



## Risks, Ethics and Justice in the governance of positive tipping points

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20 **Abstract.** Biophysical tipping points pose existential threats to current and future generations, both human and non-human, with those currently underserved being the most vulnerable. Social tipping points, as deliberate interventions into systems with the expectation of non-linear impacts and widespread change, have the potential to address some of these challenges. However, the imperative to act cannot increase risks nor perpetuate unjust or inequitable outcomes through the creation of sacrifice zones. In this paper we argue that considerations of what needs to change, who is being asked to change and where the change or its  
25 impacts will be felt and by whom, are fundamental questions that require a level of reflexivity and systemic understanding in decision-making. All actors have a role to play in ensuring that justice, equity and ethics are incorporated in each and every intervention. Enabling social tipping points towards radical transformations could benefit from more diverse perspectives to open up the solution space, with a particular emphasis on the inclusion of marginalised voices. We conclude that taking a cautious step back to explore all options, not just those that seem to offer a quick fix could offer a more substantial route into  
30 thinking through tipping points and create a more equitable as well as sustainable future.



## 1. Introduction

The world is facing a series of era-defining, environmental and social challenges, including climate change, biodiversity loss, increased inequality and poverty. In response to these critical challenges, there have been calls for ‘transformative change.’  
35 Undertaking such transformation, orienting complex systems onto more sustainable and socially just trajectories is messy and complicated (Pereira et al., 2020). As history shows, there are dark sides of transformations with potential unintended consequences, distributional impacts, and the potential for vested interests to co-opt or reap the benefits of such processes (Blythe et al., 2018). It is therefore necessary to be cautious when approaching this idea of social tipping points and to be very  
40 clear what transformations are intended, whom they will benefit and whom they will harm.

Any moment of societal change will inevitably generate winners and losers, and this should also be taken into account in the identification and operationalisation of positive social tipping points where change is both rapid and radical. Indeed, in this context, the language of ‘positive tipping points’ needs to be exercised with caution since the very definition of a social tipping point, defining a point of intervention towards an ‘idealised’ future, is likely to be experienced by many as a polarising event  
45 and can have differential welfare impacts on different subsets of the population (Ehret et al., 2022). An approach to governance that centres principles of equity and justice will therefore recognise that tipping points, whether conceived primarily as positive or negative, will leave sections of the population behind without the engagement of complementary redistribution mechanisms that can help mitigate against the worst impacts of change. When identifying or operationalising a tipping point, we argue it is necessary to ask: What kind of trade-offs are necessary and what sacrifice zones are being created? Who ends up occupying  
50 these sacrifice zones? What forms of vulnerability are exposed by change? Who is left behind? How and in what ways can a comprehensive understanding of differential justice dimensions be included in a rigorous way when examining ‘social tipping points’. Here, we understand sacrifice zones as extractive zones created by the advancement of coordinated forms of capitalism that see those territories and the communities inhabiting them as commodifiable (Gómez-Barris, 2017).

### 55 1.1. Climate Justice in Light of Tipping Points

Recent UNFCCC climate summits have seen an increasing number of calls from climate justice campaigners and representatives of the Global South, including small island developing states, for an acknowledgement of history in the international response to climate change, currently articulated in calls for ‘loss and damage’ and elsewhere for reparations  
60 (Huq et al., 2013; Constantino et al., 2023). These calls are supported by the work of climate historians, decolonial critics and authors who assert that we cannot hope to agree on climate action if we do not address the discourses and systems of capitalism, globalization and colonialism that have created the current crisis and still shape intergovernmental responses to it (Bhambra and Newell, 2022; Ghosh, 2022; Yusoff, 2018; Sultana, 2022). The future-focus of much scientific, political and popular contemporary discourse around climate change can create a disconnect with the past, occluding the fact that climate change



65 and its associated crises ‘are deeply rooted in history’ (Ghosh 2022, 158). In this context, there is a danger that the language  
of tipping points – small perturbations that trigger large, irreversible responses (Lenton, 2011) – could reinforce a discourse  
that abstracts climate change from past inequities. The notion of tipping points that are rooted in a biophysical framing, which  
assumes some ‘threshold’ and ‘set of shocks’ that tips a system over, ignores the grinding every-day realities of life that many  
of the poor and most vulnerable endure as an interconnected set of social, economic and environmental crises. These  
70 vulnerabilities will only be compounded with the increased risks given climate change and other changing biophysical  
pressures (O’Brien and Leichenko, 2000). Moreover, a focus on preventing tipping points can distract attention from the deep  
structural imbalances of capital and power that drive precarity and lead to increased vulnerability to the impacts of tipping  
events in poorer nations.

75 Additionally, the urgency that accompanies the notion of tipping points can overshadow the slow process of rebuilding trust  
and relationships that have been broken through past harms, referred to by Kyle Whyte as “relational tipping points” (Whyte,  
2020). For many Indigenous peoples and local communities who have faced the existential crisis of colonialism and who are  
now at the forefront of the climate crisis (Gilio-Whitaker, 2019), relational tipping points may have already been breached  
(Whyte, 2021, 2020). The process of rebuilding consent, trust, accountability, and reciprocity—qualities of relationships  
80 necessary to avoid further injustices—require time and commitment (Whyte, 2020). Attempts to avoid tipping points through  
geoengineering, for example, could merely pass on costs and irreversible effects onto future generations, while contemporary  
drives to reach technological tipping points, such as the push towards electric vehicles, can produce new vulnerabilities for  
communities with homes rich in rare earth minerals. Hence without due care, attempts to address tipping points can entrench  
spatial and temporal injustices.

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In this paper we discuss considerations of ethics, equity and justice in relation to the complex interconnection of biophysical  
and social, ‘positive’ and ‘negative’ tipping points. The destabilizing of critical Earth systems is already contributing to adverse  
effects on human well-being and global ecosystems on which it depends, and will continue to worsen (Rockstrom et al., 2009).  
Crossing physical and social tipping points will exacerbate current injustices and inequities as access to water, food, energy  
90 and infrastructure will be uneven, strained, and increasingly politicised (Rammelt et al., 2023), leading to greater potential  
harms on future generations by triggering potentially irreversible processes.

## 1.2. Discourse matters

95 Within the framework of tipping points, it is crucial to remember that all human and more than human ‘actors’ are, in Donna  
Haraway’s words, ‘situated.. in complicated histories’ (Haraway, 2016), which inform complex and plural visions for the  
future. The IPCC AR6 report urges immediate action and deep emissions reductions in this decade whilst also calling for  
climate resilient development that prioritises risk reduction, equity and justice (IPCC, 2023). In seeking to build a majority of



100 people in favour of stronger, faster action, it is vital that values-inclusive forms of discourse are identified to ‘create a sense of collective responsibility and action’ (Wiedmann et al., 2020), pg 7 and which avoid alienating the actors needed to form this coalition. Even processes to decolonise understandings of time, including seeing it as linear, must be fostered so that we do not exacerbate problems as we act with urgency to find near-term solutions to the climate emergency like large-scale renewable energy infrastructures that can sometimes infringe on human and nature’s rights (Whyte, 2021).

105 At the same time, the extreme difficulty and tradeoffs inherent in achieving a safe and just operating space for life on earth need to be understood. A discourse that reconciles the need to meet the internationally agreed +1.5°C rise in average global atmospheric temperature, alongside the need to address over-consumption and inequalities within and between societies, can no longer rely on the dominant narratives of efficiency gains and gradual decoupling (Hickel and Kallis, 2019; Wiedmann et al., 2020; Steinberger et al., 2020; Constantino and Weber, 2021; Lamb et al., 2020). A growing understanding of tipping  
110 points in the Anthropocene ‘cancels the peaceful and reassuring project of sustainable development’ (Bonneuil and Fressoz, 2016) 29. We have entered what Bruno Latour calls ‘the new climatic regime’ (Latour, 2018) in which the geophysical framework that we have always taken for granted, the ground on which our history, politics and economics have played out, has become destabilized. An ethical community of nations that respects the Earth’s biophysical limits and minimum social foundations for human flourishing must recognise that the only viable solutions are ones that prioritise strong sustainability  
115 and sufficiency for all (Newell, 2021; Haberl et al., 2020; Trebeck and Williams, 2019) informed, for example, by the principles of ‘doughnut economics’ (Raworth, 2017) and notions of safe and just boundaries (Gupta et al, submitted). This places differential responsibilities on different groups of people as we seek to navigate towards more just, equitable and sustainable futures.

### 120 1.3. What do we mean by equity and justice?

When considering climate justice, it is often useful to be precise about which area or domain is investigated - this could be climate impacts, or mitigation efforts, adaptation or decent living standards. There are dilemmas and trade-offs across attempts to address recognition, procedural, distributional, reparative, and inter- and intragenerational aspects of justice  
125 simultaneously. Also, clarity on the scope, both in terms of space and time, is important. Yet another challenge in the justice discourse lies in the many different terms and concepts used interchangeably across disciplines, cultures and individuals, providing a risk for misunderstandings and also misinterpretation of research findings (Newell et al., 2021). As we go about shaping just transitions it is important to find a common ground (Stavis and Felli, 2020; Zimm et al., under review).

130 Gupta et al. (2023) propose an integrated “Earth system justice” framework to approach these questions and understand how to reduce risks from crossing tipping points while ensuring well-being for all and an equitable distribution of nature’s benefits, risks and related responsibilities. Earth system justice is conceptualized through multiple approaches and understandings of



justice including, but not limited to, intragenerational, intergenerational justice and interspecies justice. Intragenerational justice refers to the relationships between humans right now and includes justice between states and among people across scales. 'Intergenerational' justice examines relationships across generations, such as the legacy of greenhouse gas emissions or ecosystem destruction by current and past generations on youth and future people, and assumes that natural resources and environmental quality should be shared across generations (Tremmel, 2009). In this context, interspecies justice refers more generally to considering the rights of nature and other species to coexist on the planet. It draws on a rights of nature discourse (Harden-Davies et al., 2020) that also counters the idea of human exceptionalism as a lens for thinking through development impacts (Srinivasan and Kasturirangan, 2016). Drawing on these frameworks can help us to assess the uneven impacts of nearing earth system tipping points, but also the differential responsibility for efforts to avoid tipping points and the distributional and procedural aspects of social tipping dynamics.

Within the domains mentioned above, one can discriminate between different forms (or dimensions) of justice, i.e., distributive justice (or equity across different populations), procedural justice (how decision or research processes are designed, who is involved), or reparative justice (e.g. recognition of wrongs, restoration where possible, and compensation for negative impacts and past injustices) (Byskov and Hyams, 2022). Such justice approaches also include recognition and epistemic justice, which consider the value of multiple knowledge systems, especially local, Indigenous, and unrecognised, misrecognized or marginalized groups (de Sousa Santos, 2008). Finally, 'intersectional' justice that includes multiple and overlapping social identities and categories underpinning inequality, underrepresentation, marginalization, and the capacity to respond (ie: gender, race, age, class, health) must be considered in the context of earth system justice (Gupta et al., 2023). These different forms of justice are not mutually exclusive: procedural justice may be used to arrive at restoration or compensatory payments, which can be assessed through the lens of distributive justice.

Changes related to earth and social system tipping can be analysed from all these justice considerations, and ideally this helps to design forward looking actions that avoid negative impacts. Especially in cross-disciplinary discussions and exchanges between different actors, having shared understanding of the nuance and need for contextual framing of challenges will enable and speed up implementation. It is key to highlight that what is perceived as fair out of all these possible combinations from the above-mentioned conceptual elements, is subjective and highly context specific and may change over time (Caney, 2012). In the context of addressing negative biophysical tipping points by attempting to enable positive social tipping, an Earth system justice approach is critical to ensure past injustices are not perpetuated in the name of staying within planetary boundaries.

## 2. Blind Spots of intervention

Whether in their eagerness to accelerate technological fixes, or in their desire to maintain unanimity, momentum and political will, climate treaty negotiators have sometimes been tempted to ignore or dismiss normative dimensions of climate policy and



170 the possibility of unintended social consequences (Klinsky et al, 2017). However, all actors in the process – from scientists to world leaders – need to be careful to avoid today’s solutions becoming tomorrow’s harms. This is especially true when considering interventions designed to trigger exponential rates of positive social change or quick ‘fixes’ such as geo-engineering (Sovacool, 2021). An equally exponential increase in unintended negative consequences is also possible. It is thus imperative that all actors take responsibility to include a justice framing, acknowledging potential risks, when referencing positive social tipping points as solutions to the ongoing climate and other social-ecological crises.

### 175 **2.1. Risks and Unintended consequences of positive interventions for climate impact mitigation and adaptation.**

180 Positive interventions for climate impact mitigation and adaptation can also have unintended consequences, broadly addressed as maladaptation. “Aside from wasting time and money, maladaptation is a process through which people become even more vulnerable to climate change,” writes (Schipper, 2020: 409). A good example of risks associated with the quest for positive tipping points for climate impact mitigation is the transformation to a renewable energy economy that is driving the growing demand for batteries, solar panels, and other digital devices, all of which require mining of lithium, cobalt and other rare earth minerals (Dutta et al., 2016). While this creates economic benefits for mining communities, it can also produce negative ecological, economic and social impacts in the near, medium and long-term (Hernandez and Newell, 2022; Manzetti and Mariasiu, 2015). A recent study finds that if today’s demand for Electric Vehicles is projected to 2050, the lithium requirements for the US market alone would triple the amount of lithium currently produced for the global market (Rionfrancos et al., 2023).  
185 However, the authors also find that lithium demand could be reduced by 92% in 2050 relative to the most lithium-intensive scenarios by decreasing car dependency (e.g. through increasing public transit or biking), limiting the size of EV batteries, and creating a robust recycling system (Rionfrancos et al., 2023). Within this context, the industrial mining sector has been accused of supporting state violence and corruption, polluting ecosystems, and failing to relieve poverty, while the informal mining sector is known for ignoring occupational safety and health standards and human rights concerns (Sovacool, 2019).

190 Other prominent examples of unintended consequences have been documented for: a) large-scale renewable and bioenergy projects, resulting in significant local opposition (Cavicchi, 2018; (Torres Contreras, 2022); b) the displacement of Indigenous peoples, local communities (Zurba and Bullock, 2020) and coastal fishers (Beckensteiner et al., 2023); c) deforestation (Kraxner et al., 2013); d) biodiversity losses (Pedroli et al., 2013); e) competition for land and water resources (Haberl, 2015; Tarhule, 2017); f) food insecurity (Hasegawa et al., 2018); and g) for decarbonisation of the built environment, particularly the housing stock, resulting in health impacts from poor indoor air quality, and fuel poverty (Davies and Oreszczyn, 2012).

200 An example of climate policy leading to unintended outcomes with social justice implications relates to the phenomenon of ‘carbon leakage’ (Carbon leakage, 2023; Grubb et al., 2022). Although often difficult to measure and distinguish from the more general offshoring of emissions due to globalisation of trade and deindustrialisation in richer countries (though noting



their increasing use of energy and materials), carbon leakage due to climate policy is an example of a negative spill-over effect. Unilateral climate policies such as carbon pricing and emissions trading schemes (ETSs), designed to encourage domestic carbon-intensive sectors to invest in carbon-neutral production, may raise costs and contribute to the decision to relocate to a region enjoying equal access to the same markets but which has fewer, less stringent policies/regulations. The inclusion of some industries (e.g. developed nations with distant water fishing fleets) in the ETs scheme may imply that, in order to avoid negative externalities, they end up exporting fishing capacity to the global South (Prellezo and Villasante, 2023). Jobs, industries and entire communities may be lost from the stricter jurisdiction while global emissions remain unchanged (at best). Further intervention in the form of carbon border adjustment mechanisms (CBAMs), carbon content labelling/mandates and other measures may then be introduced to adjust for these climate policy asymmetries.

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Relatedly, significant policy research is being devoted to the concept of a ‘just transition’ (Wang and Lo, 2021; Newell and Mulvaney, 2013), which originated from labour market impacts of decarbonization strategies in coal-intensive regions the Global North (Abraham, 2017). Unless sufficient government investment, regional regeneration, support and retraining are provided to those workers and communities most at risk in the transition away from fossil fuels, severe economic, social and cultural hardships may predictably (though unintentionally) follow. Furthermore, trust in government will fall even lower, and counter-narratives on grounds of fairness/justice voiced by actors for climate policy delay will be strengthened (Patterson et al., 2018; Lamb et al., 2020) potentially further undermining efforts to strengthen governance and make it more inclusive. More generally, fiscal policy needs to be designed to subsidise lower-income households for the higher costs that may accompany climate policies such as carbon pricing, emissions trading, new mandates/standards for energy-efficient buildings, smart energy systems, and the electrification of transport. Failure to do so could set off a cascade of unintended consequences and increase poverty, inequality, hunger and other health impacts, popular protest and political instability (Newell et al., 2021; Davies and Oreszczyn, 2012).

In the Global South, the transition to net-zero carbon emissions faces multiple challenges, such as addressing poverty, multidimensional vulnerabilities, and ensuring decent living standards for all. These countries are confronted with a shrinking carbon budget, growing inequalities, heightened climate-related risks, and limited capabilities for mitigation and adaptation due to increasing debt burdens (Steele and Patel, 2020). The debate on historic responsibilities, development rights, and net-zero efforts is gaining renewed attention (Mishra, 2021). From the perspective of the Global South, achieving just transitions requires addressing the double inequality of the climate crisis where developing countries bear a disproportionate share of the risks associated with emissions, while industrialized nations are primarily responsible for historical emissions (Gardiner, 2004). Therefore, developing countries are demanding fair procedures for distributing the costs and benefits of mitigation and adaptation.

Unpopular climate policies can sometimes trigger a widespread ‘backlash’ that can be defined as:



235 'An abrupt and forceful negative reaction by a significant number of actors seeking to reverse a policy, often through  
extraordinary means that transgress established procedures and norms' (Patterson, 2023: 68).

Examples of climate policy backlash include the ill-fated Australian carbon pricing scheme (Crowley, 2017), and the fuel tax  
increase that gave rise to the Gilets Jaunes or Yellow Jackets protest movement in France in 2018-2019 (Kinniburgh, 2019).  
Other well-researched forms of unintended impacts of policy measures include rebound effects and moral licensing  
240 (Chakravarty et al., 2013). The importance of rebound effects is contested, but generally refers to a behavioural response in  
which people consume more of something because of a reduction in cost due to an improvement in resource or energy  
efficiency. For example, people may choose to drive further or buy larger cars as cars become more fuel-efficient (Sorrell et  
al., 2009). More generally, these types of dynamics highlight the fact that interdependent human-nature systems are complex  
and that there is substantial uncertainty surrounding our efforts to strategically intervene in and to shift such systems by  
245 initiating 'positive' tipping points (Constantino et al., 2022).

In the field of climate communications, there are unintended consequences associated with a failure to build broad coalitions  
based on values-inclusive narratives and norms (Evans, 2017; Klein, 2015; Constantino and Weber, 2021; Rowson and Corner,  
2014; Sloterdijk, 2012; Meadowcroft, 2011). Research shows that politically progressive actors tend to believe in the  
250 inseparability of climate, (re)distributional and social justice issues as a moral imperative. Procedural justice is also key as  
small producers and/or vulnerable people are often excluded from political mechanisms which discuss and determine climate  
actions (Villasante et al., 2022). Some use the combined term 'climate justice' which includes colonial, gender and racial  
injustices and future generations (Jafry, 2018; Perkins, 2018), particularly in its more transformative form which seeks to  
address the drivers of climate injustice (Newell et al., 2021). In centering justice and combining multiple, intersecting social  
255 movements under the climate justice umbrella, many campaigners and scholars believe that the strength of their combined  
movements can be amplified (Mikulewicz et al., 2023). However, there are also concerns that strong social justice framings  
can have the unintended effect of increasing political polarisation rather than building broader coalitions (Patterson et al., 2018;  
Smith, 2022). Political progressives tend to frame climate change risk in terms of 'individualising' values of equality, care and  
fairness. Political conservatives prefer to use 'binding' values based on loyalty, authority, purity (Adger et al., 2017; Haidt,  
260 2013; Graham et al., 2009). Conservatives are not necessarily against stronger climate governance, but reject progressive  
framings that challenge their values and identities (Feinberg and Willer, 2013; Feygina et al., 2010; Kidwell et al., 2013).  
Research has also shown that some actors recognise the need for greater urgency in climate policy, but are reluctant to  
champion it due to a lack of support and to avoid being labelled as 'extremists' (Willis, 2020). As a result, some climate  
policymakers and other actors prefer to focus on the more technocratic, less politically risky aspects of transition governance  
265 (Patterson et al., 2018).





270 If decarbonisation is left to market-based mechanisms that prioritise only profitability, the speed and up-scaling of  
technological change may threaten the human rights and well-being of some people while allowing other, more powerful,  
incumbent actors and structures most likely to benefit/prevail (Newell et al., 2022). Unique opportunities to redesign entire  
systems and subsystems along more efficient, ethical, sustainable, and equitable lines may be lost where speed is allowed to  
trump inclusivity and depth of process (Leach and Scoones, 2006). For example, U.S. solar photovoltaic deployment is forecast  
to grow non-linearly in the near-term, generating around 12% of all US power by 2027 (SEIA/Wood MacKenzie, 2023). While  
this is a positive development in terms of the speed of overall decarbonisation, the perpetuation of an energy system dominated  
by profit-maximising utility companies would be viewed as a missed opportunity for advocates of energy democracy and  
275 place-based, cooperative and community-owned energy (Stone et al., 2022; Hoffman and High-Pippert, 2005).

280 Additionally, there is a risk that a growing concern regarding Earth System tipping dynamics could propel research into  
speculative interventions such as widespread carbon dioxide removal or social geoengineering or solar radiation  
modification—a set of hypothetical solutions aimed at reducing incoming sunlight and thus lowering global mean temperatures  
(National Academies of Sciences, Engineering, and Medicine, 2021). The most common solar geoengineering proposal  
involves injecting aerosols into the stratosphere to limit the influx of solar energy, but there are also more regional or local  
proposals involving different technologies. Proponents often argue for these hypothetical solutions on the grounds that we  
have made little progress on reducing carbon emissions and that solar geoengineering could be used to buy time or as a failsafe  
285 (Keith, 2013; Keith et al., 2017). However, solar geoengineering and other more speculative solutions often come with  
substantial uncertainty and risks, which are likely to vary across regions, and insufficient governance mechanisms to equitably  
and effectively manage such risks (Schneider et al., 2020; Stephens et al., 2021; Kravitz and MacMartin, 2020; McLaren,  
2018). This has led groups of scholars to call for an “international non-use agreement” and for limits on related research as  
well (Biermann et al., 2022).

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## 2.2. **Winners and losers: sacrifice zones**

The tendency of positive tipping points to benefit some while (intentionally or unintentionally) excluding others, creates  
sacrifice zones. Winners and losers from transitions are relational in a highly unequal global economy stratified by power,  
race, class and gender (Newell, 2021). Well-intentioned interventions therefore have the potential to put severe pressure on  
295 lands held by Indigenous and marginalized communities and reshape their ecologies into “green sacrifice zones” by  
reproducing a form of climate colonialism in the name of just transitions (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” (Zografos & Robbins, 2020: 543. They go on to define Green sacrifice zones as



300 “spaces or ecologies, places and populations that will be severely affected by the sourcing, transportation, installation, and operation of solutions for powering low-carbon transitions, as well as end-of-life treatment of related material waste” (Zografos & Robbins, 2020: 543).

As queer decolonial critique puts it, sacrifice zones are not random, but carefully chosen: “the colonial paradigm, worldview, and technologies [...] mark out regions of “high biodiversity” in order to reduce life to capitalist resource conversion” (Gómez-Barris, 2017: xvi). The violence that capitalism inflicts on places designated as sacrifice zones can be immediate, but it can also be slow and imperceptible. Decolonial ecocritical thinker Rob Nixon, denominates “slow violence and environmentalisms of the poor” to calamities that happen slowly in marginalized communities, over a long period of time and which are almost imperceptible (Nixon, 2013: 6). This extractive view from corporations and governments meets the resistance of “submerged perspectives”, that is, the ways in which the local humans and nonhumans that inhabit those territories perceive life as entangled, where the destruction of one parcel affects the rest of the entities and breaks the spiritual heritage in a region (Gómez-Barris, 2017). This slow violence has delayed effects and requires justice to take new forms to secure effective legal measures for prevention, restitution, and redress (Nixon, 2013: 8,9).

A theory of tipping points should incorporate these “environmentalisms of the poor” (Martinez-Alier, 2002) that aims at revealing how corporate-military-industrial sectors - as well as well-intentioned policies - disguise and disregard the toxicity and contamination that poor and disadvantaged communities of the world suffer (Bullard, 2005), but where also the “disposable people” from the Global South are raising in resistance demanding a climate justice attuned to local social-ecological realities (Gilio-Whitaker, 2019). Discussions of tipping points similarly need to be aware of the technologies of governance (race-making, even the processes for identifying 'indebted countries' or Least Developed Countries - LDCs) that enable access to and appropriation of stocks for capitalist resource conversion. For the concept of sustainability and just sustainable futures to help improve the situation of those local realities, environmental justice scholar Julie Sze argues that a “situated sustainability” is necessary (Sze, 2018). Situated sustainability should “set the parameters for why and how vulnerability (environmental or other) is disproportionately distributed, one of the key questions in environmental justice research” (Sze, 2018:13). In other words, if the questions we ask aim at transformative change or social tipping points, these cannot neglect how racial capitalism contributes to inequalities and environmental degradation (Sze, 2018; Newell, 2005).

### 325 **2.3. Reinforcing current power dynamics and structures**

While averting negative biophysical tipping points in the Earth system is a global challenge that will require a coordinated global effort, the research and policymaking surrounding positive social tipping must also grapple with historical and contemporary inequalities in the production of environmental harms, and the differentiated and uneven capacity and responsibility to respond or to withstand such impacts. These concerns are echoed in the principle enshrined in the UNFCCC of ‘common but differentiated responsibilities and respective capabilities’ and highlights the greater responsibility to act to



335 reduce emissions and the likelihood of crossing critical thresholds by richer countries and polluter elites, whether through their  
own direct efforts or through the support of efforts in countries with fewer economic resources (O'Brien and Leichenko, 2000).  
Refocusing mitigation attention to high-emitting groups, countries and sectors highlights the need for interventions and policy  
measures that attempt to shift the current consumption patterns of the wealthy and the actions of large private corporations  
(Newell, 2021; Kenner, 2019; Wiedmann et al., 2020; Rammelt et al., 2023) and the infrastructures of high-impact sectors  
such as food (reducing meat and dairy consumption) and energy production (switching to non-fossil fuel based energy),  
transport (reducing car use and air travel) and housing that, combined, comprise about 75% of total carbon footprints (Newell  
et al., 2021). Furthermore, this view also highlights the need for substantial financial transfers from the Global North to the  
340 Global South to help build climate resilience, to compensate for irreparable losses due to climate change, and to offset the  
costs of mitigation efforts (Jackson et al., 2023). Without such measures, efforts to address Earth System tipping points risk  
reinforcing unequal power dynamics and current inequities.

### 3. Illustrative case study on risks and justice implications in Marine Protected Areas

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The ocean economy is expected to grow faster than the global economy in the coming decades, reaching \$3 trillion by 2030  
(OECD, 2016), with well-established (e.g. fisheries, aquaculture) and novel ocean sectors (e.g. seabed mining, ocean wave  
energy) multiplying their activity and footprint in recent years (Jouffray et al., 2020). Yet, opportunities, access and benefits  
from oceans remain highly unequal. For instance, seafood production is highly concentrated in a few Global North large  
350 corporations (Österblom et al., 2015), while in most places of the Global South, the local nutritional needs are jeopardised by  
the activity of distant fishing fleets, seafood trade, and the use of catches for fish oil/fish meal for animal feed (Hicks et al.,  
2019). The unprecedented race for food, spaces and materials, but also the effects of other drivers such as climate change and  
pollution, are exacerbating social inequities and threatening marine ecosystems functioning and productivity. The race to  
occupy the oceans and exploit more resources and at greater depths, combined with the impacts of climate change, are leading  
355 to an increasing risk of reaching dangerous ocean tipping points (Jouffray et al., 2020; McKay et al., 2022). Thus, there is a  
pressing call for transformative actions that halt and reverse marine biodiversity loss rates (IPBES, 2019), particularly in some  
Global South biodiversity hotspots.

The recently agreed Kunming-Montreal Global Biodiversity Framework seeks to protect 30% of the ocean by 2030 to halt  
360 biodiversity loss (30x30 target 3 (CBD, 2022)). Through the global CBD negotiations, conserving 30% of the ocean (and land)  
is seen as an important threshold for halting biodiversity loss and maintaining ecosystem function as previous levels of  
protection were insufficient (Dinerstein et al., 2019; Baillie and Zhang, 2018). With Target 3 set 'to ensure and enable that by  
2030 at least 30% of terrestrial and inland water areas, and of marine and coastal areas, are effectively conserved and managed  
(CBD, 2022),' it could function as a potential positive tipping point if implemented. However, the 30x30 target risks  
365 perpetuating historical injustices, colonial legacies and power imbalances by imposing Western conservation models on



communities in the Global South (Obura et al., 2023, 2021). In effect, it is essential to explore the intricate social aspects of the initiative (Sandbrook et al., 2023), offering a more nuanced and equitable discourse on positive tipping points in ocean governance and conservation and the role of Marine Protected Areas (MPAs) in achieving them.

370 Although the positive ecological impacts of MPAs are relatively well understood (i.e. large, old, well-enforced and ‘no-take’  
MPAs would provide greater ecological benefits within the area effectively protected (Sala and Giakoumi, 2018), less attention  
is paid to the negative socio-economic impacts that MPA establishment can have on dependent and marginalised communities  
(Bennett and Dearden, 2014; Rasheed, 2020). Past research has shown that the MPAs can exacerbate equity issues currently  
present in the Global South, by further marginalizing already vulnerable coastal communities (Sowman and Sunde, 2018; Hill  
375 et al., 2016). MPAs establishment and management may exclude local and Indigenous participation, which in turn can also  
lead to reduced conservation and management gains (Hill et al., 2016). A heightened focus on increasing MPAs may entail  
undesirable consequences for social well-being of vulnerable communities in a variety of ways, including forced removals and  
displacement of Indigenous peoples from traditional lands and waters, loss or restricted access rights, as well as negative  
impacts on food security, health, livelihoods, identity and culture (Bennett and Dearden, 2014; Hill et al., 2016). As an example,  
380 (Sowman and Sunde, 2018) explored the social dimensions of five MPAs in South Africa, finding that they led to the  
weakening of local governance rights and processes, loss of tenure rights and access to resources, loss of livelihoods, negative  
impacts on culture and way of life, and increased conflict in already marginalised coastal communities. Similarly, (Oracion et  
al. (2005) documented how in some MPAs in the Philippines the tourism sector marginalised small-scale fisheries in terms of  
access and control, jeopardising the economic and socio-cultural viability of fishing-dependent communities.

385  
A strong global focus on increasing MPAs as a ‘tipping point’ towards conserving marine biodiversity, may fail to carefully  
and comprehensively address historical impacts and ongoing equity issues experienced by coastal communities in the Global  
South. In addition, measuring conservation success based solely on a coverage metric can incentivize the establishment of  
large centrally-governed MPAs (often situated in former colonies) (O’Leary et al., 2018), at the expense of relatively small,  
390 but locally managed MPAs (Smallhorn-West et al., 2020). A looming time horizon for 30x30 may also discourage participatory  
and collaborative processes that may take longer to achieve but are more efficient in the long term (O’Leary et al., 2018).  
Concerning global planning of MPAs expansion, maps are not apolitical. Global conservation planning exercises informed by  
biophysical variables and cumulative human impacts placed a significant fraction of priority areas within the Global South  
(e.g. Coral Triangle, Southwest Indian Ocean, Caribbean Sea) (Zhao et al., 2020; Selig et al., 2014; Jenkins and Van Houtan,  
395 2016), occupying the entire EEZ of some Global South countries (e.g. Indonesia) and thereby perpetuating a form of sacrifice  
zone. While important as foundations, this literature hardly discusses the ethical and governance considerations of such  
“conservation planning exercises” and local socio-economics needs are either conceptualised as an extra map layer that  
competes with wildlife or something to consider in future analyses.



400 The 30x30 initiative and the revitalization and empowerment of local communities may be reconciled by: (1) balancing both  
biodiversity and well-being outcomes of local communities when enhancing existing MPAs and designing new ones; (2)  
seriously considering the wide range of “other effective area-based conservation measures”, including those where small-scale  
actors are empowered; (3) involving coastal communities from the very beginning of decision-making processes to enhance  
procedural justice, increasing the likelihood of equitable outcomes; (4) acknowledging customary, traditional and local  
405 practices of Indigenous peoples when protecting coastal areas; and (5) considering ongoing sustainable Indigenous  
management systems within the 30x30 target (e.g. Atlas et al., 2021). Importantly, the expansion of MPAs, across both large  
and small areas, should not be seen as a single strategy to balance marine biodiversity and socio-economic needs; it must be  
part of a broader and more diverse management and governance portfolio to govern our oceans in a sustainable and equitable  
manner (O’Leary et al., 2018).

410

#### 4. What does this mean in practice?

Above we have laid out a series of risks and potential injustices associated with the need to act to address the existential threat  
that is climate change and related sustainability concerns like biodiversity loss. We argue that interventions, especially  
415 concerning narratives of positive tipping points, cannot be divorced from current injustices and inequities in the global earth  
system. Below, we set out some specific key messages for different actor groups to internalise as we all seek to act to shift the  
planet onto a more environmentally sustainable and equitable trajectory.

420

#### 4.1. Researchers

##### 4.1.1. Employ participatory and plural/inclusive approaches.

Biophysical and social system tipping points are interconnected, and do not exist in isolation (Sultana, 2023). Avoiding an  
increase of harms requires a broad set of expertise, approaches, and acknowledgment that we may need multiple and plural  
approaches not only within academic disciplines, but also of diverse knowledge systems beyond academia and that these need  
425 to be taken seriously (Tàbara et al., 2022). Interactions with other knowledge systems are only slowly developing, but  
participatory approaches that involve stakeholders in science, can still be very superficial and not go beyond consultation into  
more embedded modes of knowledge co-production (Osinski, 2021; Chambers et al., 2021). By being more mindful about  
inclusiveness, we can bring about more procedural justice in research through participatory co-design, action research and  
humility on the part of researchers (Huybrechts et al., 2017).

430

##### 4.1.2. Bring and engage with diversity in the research space.

Diversity is a key principle of resilience and should also be a core framing when thinking through equity, so that diverse  
groups, perspectives, knowledge systems and research methods are not side-lined in the quest for addressing global tipping  
points. Greater diversity in research is therefore needed - in terms of cultural, religious, ethnic, gender or background of the



435 researcher, but also in the disciplines that are engaged. For example, considering social sciences in the intentions, design,  
implementation and evaluation of interventions are also more likely to avoid harms and associated costs, with potential to  
achieve both positive social and ecological impacts on people. Including diverse groups, perspectives, and knowledge systems  
in the quest for addressing global tipping points will enhance resilience and success for social tipping and will broaden the  
type and scope of research undertaken (Stirling, 2010). To harness relevant social tipping opportunities we need to learn about  
440 diverse living realities and interact with actors outside science (Bentley et al., 2014).

#### 4.1.3. Have more heterogeneity in research contributions.

Science has an agenda setting function, which could benefit from accounting for the heterogeneity of the expertise that is  
needed to solve complex problems like tipping points. Place-specific information and experience is often lacking as a lot of  
445 traditional research is concentrated in high-income countries. A more inclusive global research project to reflect on the justice  
and risk aspects of the Earth system and understanding the full breadth of impacts of positive and negative tipping points needs  
to be undertaken. Diversity and inclusivity of research teams - within and beyond academia - are needed to help find solutions  
to tipping points that do not exacerbate existing inequities and inequalities.

#### 450 4.2. Business and finance

Recognising finance and business as part of social and ecological systems and not somehow apart from them; that active  
steering and regulation are required to divest, de-finance and divert financial resources to where positive tipping points can be  
found. This means recognising highly uneven access to credit, education and capital to bring about more transformative change  
455 and creating mechanisms that redirect finance away from activities pushing us past planetary boundaries and towards sectors  
and regions where they are most required (Newell, 2021).

#### 4.2.1. Introduce investment restrictions for non-compliant companies.

Cutting off investment for companies that are seen to be complicit in transgressing planetary boundaries, such as some oil  
460 majors and powerful cattle lobby groups in the Brazilian Amazon (Piotrowski, 2019), has the potential to reshape the business  
environment towards more ethical practices. Another area where investments could leverage positive tipping points. For  
example, major investments to shift away from car dependency would have benefits from the frontlines of mining, which  
would see reduced social and environmental harms, to densified metropolitan areas, which would experience myriad benefits  
from improved air quality to pedestrian safety (Rionfrancos et al., 2023). Likewise redirecting the \$11 million per minute  
465 currently being spent on fossil fuel subsidies towards improved access to renewable energy for poorer communities would  
represent a major gain (McCulloch, 2023).

#### 4.2.2. Have more supportive and inclusive investments.



470 It is crucial that investments steer the sector toward improved sustainability, as opposed to fueling unsustainable working conditions and overexploitation of resources, for example by integrating sustainability and equity into traditional finance mechanisms (Jouffray et al., 2019).

With this improved finance mechanism, businesses should then be able to a- meet standards and b - also operate in vulnerable areas that need finance to become more resilient. This includes moving money to key areas where it is needed (adaptation, biodiversity, social goods) rather than just for profit.

475

### 4.3. Decision and Policy-makers

#### 4.3.1. Design fiscal policies that are reflective and cognizant of extant configurations.

480 Fiscal policy needs to be designed to subsidise lower-income households for the higher costs that may accompany climate policies such as carbon pricing, emissions trading, new mandates/standards for energy-efficient buildings, smart energy systems, and the electrification of transport. Failure to do so could set off a cascade of unintended consequences and increase poverty, inequality, hunger and other health impacts, popular protest and political instability. Policy and governance actors attracted to positive social tipping interventions need not only to design targeted, sector- and actor-specific approaches, but also to combine disciplines and sectors for a coordinated, complex systems thinking approach and capabilities. They should 485 also maintain the highest commitment to research and policymaking standards that expose hidden assumptions, biases and potential for backfires, rebounds and other unwelcome results (Sterman, 2002).

#### 4.3.2. Support moving money where it needs to go

490 A financial sector tipping point that reconfigures where finance can go, for example towards mitigation, adaptation, loss and damage, biodiversity, addressing vulnerability etc. requires greatly strengthening the governance of public and private finance. This requires changing the mandates of multilateral development banks, reforming central banks and regulating the need to change to company law and disclosure policies. Furthermore, the public sector should ringfence funding to support unintended consequences.

495

### 4.4. Media/communications

#### 4.4.1. Be aware of the politics of language and power dynamics in the science landscape.

500 Communicators must be alert to the ideologies, values and systems of power that affect which messages are communicated and how they are encoded. For example, how a tipping point is identified and what specific language is used to define it. This is particularly relevant in relation to the language of ‘positive’ and ‘negative’ tipping points, which can imply a universality of effect that is insensitive to the diverse experiences (and responsibilities) of different communities.

#### 4.4.2. Recognize their position in framing key messages in the scientific landscape.



505 In an equity and justice context, media and communicators must be alert to the competing ideologies and value systems that  
affect how a message is ‘decoded’ or interpreted by different communities. The meaning of a message is not necessarily  
determined by the messenger or the message, but ‘a complex interplay of how this meaning is framed though ideological  
values and beliefs’ (Hall, 1980: 7). Thus, it is important to view communication not as a neutral process of information  
transmission, but as a complex, non-linear system that is entangled with issues of various knowledges and power. Studies have  
shown that knowledge does not automatically lead to enlightened action (Norgaard, 2011) and, indeed, that more factual  
510 information may serve to further entrench dismissive perceptions of climate change (Bain et al., 2012). There is, therefore, a  
need to go beyond linear ‘information deficit’ models of communication, moving instead towards a non-linear model of  
communication as an open, reflective and creative dialogue that is alert to complexity and interconnection across spatial and  
temporal borders. With this in mind, communication strategies should be co-produced with the communities they are seeking  
to engage (Moser, 2016).

515

#### **4.4.3. Embrace creative co-production practices.**

These could lead to open-ended, non-instrumental approaches to communication that can be key in this complex field, starting  
perhaps with exploring what people want to know. The effectiveness of literature, film and art in promoting ethical responses  
to climate change are increasingly being recognised (James, 2015; von Mossner, 2017; Houser, 2014); as David Holmes states,  
520 ‘the arts have an ability to communicate the vulnerability and sensitivity of climate issues that other channels may lack’  
(Holmes, 2020: 10). The arts also offer models for empowering communities to create their own narratives and contextualise  
tipping points in relation to their own systems of value, which is an important step towards the design and implementation of  
just and equitable transitions.

## **5. Conclusion**

Biophysical tipping points pose existential threats to current and future generations, both human and non-human, with those  
currently underserved being the most vulnerable. It is therefore imperative to act, however, this cannot be done in a way that  
perpetuates past and current unjust or inequitable outcomes. Considerations of what needs to change, who is being asked to  
change and where the change or its impacts will be felt and by whom, require a level of reflexivity and systemic understanding.  
530 All actors have a role to play in ensuring that justice, equity and ethics are incorporated to all actions, with a particular emphasis  
on the inclusion of marginalised voices (those most affected by disruptive environmental change and the least responsible for  
causing it). Finally, enabling social tipping points towards radical transformations could benefit from more diverse perspectives  
to open up the solution space, leveraging a shift in worldview and paradigm rather than just reconfiguring materials and  
535 feedbacks (Meadows, 1999). Trying to fix a system using the same tools that created it is not the best way to go about solving  
our planetary crises. Taking a cautious step back to explore all options, not just those that seem to offer a quick fix or ‘low-





hanging' fruit, could offer a more substantial route into thinking through tipping points that could create a more equitable as well as sustainable future.

#### 540 Author contribution

LP conceptualised the paper and prepared the initial draft together with SRS, LG, PN, BS and SV. TA, AC, SC, AG, CV and CZ edited and reviewed the draft.

#### Competing interests

545 The authors declare that they have no conflict of interest."

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