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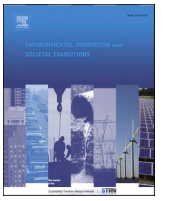

Research article

Just transition boundaries: Clarifying the meaning of just transition

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ABSTRACT

The rapid expansion of the public discussion and research on just transition implies the risk of watering down either justice or the (eco-)socio-technical transition itself. We create a theoretical notion of just transition boundaries and propose it to help consider non-negotiable limits to just transition discourse and make sense of negotiations within such limits. Just transition boundaries are comprised of ecological and social boundaries. They determine that just transition-processes must bring societies effectively within the safety thresholds of the two most critical planetary boundaries, climate change and biodiversity loss, and must do that by means and supportive measures that protect vulnerable groups from falling or getting stuck below social minimums in those processes. Boundaries leave room for plural values and visions for realizing transitions and remaining within safe thresholds in community-specific conditions. Context-specific additions to what just transition should cover are possible insofar as they do not contradict or risk just transition boundaries. In addition to justifying and conceptualizing just transition boundaries, we reflect on its implications for policymaking and research.

1. Introduction

Disproportionate impacts of climate change presuppose climate action, alongside other reasons, for the sake of justice (McMichael, 2017). The repercussions of climate actions have triggered another, additional call for justice. This call for *just transition,* enacting decarbonization in a just way, is grounded in climate, energy, and environmental justice (Evans and Phelan, 2016; Heffron and McCauley, 2018; Newell and Mulvaney, 2013) and raises questions regarding the impacts of environmental policies, their systemic repercussions, and fairness in decision-making processes. Just transition[1] has become the paradigmatic discursive framework and political idea for addressing social justice and socio-economic impacts related to environmental sustainability transitions, especially in climate policy related debates and sustainability transition studies. Making transitions just promotes the intrinsic value of justice – living in a world that is more just for all, including those in less privileged positions – and instrumental value, by facilitating the

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[1] For us, just transition (singular) refers to the overall idea of just transition or the totality of systemic changes (system-specific just transitions in energy systems, food systems, etc.).

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benefits of higher decision-ownership, willingness to cooperate, and thus increased likelihood for successful transitions.

Simultaneously, just transition research has expanded widely. New explorations by researchers, political coalitions, and civic movements expand the understanding about, but also expectations for, just transition. While distributive, procedural, and recognition justice have become established dimensions for clarifying the meanings of just transition, the richness of just transition viewpoints in literature has been described as 'overwhelming' (Coninx and de Rooij, 2022) and theoretical-conceptual clarifications as lagging behind (Banerjee and Schuitema, 2022; cf. Heffron and McCauley, 2018). In the sphere of collective action and political negotiations, the increasing number of concerns increases tensions between the environmental and social aspects (Ciplet and Harrison, 2019) and competing claims and visions for just transition (Banerjee and Schuitema, 2022; Murphy et al., 2022). For example, demands for better wages or compensation for economic losses may compete with demands for making basic goods more affordable. Showing respect for diverse conceptions of the good life with non-coercive policies (cf. Fischer et al., 2023) may conflict with correcting existing injustices by curtailing the liberties of privileged groups, including the middle-class. Transforming practices may create experienced injustice (Kaljonen et al., 2021). Some of the competing interpretations harness the concept to serve privileged interests (Moussu, 2020; Bainton et al., 2021; Alarcón et al., 2022; Thomas 2021). Justice framings may get distorted due to co-optation by powerful stakeholders who voice their interests so loudly that the most disadvantaged and vulnerable groups remain unheard (Maluf et al., 2022), the emphasis of social issues may be made at the cost of environmental ambition (Huttunen et al., 2024), or there may be concealings of disagreements and 'buying time' intentions (Thomas 2021). Wang and Lo (2021, p. 8) conclude in their conceptual review that "…the term [just transition] has become extended, multifaceted, and to some degree problematically polysemic, which leaves room for confusion in interpretation". Without critical reflexivity, the meaning-plentifulness might dilute the concept to the point of meaninglessness.

Therefore, critical and clarificatory research approaches that work against the unjust co-optation or slowing down of just transition (e.g., Swilling and Annecke 2012; Swilling 2020; Bainton et al., 2021) are much needed. Concluding that 'just transition is plural and is to be negotiated' is, in our view, an insufficient reply from the research community to the question of what justice in transitions is about (cf. Wallack 2006). In this theoretical research, we address the aforementioned need for critical and clarifying contributions about the meaning of just transition(s) in the contemporary wide sense (not only as a labour justice question). Our contribution's novelty lies in that we accomplish this in terms of a limits-based approach that draws on Raworth's doughnut model. We propose that there are non-negotiable elements, *just transition boundaries,* without which such a transition would be a conceptual oxymoron: it would be neither just nor trigger actual transition. Just transition boundaries determine the minimum contents for any meaningful idea of just transition (or its sub-domains, such as food justice or interspecies justice). Simultaneously, they leave room for ethical pluralism in negotiating and realizing just transitions in various geographical and socio-cultural contexts. We propose that the boundaries-notion helps dealing with the competing just transition framings by highlighting what matters most to make systemic changes count as just transitions.

We begin with theoretical remarks on the boundary approach (Section 2). Then we proceed to construct the notion of just transition boundaries (Section 3). Our analytical perspective is grounded in the doughnut model that conceptualizes the thresholds for just and sustainable economies (Raworth, 2012; 2017a; 2017b). Beyond distributive justice but linked to it, we also explore how procedural justice and recognition justice in transitions link to the boundaries (Section 4). Finally, we reflect upon the implications of just transition boundaries for transitions, policy planning and research (Sections 5-6).

2. A boundary approach: between universalism and relativism

Clarifying the meaning of just transition by seeking its limits concerns both the meaning of the transition and its justice. From both pragmatic (action-oriented) and normative viewpoints, boundary-seeking clarifications should help in assessing the justifiability[2] of various statements - claims, strategies, visions, and framings – regarding just transition. Conventional normative political theory could assess justification by theorizing about universally just structures and relations. However, decolonising sustainability studies and normative theorising calls for moving "…away from a universalist philosophy of justice in general and climate justice in particular, rooted in Northern traditions, and towards more diverse understandings of 'climate justice'" (Newell et al., 2021; see also Álvarez and Coolsaet, 2020). This necessitates attention to geographies, contextualities, and relationships between people and their socio-ecological environments (Behrens, 2010; Raworth, 2017b; Rozzi et al., 2012), which easily get neglected in universal theorizing.

Yet, the other extreme is also problematic: normative relativism is the idea that everything in the meaning and goals of just transition ought to be left to local communities, i.e. that justice is fully up to place-specific negotiations. Normative relativism can be as mis-recognitive as universalism by reproducing dominant societal norms. Downplaying impacts of decisions on distant communities and future generations, for example, has not been central to the previously dominant state-territorial framings of justice (Fraser 2009). Those impacts have also been found to be lacking or sidelined in at least some just transition studies on stakeholder and public perceptions (e.g., Huttunen et al., 2024). Henry Shue (2014) articulates another, more concrete example for an inherently contradictory idea of justice: demanding that anyone sacrifice their vital interests to enable others to realize their trivial interests is unfair. Consequently, unless we accept that justice can be about the continuation of oppressive relations, any idea of justice seems to call for boundaries to avoid falling into relativism. Justice is otherwise conceptually permitted to contradict itself or to dismiss how people are currently disproportionately equipped and empowered to participate in determining what justice means.

Similar challenges exist with the concept of transition where full relativism demands leaving the meaning of sustainability

[2] The quality of being justified in terms of grounding arguments and assumptions.

transitions to any context-specific group of actors. If a just transition statement disregards those environmental sustainability targets that the scientific community has proposed as critical for securing safe human existence, that idea of a 'just transition' contradicts the fundamental meaning of just transition by eradicating or diluting the critical transition-element.

The above-described problem implies that statements for justice should be compatible with a certain minimum idea of justice according to which justifiable conceptions of justice cannot contradict justice itself or involve/assume the reproduction of highly oppressive relations as 'just'. Clarifying the limits of justice is a conceptual-theoretical exercise but it also relates to practical demands. Just transition can be also conceptualized in terms of ideals or perfect justice. Ideals help in identifying whether A is more just (closer to the ideal) than B but say nothing about minimum requirements. Consequently, assessments that merely rely on ideals as reference points allow calling any incremental improvement a just transition. This would risk watering down just transition into either 'greenwashing' or 'social washing'.

For these reasons, we adopt a non-ideal threshold approach to seek the justifiability conditions for a process to count as just transition. That is, we aim to define the conceptual-theoretical, normative *just transition boundaries*. Because boundaries leave room for diverse justice understandings and transition pathways, our approach represents a midway between universalism and relativism.

Our theoretical work draws on the doughnut model (Raworth, 2017a; 2017b), an influential integration of social and environmental limits for safe and just economies. To our knowledge our work is the first application of the doughnut to just transition. Recent works have sought to quantify the social thresholds for the doughnut (Rockström et al., 2023) which triggered some critical responses (Humphreys, 2023). These works concern the purpose of sustainability transitions: the importance and goals of achieving the transition. We, instead, focus on the qualities of transition-processes that are designed to direct societies towards transition. *Transitions* raise a different (even if related) set of questions than *outcomes*; if that was not the case, the discussion on just transition (as something separate from general social justice) would be unnecessary.

3. Integrating social and ecological boundaries: the doughnut framework

The 'doughnut model' (Raworth, 2017a; 2017b) has become an influential conceptualization of the thresholds for economic activities in societies that aim to be just and sustainable. It emerged as a beyond-GDP alternative for measuring development and depicts the social foundation and ecological ceiling between which all of humanity could flourish. The ecological ceiling comprises nine planetary boundaries: climate change; biosphere integrity; land-system change; freshwater use; biogeochemical flows; ocean acidification; atmospheric aerosol loading; ozone depletion; and novel entities including chemical pollution (Steffen et al., 2015). Social foundation factors have been altered slightly across sources. In a large study on the social shortfall and ecological overshoot of nations over time, Fanning et al. (2022) include two measures of well-being (life satisfaction; life expectancy) and nine need satisfiers (nutrition; sanitation; income poverty; access to energy; secondary education; social support; democratic equality; equality; and employment). Thresholds for these social minimums can be determined by indicators such as calorie supply and access to electricity (Fanning et al., 2022; O'Neill et al., 2018).

The doughnut integrates social and ecological boundaries as minimum conditions for safe and just economies, or a just and sustainable space for co-existence (definitions vary slightly in these terms). Integration implies setting social minimums at a level that is achievable for all within ecological limits (see also Rockström et al., 2023). While offering and protecting social minimums has environmental costs, some actions also come with synergies regarding both boundaries, including so-called health co-benefits. For example, decarbonizing transportation by improving public transport and cycling/pedestrian infrastructure can improve the health, but also well-being and participatory opportunities, of the urban poor (Kortetmäki and Järvelä, 2021), which are often referred to as health co-benefits. Due to its integrated approach, the doughnut offers a useful model for discussing just transition boundaries as well. We will next examine how to make the doughnut fit depictions of just transition related, process-focused boundaries.

3.1. Ecological ceiling: what kind of change counts as a transition in 'just transition'?

Political philosopher Michael Wallack (2006) proposes the principle of *minimum irreversible harm* to distinguish between damages that can justifiably be compensated or restored and barriers that cannot be justifiably crossed due to their impacts on future generations. This principle is in line with sustainability transitions research aiming to help resolve pressing environmental challenges: the foundations of sustainability transitions are grounded in the imperative of avoiding irreversible harms for justice and well-being.[3]

The ecological ceiling of just transition refers to the minimum conditions for transition-processes to count as *environmental sustainability transition(s)*. In just transition research and discourse, climate change mitigation is the standard environmental anchoring. In the doughnut model, ecological ceiling instead comprises nine planetary boundaries (including atmospheric composition) for safe human existence (Steffen et al., 2015). The crossing of safety thresholds for planetary boundaries greatly increases the risk of disruptions that threaten environmentally safe and relatively stable conditions for human well-being and development.[4]

Climate change and biodiversity loss have been identified as the most critical planetary boundaries: unmitigated climate change will lead to uninhabitable conditions on the planet (Steffen et al., 2015, p. 8) and biosphere integrity is essential for the provision of

[3] We do not consider here local level 'irreversible harms' (such as the cutting of a single forest plot with recreational local value to create space for new residential housing) because, first, many of them do not undermine human well-being and justice in Wallack's sense and because we consider them to be a matter of environmental justice more generally but not necessarily related to transitions specifically.

[4] Beyond the safe operating space there are also tipping points after which the related biogeophysical processes might become irreversible.

basic goods (Richardson et al., 2023). Thus, defining sustainability transition as decarbonization that only includes low-carbon transition could still lead to irreversible, Holocene-ending harms resulting from biodiversity loss. There is more system-dependent variation in the relevance of the other boundary-variables (e.g., nutrient and freshwater use are more central challenges in food systems than in energy production). In addition, we argue that climate change and biodiversity loss are sufficient for defining ecological just transition boundaries due to their close links to other critical planetary boundaries. Addressing climate change and biodiversity loss together will also impact positively on other boundaries. For example, effective biodiversity protection and restoration fundamentally changes agriculture: stopping large land conversions and restoring degraded ecosystems in agriculture will also decrease biogeochemical (nutrient) runoffs and freshwater use (Pereira et al., 2018).

The irreversible harm principle implies that to count as a transition, changes must create sufficient efforts to bring the system-in-transition below the safety thresholds of the two core planetary boundaries. What counts as 'sufficient' depends on the geographical and temporal scale of assessment. The IPCC, IPBES, and scientific reports assess the required harm reductions for different timelines and sectors. National, regional, and energy/mobility/food system-specific target determination falls to actors at the research-policy interface such as national climate change panels.[5] We highlight that estimating the required extent and pace of transitions should use the best scientific knowledge available.

Irreversible environmental harms imply injustices by undermining the preconditions for well-being. Chronic climate instability with extreme heat waves, droughts, and migrating disease vectors, such as mosquitos, deprives people of basic safety and disrupts their access to food, energy, and water already, particularly in Sub-Saharan Africa. Anthropogenic environmental changes alongside social factors also drive the permanent loss of indigenous ways of life, leading to biocultural homogenization that is hardly reversible (Rozzi, 2012). In such cases, even local habitat losses may constitute irreversible harms regardless of whether some can escape the plight by migrating (Parks and Roberts, 2006). Environmental harms may also become irreversible with smaller changes that aggravate over time: ever-degrading social-ecological conditions may eradicate the capacity of people to adapt to and resolve further challenges. For example, poverty, disease, and malnutrition create vicious circles and consequent traps of lifelong poverty (Sapkota et al., 2021) and irreversible harm. Poor diets make people prone to illnesses and thereby missing work and/or becoming poorer due to medical treatment costs. This reduces their capacity to acquire healthy food, which worsens illnesses and increases the likelihood of family members becoming ill or impoverished. The current plight even leads to selling of livelihood assets and savings for short-term survival. Climate change and biodiversity loss will increase the number of harmed people and aggravate their plight over time (Perkins, 2018).

The ecological ceiling and its grounding in the avoidance of irreversible harm makes just transition a concept with a sense of urgency: if sustainability transition does not happen within a certain timeframe, chances for just transition may be lost. It could be either impossible to return to a safe operating space for humanity, or possibilities to make the required transition even minimally just are lost due to the need for an overly radical transitioning pace.

3.2. *Social minimums: what makes a transition un/just?*

When applied to just transitions, the social boundary of the doughnut model asks about the minimum conditions for transitions to count as *just*. The doughnut has its social foundation in human rights (Raworth, 2012) that enable humans to lead and live their lives of dignity and opportunity. As human rights are based on international agreement, sustainable development should over time produce sustainable, prosperous fulfilment of human lives following the principle of progressive realization (cf. Beitz, 2009). Basic rights comprise perhaps the most elementary form of safeguarding a social minimum. They are rights to fundamental goods which are needed for a healthy life without which humans are unable to enjoy other institutionalised rights (Shue, 1996). For instance, chronically hungry people are unlikely to be capable of making good use of their political rights.

Setting the social minimum threshold too low, such as merely access to food, water, shelter and basic medicines for survival and not getting ill, is strongly criticised. One concern is deteriorating standards over time: basic rights can only be sustainably secured if people can meaningfully participate in political decision-making (Shue, 1996). This, however, also requires sufficient access to education and information, and institutionalised principles of social equity, freedom of association, and political voice (cf. Raworth, 2017b). The same point highlights how material distribution is linked to in/equality in political participation: wealth increases one's ability to translate financial resources into political power, whereas for poor people the cost of active political participation can be unbearably high (Robeyns, 2017). Moreover, barely coping people are extremely vulnerable to environmental and societal disruptions and unable to plan or improve their life on their own means by taking reasonable risks (Haushofer and Fehr, 2014). Hence, the United Nations has warned against minimalistic interpretations that may jeopardize realizing human rights (UN Committee on Economic Social and Cultural Rights, 1999). For example, the right to food requires both meeting nutritional needs and leaving room for certain non-nutritional preferences related to cultural and religious values (opportunity to eat well despite abstaining from certain foods).

Although human rights have been criticized as a Western idea, based on nonuniversal individualist human conceptions (Cobbah, 1987), adhering to the rights-grounded social minimums does not necessitate adhering to the institutionalized human rights language. Similar basic needs and needs-related goods are also captured with perspectives focused on human dignity (Cobbah, 1987; also Nussbaum, 2011). Likewise, dignity-based conceptions of decent social minimums manifest, for example, in the Confucian perspective on the universal right to health (Fan, 2016), African views on communal responsibilities (Cobbah, 1987), and the wellbeing of people and their surroundings relying on relational ontologies in Andean world views (Sax, 2015). There are various ways in which people can

[5] Other planetary boundaries may provide important additional system-specific objectives in food, energy, and mobility transitions.

justify what they owe to each other and how to organize society so that social minimums are secured, particularly at community levels, and to make these societal arrangements compatible with local socio-environmental conditions.

We distinguish three shared core elements among the efforts to determine human rights based social minimums. First, most agree on providing goods that allow people to live and cover basic material and immaterial needs. Second, most agree that people should have possibilities to improve their situation through their own means (self-determination and agency). Finally, the principle of democratic participation is widely accepted. These link to the three most common and interlinked justice dimensions in just transition studies: distributive, procedural, and recognition justice (Wang and Lo, 2021). The first and second elements largely concern distributive justice, including the provision of basic conditions for being able to participate politically (as we noted above) alongside the recognition of agency. The third element, protecting the autonomy-supporting and choice-enabling spaces, makes room for value pluralism, a widely accepted demand of procedural justice (Schlosberg, 2007; Williams and Doyon, 2019; Wang and Lo, 2021) and is closely linked to recognition justice to make participation meaningful (Schlosberg, 2007).

Raworth's social minimums can be linked to a needs-based theory of wellbeing (Gough 2017) that names health and autonomy as the fundamental basic needs and associates the following need satisfiers for them: adequate food and water; housing; safe environmental conditions; healthcare; basic education; sufficient security; the possibility to form significant relationships; and reproductive safety. Yet need satisfiers highlight how distributive justice alone is insufficient for just transitions (cf., Sovacool et al., 2019). This is exemplified by the need for autonomy. Procedural justice is central for satisfying autonomy-related needs (Gough, 2017, p. 43) and accounting for differential support-needs and cooperation opportunities in transitions, while sufficient distributive justice is a prerequisite for realizing procedural justice (cf. Robeyns 2017). Autonomy also requires recognition by peers and institutions as an autonomous and dignified community member, whose potential to contribute to their communities and beyond can be strengthened institutionally (Timmermann, 2018). These aspects also highlight the importance of having opportunities for future-planning and improving one's situation, activities inherent in human nature (Steinvorth, 2009). Raworth (2017b) also notes the importance of meaningful relationships, political voice, and capacity building by education. The intertwinement of distributive, recognition, and procedural justice – there cannot be the first without the latter two – is exemplified throughout environmental justice literature (see, e.g., Schlosberg 2007 and Whyte 2017 to mention but a few examples).

Consequently, we consider that the contents and thresholds for social minimums are most meaningfully determined as (1) including the universal need satisfiers (see above) for a healthy and dignified life as an autonomous agent (the contents); (2) having enough to produce or acquire need satisfiers over time to enable planning ahead and improving one's situation (the threshold); and (3) having rights and resources that enable exercising agency via meaningful relationships and democratic participation (the empowered community). We address the additional yet related procedural and recognition aspects in Section 4.

Social minimums set boundaries below which the environmental sustainability transition-processes must not push community members. The framework we propose focuses on minimums, yet safeguarding the material aspects of the minimum in the world of scarce resources necessarily raises questions of also setting maximums without which the minimums cannot be secured for the most deprived (Hickey 2023). The implications of "upper limits" or limitarianism to just transition and generally theories working with notions of sufficiency need future research.

Nation-states possess unique redistributive capacities (e.g., Routledge et al., 2018) and are both in legislative and moral terms obliged to respect, protect, and fulfil the rights related to social minimums. Nation-state capacities also apply to labour and livelihood issues that are one relevant aspect of just transitions (e.g., Jenkins et al., 2020). Right to adequate work and just remuneration matter for social minimums since work is usually the primary way of acquiring resources for meeting and surpassing the social minimums. The precise standard of living, material goods and social services required for achieving social minimums, is not universal: the combination of environmental policies, social and public policies and social services, market conditions, urban design, and community relations influence the requirements for reaching and staying above the social minimums (De Schutter, 2024). For example, the purchasing power needed to secure a healthy diet depends on market factors but also local policies that allow satisfying needs outside markets by supporting access to the means of production (such as encouraging urban gardening by providing suitable allotments) or providing other relevant public services. Otherwise disproportionate impacts or vulnerabilities can be alleviated with social policies but also capacity building (Kortetmäki and Järvelä, 2021). For instance, food education supports the engagement of less-resourced individuals in dietary transitions (Kaljonen et al., 2021). Knowledge exchange on sustainable eating and communal cooking can help in saving resources, acquiring more sustainable food habits and reinforcing community networks (Vivero-Pol et al., 2018). School meal programs can simultaneously satisfy needs and promote transition capacities (Kaljonen et al., 2021). Strengthening the adaptive capacities of less resourced actors can also speed the pace in which transitions can be implemented justly. Supporting the agency and opportunities of people to improve their situation by their own means (recognition justice) and collectively plan ways forward (procedural justice) can, thus, improve just transition.

In most conceptions of justice, many transition burdens such as economic costs become unjust only after exceeding certain thresholds (e.g., Nussbaum, 2011).[6] The social minimum viewpoint determines this threshold. In social welfare states, the material aspect of social minimums usually has a threshold tied to welfare payments and services linked to concrete (and possibly partly democratically agreed) standards for claimable goods and services (e.g., household appliances, public transport, health care, participation in cultural life) as a part of social minimum. However, standards may be close to the 'survival level'. Just transition, according

[6] Most *theories* of justice (except for strict egalitarianism) do not demand a strict egalitarian distribution of the costs and burdens of transitions. Citizens are expected to shoulder certain irregularities in the distribution of costs and nuisances for the advancement of socially desirable targets, insofar as these are not excessive.

to boundaries approach, requires keeping social minimums at a level that enables people to participate socially and plan and improve their life. Such social minimum thresholds are politically quite demanding yet achievable. Programs supporting the reintegration of citizens in labour markets and offering public spaces for community organisation are good examples of setting the social minimum threshold higher. Overall, social minimums (concretized via need satisfiers), including structures that support autonomy and participation, comprise a meaningful interpretation about the non-negotiable minimum conditions for justice in transitions, with relation to the impacts of the transition on individuals and communities.

4. What role for procedural and recognition justice?

Procedural justice is pivotal for just transition (e.g., Newell and Mulvaney, 2013; Routledge et al., 2018; Williams and Doyon, 2019) and is linked to recognition justice. Both play a key role when communities decide about the actions to take from the plurality of options that help systems transition to get within the ecological boundaries. They are needed to choose the means for enacting just transition in varied contexts and to create the path to bring pluralist goals (those that go beyond social minimums) into just transition processes. Additionally, as noted earlier, social minimums presuppose rights and resources that enable exercising agency via meaningful relationships and democratic participation. The connectedness of justice dimensions discussed earlier means that fully authoritarian transitions, even if they met ecological goals and provided material social minimums effectively, would not count as *just* transitions. However, the political nature of just transitions calls for discussing the role of procedural justice with relation to the boundaries.

To meet procedural and recognition justice demands, transition processes should ensure (historically) underrepresented voices an opportunity to be heard in decision-making, be recognized as peers with their own views and agency, and to be involved in decisions directly affecting them – an issue much discussed with relation to environmental justice and indigenous communities. Powerful actors have already created strong narratives around preferable solutions and, thus, get their interest-driven claims easily spotlighted in public discourses (e.g., Healy and Barry, 2017; Maluf et al., 2022). This would require distributive justice measures since material wealth aggregates inequalities in political power (Robeyns 2017). While urgency and procedural inclusiveness may conflict (Ciplet and Harrison, 2019), neglecting procedural and recognition justice likely leads to less governable transitions where capital sets its terms (Newell and Phillips, 2016) with culturally and socially inadequate interventions and failing to recognize non-commodified solutions (De Schutter, 2024). Such transition pathways also risk the social minimums of distant parties by, for example, not regulating intensified extraction for clean technology that affects indigenous and rural livelihoods and distant ecosystems (Newell and Mulvaney, 2013).

Procedural justice in just transition calls for public deliberation that can be seen as the search for the common good for society (Freeman, 2000), even though such a common good may be partial and compromised (Patterson, Feola and Kim 2024). Deliberation operates at multiple levels, rescaling the state into a platform that amplifies local initiatives and mediates between local and international processes for transitions (Routledge et al., 2018). Engaging in thorough deliberation on how to implement just transition opens opportunities for debating and negotiating societal goals, putting individual preferences in perspective with relation to solidarity and social cohesion. It is useful to understand deliberation more widely than as discussing together: civic movements and networks, for example, are relevant participants in deliberative practices, trying and seeking new forms of social organization for more sustainable solutions (Huttunen et al., 2022). Collective deliberation on the material implications and social organisation of social minimums necessitates ensuring the representation of less powerful actors and keeping the ecological ceiling in sight. This perspectivation helps 'calibrate' the subjective perceptions of justness by increasing sensitivity to the situation of others (Solum, 2004) with potential to alleviate some of the tensions between competing interests. Moreover, the boundaries perspective supports shifting the procedural realm from co-productive rigidity, where tensions hinder transformations, to co-productive agility, where tensions enable transformations (Chambers et al., 2022; see also Patterson, Feola and Kim 2024).

Deliberation with a societal perspective is critical for implementing effective climate and biodiversity action. This requires fundamental reflections on the dominant economic models, what kinds of goods are relevant to well-being, and which economic functions do not serve broader societal goals (e.g., Patel et al., 2017). Just transition boundaries can serve as guiding instruments for such deliberation as bridging elements between more extreme positions. Acknowledging the role of local communities in promoting the common good might simultaneously alter current worldviews, challenging hyper-individualized societies and the domination of capitalism (Routledge et al., 2018). While just transition boundaries do not require a just transition to imply full-scale economic transformations but focus on getting into a safe operating space, just transition processes should be supportive towards more thorough societal and economic transformations over time.

Procedural justice, linked to recognition justice, also contributes to more sustainable and equitable well-being in transitions. Participatory engagement for collective environmental action offers immediate benefits for participants, such as building and exchanging skills and know-how and the sense of meaningful participation and relatedness (cf. Heath, 2006). This supports psychological well-being and relates to the experiences of competence, relatedness, and autonomy (Gough, 2017; Ryan and Deci, 2022), which are nurtured by collaborative action. The collective deliberation about the common good and the good life is also important to support the autonomy-aspect of social minimums. Autonomy is currently eroded by adaptive preferences: deprived people downgrade their expectations while the wealthiest get habituated to a high standard of living, which erodes their capacity to rethink and revise their conceptions of the good life and affects the demands that marginalized people set on political systems (Zwarthoed, 2023). Thus, procedural and recognition justice foster transitions' justness also by increasing the self-determination related (immaterial) aspects of human well-being. The point in making transitions procedurally just and recognitive is, thus, also to help communities develop their self-determination, self-understanding, and thereby pave the way to deeper transformations (cf. Routledge et al., 2018).

Determining minimum thresholds for procedural justice is not feasible even if philosophically backed procedural justice principles help to see relevant contents. Concrete thresholds for sufficiently hearing opportunities, for example, depend on socio-historically unique institutional settings that vary greatly across political systems. Here we also need to recognize inadequately addressed historical injustices that may discourage members of marginalized communities from voicing their interests and contributing to decision-making forums. Moreover, as climate change and biodiversity are such urgent matters, accepting some procedural unfairness might be necessary to avoid the catastrophic consequences of further delaying action (cf. Stemplowska, 2016). Thus, procedural justice comprises the realm of experimenting and learning by doing within ecological and social boundaries. Learning might later enable specifying the minimum conditions for just procedures.

5. Implications of the just transition boundaries

According to just transition boundaries (Fig. 1), just transition requires transition processes that effectively bring communities within climate change and biodiversity related planetary boundaries. Alongside that, other policy and community measures are needed that protect people from falling or getting stuck below social minimums due to transitions or aggravate intersectional injustices against these groups. Boundaries propose the minimum conditions for any meaningful interpretation of just transition. The boundaries imply a normative stance that, in the unavoidable trade-offs in the course of transitions (Newell et al., 2022), priority must be given to ensuring that boundary conditions are not compromised. Beyond those, boundaries leave room for community-specific interpretations about contents of justice and means for realizing just transitions. However, the boundary framework suggests that such pathways cannot reside outside the boundaries. Thus, the boundaries approach benefits just transition planning and implementation by helping evaluate the justifiability of statements made for just transition. Justifiability requires that visions, pathways, and policy proposals are in line with both boundaries even if they do not need to address all aspects explicitly.[7] This promotes 'net justice', overall justice across space (Barnes, 2022), while also ensuring that nobody loses enormously in absolute terms.[8]

Boundaries call attention also to the global impacts of transition pathways and visions, such as impacts of the transition on the communities' control over their natural resources and international relocation of livelihood opportunities (e.g., Banerjee and Schuitema 2022; Swilling 2020). Economies dependent on exporting those goods whose markets will greatly change with transitions, such as fossil fuels or rare metals for fossil-free technologies, are particularly vulnerable. Because harms may stem from trade or governmental relations with any trade partner, single nation-states can protect distant people(s) only by collaboration: strengthening global institutional coordination to address distant transition impacts. For example, UNFCCC-based processes can contribute to alleviating geographically unequal transitions by knowledge and good practice exchange (Jenkins et al., 2020) and by economic redistribution upon agreement (as in the case of adaptation funds), while nation- and federation-level policies for redistribution, capacity building, and social provision can secure minimums at household levels. A cosmopolitan perspective on boundaries encourages seeking measures that simultaneously support people in disadvantaged communities to meet social minimums, such as encouraging innovation incentive systems that help them adapt to climate change (Timmermann, 2020 for agricultural innovations; Dollinger and Jose, 2018 for agroforestry).

Past inequalities and path dependencies affect the requirements for just transitions required in various contexts and timelines for just phase-outs (Pueyo and Leining, 2023). For example, coal phase-out may hamper or undermine the opportunity for people to plan and improve their lives unless additional measures support creating new regional livelihoods and provide material and mental support. The stricter the schedule to advance transitions, the more support social minimums require: the possibility of individuals to seek and plan new livelihoods is greater if they have more time. On the other hand, giving too much time would compromise the effectiveness demands set by the ecological ceiling. Thus, justice considerations can justify slowing down phase-out processes only within the limits allowed by the ecological ceiling. Addressing the inherent transition tension (Ciplet and Harrison, 2019) with the boundaries approach implies that the actual impact of tighter phase-out timelines on the meeting of social minimums must be evaluated case by case rather than applying long phase-out periods anywhere in the name of equality. Those whose social minimums are not risked may be required to take more rapid action so that protecting the rights of the disadvantaged does not compromise effective transition. Boundaries suggest certain clear criteria for identifying 'the greatest losers' in the transition to help navigate the tensions between urgency and justice (Newell et al., 2022).

5.1. *An illustrative example: carbon pricing*

Next, we will exemplify the implications of boundaries by discussing carbon taxation that is considered a core instrument in climate change mitigation in the global North (Mehleb et al., 2021; Stiglitz et al., 2017). Carbon taxation basically fits in neoliberal policy frameworks where priorities are often given to soft policy measures, such as nudging and soft incentives (e.g., Huttunen et al., 2024; Harrison, 2014), aligning with ideas that justice must protect the choice-freedoms of all citizens (Fischer et al., 2023). From the ecological boundary perspective, the first question is whether pricing policies are effective. As the main solution, the effectiveness of pricing policies is questionable even for emission reductions alone, implying that suggestions where the whole decarbonization process

[7] Much of just transition research has focused on decarbonization, not biodiversity. Such research might still be in line with boundaries unless it suggests transition pathways that would undermine effective biodiversity protection alongside decarbonization.

[8] In relative terms, wealthy actors might lose very much along the just transition trajectories. If they have also gained unjustly achieved benefits previously, these losses may not be unjust according to many views of justice.

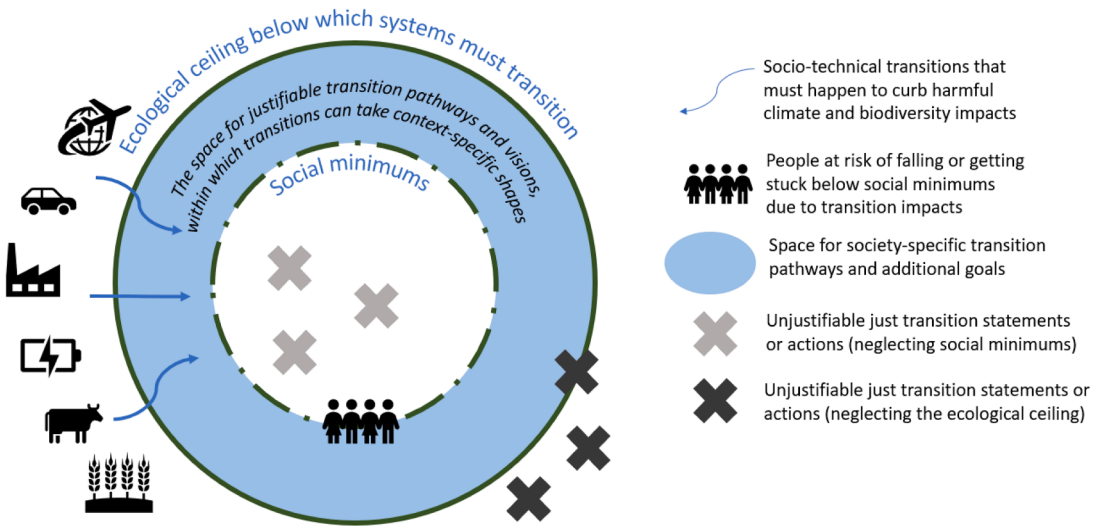

Fig. 1. A visualization of just transition boundaries. Delayed climate or biodiversity action would narrow the space left for pluralism and negotiability in transitions.

would rely on carbon pricing does not meet the boundary criteria. Moreover, since some GHGE mitigation actions are known to worsen biodiversity loss, carbon pricing always needs coupling with biodiversity-concerned environmental measures. Thus, proponents of carbon pricing have the burden of proof to show how their overall vision actually ensures transitioning below the ecological ceiling in terms of emissions and biodiversity impacts.

For the social boundary, carbon pricing has invoked justice concerns for its impacts on lower-income people in terms of energy, mobility, housing, and food (Gough, 2017; Boyce, 2021; Kelly et al., 2020; Feenstra et al., 2021)[9] manifesting in protests, like the yellow-vest movement in France (Mehleb et al., 2021). Concerns link partly to accumulated disadvantages, hampering access to basic goods, but also to policy impacts on the purchasing power of common people (Mehleb et al., 2021). To successfully restrict overconsumption within the middle-income majority, pricing policies would need to make a big difference, implying heavier burdens on lower-income households. From the boundary perspective, this is not a final argument against carbon pricing but depends on other societal measures: social policies can compensate the negative impact on the disadvantaged. Possible measures include subsidies, universal basic income, or the improvement of public services that contribute to meeting social minimums without market-based solutions. However, it is a challenging and profound question whether societies could succeed in combining ecologically effective carbon pricing with socially equally effective social policy to protect the disadvantaged groups in terms of social minimums.

Another implication is quite profound. Justice, when thought to include equal opportunities (for well-being or for anything), begs the question whether market mechanisms promote just climate policies since they imply measures where money substantially determines individuals' freedom. The equal opportunity to exercise one's own conception of a good life, central to liberal political traditions, assumes both negative freedom from coercion and positive freedoms to select and do various things (e.g., Nussbaum, 2011). Market-based solutions end up restricting both positive freedoms and the sustainability agency of the lowest-income people.[10] Sustainability agency is restricted due to the price premium of more sustainable choices, especially within product categories (e.g., meat or private cars), at least in the Global North. Simultaneously, markets have expanded positive freedoms so that most middle- and high-income citizens could lead lives with excessive carbon footprints, even with relatively heavy carbon pricing. Social boundaries require ensuring that freedoms to satisfy basic needs and plan one's life can be enjoyed by all but do not require freedoms to satisfy basic needs via *any* means that markets can come up with. Hence, just transition calls for deliberation about the limits of market-based policy instruments vis-à-vis justice. The realpolitik challenge is to conduct such deliberations in ways that do not overplay the voice of the wealthiest groups whose conceptions of the good life may have been narrowed by getting used to wealthy standards of living (Zwarthoed 2023). Nevertheless, letting the voice of the wealthier groups dominate deliberation would be procedurally and recognition-wise unjust.

Protecting extensive positive freedoms is unjust if it permits the better-off to exercise additional freedoms at the cost of others' possibility to meet social minimums now or in the future (Robeyns 2017; Pinto 2019). For example, meat-rich diets are compatible with transition only if enjoyed by a small minority (e.g., Eisen and Brown, 2022). While curtailing positive freedoms implies harm to affected individuals, such harm rarely puts people at risk of falling below social minimums; in contrast, *not* curtailing freedoms would

[9] GHG emissions from consuming basic goods are so high that middle- and low-income households comprise a greater share of overall GHG emissions than of overall income in several continents (for Europe, Sommer & Kratena 2017).

[10] Social subsidies reflect the minimum price for satisfying basic needs via markets, 'forcing' people to rely on the cheapest choices that are often less sustainable.

risk the social minimums of people in vulnerable communities sooner or later (cf. Pinto, 2019). The question of having to limit extreme wealth is, thus, unavoidable because conditions permitting extreme wealth accumulation are hardly compatible with justice when there are still unmet urgent needs and urgent collective-action problems in a world of limited ecological resources (Robeyns 2017).

Just transition boundaries imply that upholding harmful positive freedoms correlated with income is incompatible with just transition. Via public deliberations, communities can decide which positive freedoms to curtail and which to protect while ensuring effective transition, depending on community-specific valuations and priorities. This depends on the community-specific values and circumstances. Already realized examples include the short-haul flight ban in France, car-free city zones, and the banning of the sales of fossil-fuel cars in the EU by 2035. Procedural justice requires listening to the diversity of voices, even those who oppose curtailing their unsustainably achieved privileges. Dialogues, where people reflect upon their freedoms and life opportunities relative to others, hopefully promotes sensitivity to the needs of others and acceptance of freedom-curtailing policies. Resistance to carbon pricing can be in line with boundaries if actors propose or are willing to accept alternative policies for effective transition: reasons for resistance to carbon pricing can be diverse (Mehleb et al., 2021). However, when resistance is based on the argument that just environmental policies should not lower the living standards of the middle class in high- and middle-income societies, it is not justifiable from the boundaries perspective since there is no way to make societies get below the ecological ceiling while retaining the current middle-class living standards (Table 1).

6. Discussion: what matters in just transition?

The boundary approach has several implications for just transition thinking in policy and research. It brings in pluralism yet provides a critical framework to avoid diluting just transition to relativism that might mainly serve the interests of the loudest participants in societal arenas (with, for example, economic power and financial interests at stake). Relativism is akin to what Wilgosh et al. (2022) call the affirmative approach to just energy transition, which they see as defensive of privileges, tending to reinforce or reproduce colonial relationships, and suggesting neoliberal approaches to distributive equity (Wilgosh et al., 2022, 7–8). The privileged, dominant voices may be amplified especially in the public sphere but also in certain types of empirical interviews and surveys. Those who are 'on the roof terrace', far above social minimums, are more capable of active engagement in various interviews, workshops, surveys, and so on. Consequently, their voice might get overplayed in public discussions at the cost of downplaying attention to those who are below social minimums or prone to fall below. Just transition boundaries provide critical justifiability assessment for claims characteristic of the affirmative (non-transformative) approach. For example, neoliberal solutions face the burden of proof to show that they would effectively promote the transition instead of mainly buying freedom for wealthy actors. Also, the classic question "who will win and who will lose in the transition?" appears in a new light. Meeting social minimums while curbing environmental harms means that just transitions will pose much greater demands on privileged lifestyles and 'progressively' curtail unsustainable positive freedoms. Notably, many freedom-related tensions only arise because a consumption ceiling has never been set, as the literature on limitarianism suggests. Discussing them is inescapable and may even lead to a wealth ceiling.[11] This way, the boundaries also seek to improve balancing between two important perspectives on justice: those focused on public perceptions and those on material and economic realities.

Boundaries can help critically assess and refocus or reframe policy planning, deliberative processes and research. On the environmental side, the difference from conventional just transition theorizing is the demand to incorporate biodiversity into just transition, since the fundamental purpose of just transition is to protect the critically necessary planetary conditions for safe human existence and well-being. We propose that when the focus is solely on decarbonization, this could be made explicit with speaking of 'just low-carbon transition' specifically. Regarding social matters, boundaries make explicit the point by Ingrid Robeyns that, in the world of unmet urgent needs and urgent collective-action problems (like climate change), 'certain needs will have a higher moral urgency' (Robeyns 2017, 12). Just transition boundaries point out the needs with arguably a higher moral urgency, such as energy access (Newell and Mulvaney 2013) and food security (Kaljonen et al., 2021), that need to be met to make the pursuing of other goals meaningful. Urgency highlights the injustice of hindering or delaying transitioning, which would narrow the space of negotiable solutions and the realization of procedural and recognition justice. This is a critical point for public discussion and policymaking. For research, boundaries call for strengthening the reflection about the non-negotiable elements of justice and bringing more attention back to material realities. For example, modelling studies on socio-economic policy impacts benefit from discussing how their results relate to social minimums or whether they address other distributive impacts. In the latter case, relevance to just transition depends on the context: justice likely requires the 'disproportionate' distribution of economic burdens from climate action (Caney, 2012) and the widening of opportunities for disadvantaged groups requires curtailing the excessive opportunities that those at the top of society currently have (Robeyns 2017, 33–34). The agency-emphasizing aspect of social minimums demands participatory processes for workplace- and industry-specific transitions, supporting earlier findings (e.g., Banerjee and Schuitema 2022) yet suggesting the minimum definition for just transition to start with, and to help affected parties align their expectations for just transition.

Moreover, reflecting the interpretation of stakeholder and citizen perceptions vis-à-vis transition boundaries can be useful. Better-resourced groups are often overrepresented because people below social minimums lack resources to voice their issues or to participate in anything beyond daily survival tasks. Majority perceptions often reflect dominant values and can be mis-recognitive or otherwise oppressive (e.g., D'Ignazio and Klein, 2020): consider times when the oppression of women or of black people were considered as

[11] Political philosopher Ingrid Robeyns (2017) argues that just states are obliged to limit extreme wealth and power of individuals because this would ease meeting the unmet needs of the poor. Extreme wealth limits could also concern corporations.

Table 1
Implications of the just transition boundaries for carbon pricing.

	Ecological ceiling	Social minimums
Requires	Just transition visions and policy combinations to effectively promote decarbonization and biodiversity conservation in the given timeframe	Accompanying environmental policies with social policy measures that ensure social minimums to low-income people; Paying more attention to the impacts of global North transitions on global South communities; Prioritizing social minimums related questions in restorative (compensatory) justice
Prohibits or disqualifies	Decarbonization pathways that are harmful to biodiversity; Biodiversity conservation with measures that undermine effective decarbonization Ideas that any perceived injustice is a justifiable reason to reject an environmental policy as unjust; Postponing transition actions due to disagreement about social issues unrelated to minimums	Just transition visions where justice is framed primarily as a matter of positive freedoms; Maintaining the achieved above-minimum social benefits if that hampers distant or future people from getting above minimums; Focusing justice discussion on the price of consumption at levels far above the social minimums
Encourages creating spaces for	Deliberating the relative role of different types of environmental policies that together suffice to meet environmental goals; Shifting from co-productive rigidity to co-productive agility to harness tensions enabling sustainability transformations	Deliberation about the socio-cultural desirability of different policy measures and different future visions; Capacity-building that empowers vulnerable groups; Discussion about the common good and its role in just transitions

justifiable by the majority. Habituation to a privileged position[12] may also distort ideas about the standards of living and positive freedoms that transitions can sustain. Just transition boundaries call researchers to assess how the perceptions are in line with the minimum conditions of just transition, expressed by the boundaries, whether we researchers keep the foundational minimums of just transition in sight, and how to distinguish views that represent plurality and fitting within boundaries from visions or proposals that either risk effective transition or neglect the prioritization of social minimums over other social concerns. Research has shown how just transition framings may embrace concerns far above social minimums at the cost of environmental ambition (e.g., Huttunen et al., 2024). Thus, an important topic for future studies is whether and how the boundary-crossing nature of some just transition visions and framings would best be addressed in times when the transition is a necessity for protecting the most vital and foundational interests for justice and future generations' well-being.

For policy studies, the boundary approach signals the importance of holistic assessments, resonating similar calls for whole-systems approaches (cf. Abram et al., 2022; Sovacool et al., 2019) and for sufficiently global and long-wave perspectives (cf. Swilling 2020). The effectiveness of policies is often a result of policy mixes with both constructive and disruptive elements (Kivimaa et al., 2021). The boundaries perspective adds an argument in favour of regime-disruptive policies: tending to shift power from incumbents to other actors (e.g., Johnstone et al., 2020), disruptions build conditions for meeting the social minimums in participatory terms. Similarly, justice is influenced by the overall combination of environmental and non-environmental policies that also vary in different societal conditions. The same policy instrument might be just or unjust depending, for example, on the capacity building measures that influence the ability of people and local communities to engage in and benefit from the transition and be recognized as potential contributors to promoting transition (Kortetmäki and Järvelä, 2021; Timmermann and Noboa, 2022). A more challenging aspect of holism concerns global considerations. Many transition injustices are deep-rooted in longer globally unequal relations of exchange and exploitation (Swilling 2020) which socio-technical transitions may easily aggravate by further exploitation that is framed to serve environmental goals (e.g., Zografos and Robbins 2020). The weight of inherited injustices in global South countries, keeping large groups of people stuck below social minimums, call for critically reflecting upon the global North perceptions of injustices that concern giving away a portion of achieved privilege (cf. Olson-Hazboun 2018; Fischer et al., 2023).

We acknowledge that as the doughnut is grounded in human rights, the just transition boundaries perspective has an individualistic, even if relational, orientation to justice. Current just transition research needs conceptual clarification about communities as subjects of injustice (cf. Schlosberg 2007). Another question left to future research concerns is how sentient nonhumans as recipients of justice are included in social minimum considerations (Tribaldos and Kortetmäki, 2022). The ecological ceiling generally covers ecological integrity and ecosystem health, not individuals' status. We tentatively propose that contents and thresholds for sentients' social minimums are not generally very distinct from those of humans, except for the aspects of relatedness and societal participation (cf. Nussbaum, 2011). Yet, the demands for nonhuman social minimums and their species-specific variations need detailed examination that lies outside the scope of this paper.

7. Conclusion

Just transition has been an increasingly adopted idea in public arenas and policy discourse, with competing interpretations and visions. Conceptually, just transition faces the risk of becoming an ambiguous action-delaying notion or getting co-opted by the powerful parties who get their concerns overplayed at the cost of vulnerable groups and communities. To contribute to critical just transition research theorising and identifying such risks and to counter them, the just transition boundaries framework determines

[12] We authors acknowledge ourselves as privileged too.

non-negotiable minimum conditions for societal processes or various visions and strategies to count as just transition or as promoting it. Boundary-setting is guided by the foundational purpose of sustainability transitions: avoiding irreversible harms that undermine prospects for human well-being.

The boundaries highlight that while achieving perfect justice is impossible, attaining minimum justice is feasible and indeed required. According to the minimum meaning of just transition boundaries, just transition requires curtailing anthropogenic climate change and biodiversity loss impacts effectively below their planetary boundary thresholds and accompanying this process with measures that protect people from falling below social minimums or lifting them into them during the process. The social minimum is set higher than at survival: the social minimum should enable people to exercise their autonomy, plan life forward, and engage in community activities and decision-making. Therefore, just transition needs to be conductive to distributive, procedural, and recognition justice. Justice to sentient nonhumans could be approached with the boundaries approach too, but concretising this will require further elaboration. Community-specific conditions for realizing just transition are up to fair deliberation that simultaneously supports immaterial aspects of well-being (including biocultural values), builds capacities for deeper transformations over time, and recognizes the self-determination of people(s). Other ideas can, and will, complement and concretize system- and community-specific just transitions yet should not contradict just transition boundaries. Partial political settlements and acceptable compromises are the likely way forward in the conditions of contestation and disagreement about sustainability transformations. Just transition boundaries provide an evaluative framework for checking that such settlements take societies in the direction of just transitions and may also help in finding the sufficiently shared ground for partial settlements (although this remains a topic for future research).

For research, just transition boundaries can help formulating research questions and priorities. Boundaries support reflexive research by helping to critically assess whether the presented stakeholder perceptions or policy strategies are in line with the minimum requirements for just transition or at risk of falling to either non-transition or transitions that fail to meet the minimum conditions of justice. Boundaries also imply the importance of holistic policy assessments. For policy planning and implementation, just transition boundaries help make sense of statements proposed in the name of just transition and contextualize perceived injustices. Critical evaluation requires disclosing the underlying assumptions or visions of transitions (or non-transitions) as well as highlighted and downplayed aspects of justice.

Failing to establish effective sustainability transitions will cause the greatest irreversible harm and injustice over time. Thus, if human communities adhere to any conception of justice, this involves moral obligation to cooperate for realizing sustainability transitions. The point of just transition is not to become a new synonym for social justice but to seek ways and coalitions for the needed cooperation for securing the continuity of human civilization while ensuring minimum irreversible harm from transitions. Transdisciplinary research and public deliberation play a role in creating the conditions for just transition, and just transition research is responsible for keeping the fundamental point and meaning of just transition in sight.

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Declaration of competing interest

The authors have no competing interests to declare.

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Data availability

No data was used for the research described in the article.

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