaches to sustainability in relative terms. Defining sustainability efforts as falling behind, on, or ahead of the curve can support people to contextualize and navigate calls for universities to undertake more substantive forms of institutional and social change, several of which I reviewed in the previous section. Thinking about their position on a curve can also allow staff, faculty, and students to situate their institution in relation to others and anticipate different possible responses to any given sustainability effort (see Table 1 for a summary).

Mainstream sustainability

Mainstream sustainability approaches in higher education operate from the assumption that the current system is inefficient and needs to be revised so as to ensure the expansion of economic growth and avoid significant disruptions in the midst of ecological changes. These revisions are primarily intended to achieve a "greener" version of the system we already have and thereby focus on technical solutions. Sustainability efforts are organized by questions about how we can most efficiently balance people's well-being, planetary limits, and economic profit.

University researchers are framed in this approach as the primary creators of universal solutions and influencers of policies related to climate change, and teaching is focused on preparing the next generation of experts. Meanwhile, university administrators are primarily tasked with ensuring institutional continuity in a context of increasing uncertainty and volatility. Examples of mainstream sustainability approaches are efforts to align institutional strategy documents with the UN SDGs or basic commitments to "green" the campus itself.

Critical sustainability

Critical sustainability approaches are gaining traction in higher education, so much so that they can increasingly be considered "on the curve." These approaches critique the existing

Table 1 Different approaches to sustainability in higher education

	Mainstream sustainability (behind the curve)	Critical sustainability (on the curve)	Beyond sustainability (ahead of the curve)
Diagnosis of the root cause of climate change	The current system is threatened by technical inefficiencies (it requires minor reform)	The current system is dominated by political and economic elites (it requires major reform)	The current system is inherently harmful and unsustainable (it is, therefore, beyond reform)
Orientation of sustainability	Make the current system greener through the innovations of western science and technology	Make the current system more inclusive and fair, and prioritize people and the planet over profit	Accept that we cannot make the current system sustainable, minimize harm, and gesture beyond it
Guiding questions	How can we more sustainably and efficiently balance people, planet, and profit?	How can we more equitably (re)distribute the risks and benefits of sustainability transitions?	How can we learn to relate more responsibly to each other and to the living planet we are part of?
Role of university researchers	Discover and disseminate universally relevant knowledge, solutions, and technologies; influence public policy; shape public opinion	Speak truth to power; look to "the people," especially the most marginalized, to develop more just, inclusive, and democratic solutions	Emphasize intellectual and relational rigor and (self-) reflexivity; prioritize accountability to front-line communities, and collaboration over competition; question simplistic solutions
Role of university educators	Prepare future leaders, professionals, and experts with the skills to solve global challenges; support graduates to become "happier, healthier, and wealthier."	Prepare effectively engaged citizens, activists, and change agents; empower young people to demand social change and challenge the inherited status quo	Prepare people to face wicked problems in responsible ways by developing stamina and expanding intellectual, affective, and relational capacities for justice-oriented coordinated action
Role of university administrators	Ensure continuity in the face of uncertainty and volatility; overcome barriers to sustainability; use sustainability to advance reputation, rankings, and resources	Follow the solutions proposed by students and communities on the frontlines of climate action in order to transform campuses and enable climate justice	Interrupt, learn from, and enact repair for past mistakes in order to clear space for different, more accountable futures in universities and beyond; redistribute resources in recognition of systemic inequities
Examples	Align strategic plans with SDGs; green the campus (e.g., recycling; LEED certification); green rankings; carbon offsets	Divest endowments; refuse fossil fuel funding; net zero campus; climate emergency declarations; no-fly pledges/policies	Climate reparations; failure reports (e.g., McGill University 2020, 2020); return university lands to Indigenous stewardship

socio-economic system, particularly its assumption that we can achieve sustainability while still seeking infinite growth on a finite planet. Rose and Chachelin (2018) define critical sustainability as "a form of sociopolitical and socioeconomic engagement that rejects the superordinance of capital accumulation over ecological integrity" (p. 518). It suggests people and the planet should take precedence over profit in the "people + planet + profit" equation offered by mainstream sustainability. Thus, critical sustainability seeks major reforms to the existing system, such as replacing growth-centered sustainable development with alternative economic models (e.g., degrowth, donut economics, and the Green New Deal). There is also a strong focus on equity, specifically the need to equitably redistribute the risks, costs, and benefits of seeking a more just and sustainable socio-economic system.

The primary purpose of research in critical sustainability approaches is to challenge political and economic power structures, especially elites who profit from the system that creates climate change in the first place and who also profit from many proposed climate solutions and dominate public conversations and policies. The intention is that this research should elevate the voices and seek solutions and alternatives for those most negatively affected by climate change. The role of university educators is to empower engaged citizens who will demand and lead changes toward a more equitable and sustainable version of our current system. Administrators are expected to take direction from students and marginalized communities to transform their campuses. Examples include efforts to divest institutional endowments from fossil fuels and achieve a net zero campus. Climate emergency declarations and "no-fly" pledges may also be examples of a critical sustainability approach.

Beyond sustainability

Beyond sustainability approaches are still emerging in higher education but may become more common with growing awareness about the depth and magnitude of challenges posed by climate change, especially among younger generations. Like critical sustainability approaches, beyond sustainability approaches are concerned with questions of equity and justice. Both approaches are concerned, to varying degrees, with some or all of the three critiques of mainstream university efforts reviewed earlier (greenwashing, climate colonialism, and solutionism). The primary distinction between these two approaches is that critical sustainability approaches seek to reform the current system, while beyond sustainability approaches suggest the system is inherently harmful and unsustainable and, thus, beyond reform (Stein, 2019; Stein et al., 2022).

In beyond sustainability analyses, it is not only that some are excluded from the benefits of this system, but more fundamentally that these benefits come at the expense of both human and other-than-human beings. That is why these approaches describe this system not only as capitalist but also modern/colonial, wherein the shiny promises offered by modernity (e.g., comfort, security, certainty, and innocence) are actually made possible through the violences of coloniality (exploitation, expropriation, genocide, and ecocide). Beyond sustainability approaches thus emphasize that the modern/colonial system cannot solve the problems it has created.

Another defining feature of beyond sustainability approaches is the analysis, grounded in many Indigenous and decolonial critiques, that a root cause of climate change is the illusion that humans are separate from each other and separate from (rather than part of) nature. This presumed separation allows us to deny our responsibilities to current and future

generations of other human and other-than-human beings (Huni Kui, 2022; McGregor et al., 2020; Whyte, 2020). This dynamic was illustrated in the billboard advertisement of a car insurance company posted near the COP27 conference in Sharm el-Sheikh, Egypt, which showed a car that is half metal, half leaves (see Fig. 1). The billboard read "save both worlds" that is, both the natural world (symbolized by the leaves) and the modern/colonial world (symbolized by the car and the infrastructures and energy sources on which it runs). While mainstream sustainability approaches would agree the two worlds are separate and that we can balance and save both, beyond sustainability approaches emphasize that the worlds are metabolically entangled, and the modern/colonial world is destroying the natural world. Hence, if we want to "save" the natural world, we will need to hospice the modern/colonial one and reactivate our sense of entanglement with each other and the planet, and thereby our sense of responsibility as well.

Hospicing the modern/colonial world would require identifying, interrupting, and learning from past mistakes in self-implicating ways, and repairing social and ecological relations, so as to clear space for the emergence of different, more responsible futures (Machado de Oliveira, 2021). However, beyond sustainability approaches emphasize that these futures cannot be known in advance, because anything imagined from within the modern/colonial system is likely to repeat itself. Thus, rather than promising an idealized future, beyond sustainability approaches emphasize that educators should support students to develop the stamina and the intellectual, affective, and relational capacities to collectively navigate climate change and other wicked problems in inevitably partial and imperfect ways, learning as we go and moving at the speed of trust. Indeed, these approaches emphasize that in order to be able to respond to wicked problems with ethical and effective coordinated action, we will need to develop relationships grounded in trust, as well as respect, reciprocity, consent, and accountability (Whyte, 2020).

Beyond sustainability approaches to research emphasize trans-/post-disciplinary inquiry that is both intellectually and relationally rigorous and responsive to and guided by the

Fig. 1 Billboard posted nearby the COP27 conference (photo credit: Vanessa Andreotti)

needs and aspirations of communities on the front lines of climate change. In turn, they question the presumed universalism and benevolence of research that poses simple solutions and seeks the continuity of modern/colonial business as usual. They also invite self-reflexive engagements with alternative approaches to sustainability that still seek guaranteed outcomes, given that the desire for guarantees itself suggests a continued investment in at least some modern/colonial promises.

Beyond sustainability approaches are still emerging and can therefore be considered "ahead of the curve." Because of this, it is difficult to identify clear examples of beyond sustainability in action, as universities largely remain embedded within the systems that this approach identifies as inherently harmful and unsustainable. However, we can nonetheless identify incipient efforts that gesture in this direction. In practice, these efforts are often situated somewhere in between critical sustainability and beyond sustainability, operating in the cracks of institutional confines.

Examples of these gestures include research, teaching, and community engagement focused on climate reparations or reparative forms of resource redistribution. For instance, some have called for pathways to redirect funds previously allocated for faculty travel toward climate research and action projects led by frontline communities. Another example could be "failure reports" that reflect on the missteps of sustainability efforts. Often, institutions celebrate their sustainability initiatives in search of positive publicity. Yet given that climate change is a complex wicked problem, it is almost guaranteed that some initiatives will fail. Failure can be generative if treated as an opportunity to learn from mistakes so as not to repeat them (Arshad-Ayaz et al., 2020; Gesturing Towards Decolonial Futures 2021). The "failure report" produced by McGill's Vision 2020 sustainability team gestures in this direction in its premise, although arguably its content aligns more with critical sustainability. Finally, people are trying to link decarbonization with decolonization by advocating to return the stewardship of campus lands to local Indigenous Nations who hold intergenerational, place-based knowledge about how to ensure the well-being of their territories (Lin, 2022).

Discussion of the sustainability in HE cartography

It is important to keep in mind that these three approaches to sustainability in higher education are not intended to describe individual institutions, programs, and people. Many will draw on one or more approaches, and the approach people choose will likely depend on what feels possible and relevant in their context.

I also note that the use of the "curve" metaphor is intended to be diagnostic and pedagogical rather than normative or teleological. It describes dynamics at one moment in time, but the curve itself is constantly in flux, and there is no guarantee that universities will keep moving in a particular (especially linear) direction, nor is there an assumption or prescription that they should. Like all elements of the map, the diagnosis of where an approach sits on the curve is situated and provisional. This also explains why the map does not include every approach to sustainability—that is, it does not claim to exhaustively represent all possibilities, particularly as many possibilities remain unimaginable from within existing institutions. Instead, the map highlights established approaches to sustainability as well as some emerging alternatives, and seeks to remind people that other possibilities exist, even if they are not yet visible.

There are other ways of mapping sustainability in higher education.

For instance, Ruiz-Mallén and Heras (2020) identify three different sustainability discourses in higher education, the most common of which is the discourse about greening the existing socio-economic system. They also find discourses of resilience that seek to anticipate risks and identify technological solutions for sustainable development, as well as alternative discourses of social transformation that challenge the premise of sustainable development. Although Ruiz-Mallén and Heras suggest these alternative discourses have thus far been "neglected by universities," arguably things are quickly shifting.

Conclusion

In this article, I have argued that climate change is a complex wicked problem, and as such, it prompts various proposed responses in the context of higher education. I have sought to identify some recent challenges to mainstream university responses to climate change and to map some of the possible approaches to sustainability that have been articulated in the context of these challenges. While for now, mainstream sustainability approaches are arguably still dominant in higher education (Ruiz-Mallén & Heras, 2020), they are increasingly considered behind the curve in light of growing critiques about the inherent limits, contradictions, and harms of growth-centered sustainability (e.g., sustainable development), along with general trends in the intensified speed of social change and polarization (Bauman, 2011; Stein, 2021).

More people are beginning to question whether universities' "traditional ways of working will be up to the task" of addressing climate change (McCowan, 2020, p. 14), while others argue more pointedly "there has been a collective failure to acknowledge [universities'] part in a system that is bringing humanity to the brink of catastrophe" (Green, 2021, p. 4). Indigenous scholars and activists have pointed to the risk that many mainstream proposed climate solutions will reproduce long-standing colonial relations (Hunt, 2022; McGregor et al., 2020; Whyte, 2018, 2020). Frustrations on the part of students also reflect intergenerational tensions, exemplified in worldwide school climate strikes in 2019 and student-led divestment campaigns (Green, 2021; Nxumalo et al., 2022). While older generations may feel it is unwise to question the very social, political, and economic systems that enable universities' existence, younger generations may feel we have little choice but to pursue bold action, given analyses that these systems are what led to climate change in the first place. Many of these young people raise critical questions about who pays the costs of continuing business as usual and suggest "there is no time for timidity" (The Vision 2020 Team, n.d., p. 1).

In this context, in order to remain socially relevant and fulfill our responsibilities to multiple local and global communities, those of us working in universities will need to be responsive to the tensions, complexities, and uncertainties that characterize sustainability efforts in our particular contexts and prepare our students to do so as well. We will need to learn to hold space for more critically informed, complexity-based, and socially and ecologically accountable conversations about the role of universities in either foreclosing or pluralizing possible futures on a shared, living planet. Such conversations would need to account for social and epistemic differences, minimize the negative effects of conflict and polarization without papering over relevant disagreements, and prioritize ongoing, reflexive engagements with challenging, self-implicating questions. Finally, these conversations would have to actively account for the unequal power of different narratives and communities so that those who disagree with mainstream sustainability agendas can express

their dissent in meaningful and consequential ways, particularly those on the frontlines of climate change whose knowledge and first-hand experiences have been systemically and systematically silenced, ignored, or tokenized. Perhaps it is through the difficult process of learning to collectively grapple with complex wicked problems that we will cultivate the capacities we will need if we are to confront climate change in relevant, rigorous, and responsible ways.

Declarations

Conflict of interest The author declares no competing interests.

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