# Sharm el-Sheikh Mitigation Ambition and Implementation Work Programme (MWP)

January 30, 2024

**Submission on behalf of the co-authors of the**
**Global Tipping Points Report 2023 (Lenton et al. 2023)[1]**

This submission responds to paragraph 7 of decision FCCC/PA/CMA/2023/L.16, which encourages Parties, observers, and other non-Party stakeholders to submit via the submission portal by 1 February 2024 suggested topics in line with the scope of the Mitigation Ambition and Implementation Work Programme (MWP) to be discussed at the global dialogues in 2024.

## SUMMARY PROPOSAL

**One of the global dialogues of the MWP in 2024 should address the implications of the present risks of passing climate tipping points for global mitigation ambition and implementation, esp.**

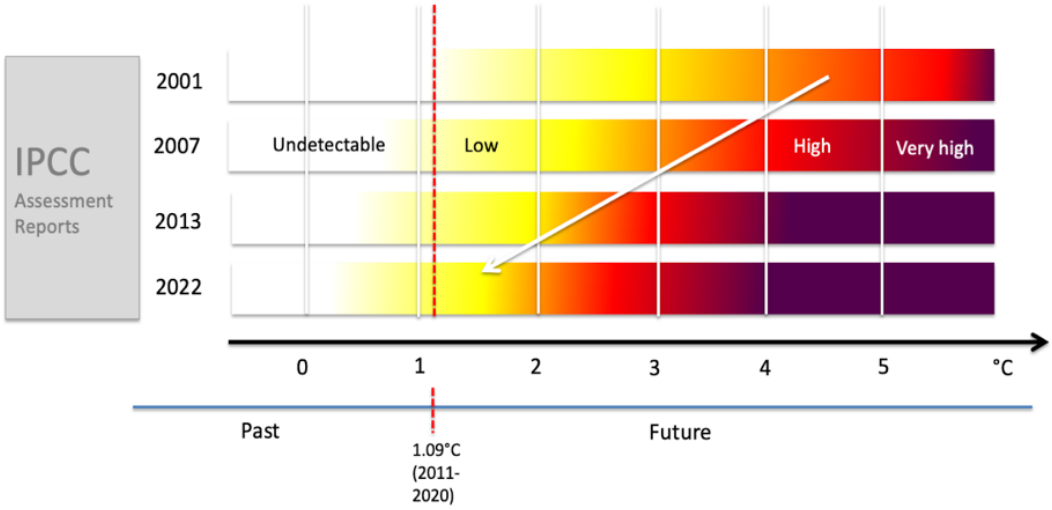
1. **Identifying and pursuing acceptable global mitigation pathways that minimise the risk of passing climate tipping points,**
2. **Strengthening global mitigation efforts for Short-lived Climate Pollutants,**
3. **Developing and rapidly scaling sustainable capacities for carbon removal with the purpose to reverse temporary global temperature overshoot over 1.5°C.**

[1] T. M. Lenton, D.I. Armstrong McKay, S. Loriani, J.F. Abrams, S.J. Lade, J.F. Donges, M. Milkoreit, T. Powell, S.R. Smith, C. Zimm, J.E. Buxton, E. Bailey, L. Laybourn, A. Ghadiali, J.G. Dyke (eds), 2023, The Global Tipping Points Report 2023. University of Exeter, Exeter, UK.

## 1. Global Tipping Points Report 2023

In 2023, an international community of over 200 scientists from 91 academic institutions in 26 countries conducted a comprehensive assessment of the current risks associated with Earth system tipping points and the opportunities for accelerating climate solutions with positive tipping points in society, economy, and technology. The 12-month process resulted in the Global Tipping Points Report 2023 (GTPR 2023, hereafter "the Report"), which was launched on 6 December 2023 at COP28.

The Report provides a comprehensive, in-depth assessment of tipping point risks and opportunities that complement and deepen the insights provided by the IPCC's regular scientific assessment reports. In particular, the Report updates the risk assessments provided for 'large-scale singular events' (reasons for concern) in the IPCC's 6th assessment cycle.




**GTPR 2023 Chapter 3.4 | Figure 3.4.1**: **Changing risk assessment of tipping points in IPCC reports over time.** The IPCC assessed the risk of tipping points ('large-scale singular events') and pointed to them as one of five 'Reasons for Concern' in a bar graph ('burning embers') in most of its assessment reports since 2001. Colors indicate levels of risk from white (undetectable) to yellow (low), red (high) and purple (very high). Each AR increased the level of risk expected for a specific level of warming.

## 2. Key Findings of the GTPR 2023

Tipping points are defined as when large-scale change in part of the Earth system (such as ice sheets, forests, or ocean currents) becomes self-sustaining beyond some critical level of pressure on the system, leading to an often rapid and irreversible shift in its state with major consequences for humanity.

The Report identified over 25 parts of the Earth system that show evidence for potential tipping points, including in the cryosphere (the ice-bound parts of the planet), the biosphere (global ecosystems), and ocean and atmospheric circulations. Climate change is driving many of these systems closer to tipping points, along with other drivers like habitat loss and pollution. At today's 1.2°C average global warming, widespread tipping of warm-water coral reefs is already likely, and we cannot rule out that four other systems may pass tipping points (the Greenland and West Antarctic ice sheets, the North Atlantic Subpolar Gyre, and permafrost subject to abrupt thaw). Beyond 1.5°C, widespread mortality in warm-water coral reefs becomes very likely, and another three potential tipping systems become vulnerable: boreal forest, mangroves, and seagrass meadows. Some tipping systems such as the Amazon rainforest, parts of the Greenland ice sheet, and the North Atlantic circulation are already showing "early warning signals" consistent with destabilisation prior to tipping. Interactions between tipping systems can further destabilise them, leading to the possibility that tipping could "cascade" (where the tipping of one system triggers the tipping of another, and so on).

The existence of tipping points means that 'business as usual' is now over. Crossing Earth system tipping points has the potential for severe impacts on water, food and energy security, health, ecosystem services, communities, economies, and biodiversity. For example, Amazon dieback would be a catastrophe for biodiversity, would add to global and regional warming, and could put six million people at direct risk from extreme heat stress and cause between US$1 trillion and US$3.5 trillion in economic damages. Instability of the Antarctic ice sheet, which could lead to sea level rise of up to two metres by 2100, would expose 480 million people to annual coastal flooding events. Permafrost thawing would add significantly to global warming: it already damages property and infrastructure, and 70% of current infrastructure in permafrost regions is in areas with high potential for thaw by 2050. A collapse of the Atlantic Meridional Overturning Circulation (AMOC) could substantially reduce crop productivity across large areas of the world, with profound implications for global food security. Many of these tipping point impacts are not considered in conventional climate assessments.

Given these potentially severe consequences of Earth system tipping processes, one of the Report's key recommendations is that prevention of Earth system tipping points should become the core objective of governance in this domain. Effective prevention strategies require first and foremost the limitation of global temperature increase. Hence, they have important implications for global mitigation efforts in the framework of the Paris Agreement.

## 3. Climate Tipping Points and Mitigation Ambition

Climate tipping points have multiple interacting drivers that operate at different scales (see GTPR 2023 Table 3.2.1). Effective prevention strategies need to address all drivers with coordinated cross-scale approaches**.** Global temperature increase is the most common driver of tipping processes at the global scale, making climate mitigation the most effective prevention strategy across the diverse set of tipping systems identified to date. Given that Earth system tipping risks are already moderate at current levels of warming and increase substantially when global temperatures reach 1.5C above pre-industrial levels, countries need to reduce GHG emissions rapidly and dramatically in the near term and reach zero emissions by mid-century to minimise the risk of transgressing tipping points. Deep and early emission reductions based on principles of international law are a core part of any effective prevention strategy for almost all tipping points. It is the only reliable way to limit global temperature increase, which can prevent the crossing of most tipping points altogether.

Existing global governance efforts supporting mitigation should be strengthened immediately and maximised in the future. Social tipping dynamics might be able to accelerate mitigation efforts (GTPR 2023, section 4). Regarding GHG emission reductions, governments should immediately accelerate their efforts by

- pursuing a rapid phase out of all fossil fuels,
- bringing forward their target year for reaching net-zero,
- increasing mitigation ambition in revisions of Nationally Determined Contributions (NDCs) following the first Global Stocktake,
- accelerating corresponding national policy measures, such as tripling clean energy production by 2030,
- financially and technically supporting mitigation efforts in low-income and emerging economies.

To best support tipping point prevention, mitigation efforts should focus not only on reducing long-lived GHG emissions, but also support measures to cut short-lived climate pollutants (SLCPs), and to develop just and sustainable forms and levels of carbon removal as a supplement to emissions reduction.

***We recommend that at least one MWP dialogue in 2024 focuses on the implications of climate tipping points for mitigation ambition in the UNFCCC, structured around the following three discussion streams.***

### (a) GHG Emission Reductions – Mitigation Pathway Narrowing

Making the prevention of climate tipping processes an explicit objective of global climate governance would have important implications for the selection of global and national emission pathways towards the temperature goals established in the Paris Agreement. Only a subset of the emission scenarios included in IPCC AR6 are suitable if decision makers take into account the need to prevent the passing of tipping points.

The Paris Agreement sets a long-term temperature goal, aiming to keep warming to well-below 2°C while pursuing efforts to limit 1.5°C above pre-industrial levels. This goal needs to be read in the context of the overarching aim of the Agreement to "significantly reduce the risks and impacts of climate change" (Art. 2) and the objectives of the Convention. Acknowledging the imperative to prevent the crossing of tipping points, only a limited subset of IPCC AR6 emission scenarios (and corresponding mitigation pathways) towards the long-term temperature goal are aligned with the Paris Agreement objectives (Pouillet et al., 2023).

More specifically, emission pathways that are consistent with the objective to prevent climate tipping points have three important common features. First, they minimise 'temperature overshoot'. While accepting that warming of more than 1.5ºC warming above pre-industrial levels can likely no longer be avoided, emission pathways that minimise temperature overshoot beyond this level have a higher chance of avoiding the crossing of tipping points. In other words, considering only long-term (end of century in most analyses) temperatures is not sufficient; global peak temperature is an equally important measure for achieving global objectives. Second, emission pathways that are more likely to avoid tipping points keep the duration of the overshoot period as short as possible. These two features lead to a third characteristic of emission pathways that effectively prevent tipping points: rapid, early emission reductions (this decade) coupled with rapid scaling of carbon removal capacities.

Based on these recent scientific insights, there is a need for Parties to the Paris Agreement to collectively evaluate and revise their current preferences for global and national mitigation pathways.

*Key questions for discussion of topic (a):*

*(1) Which mitigation pathways to the global temperature goals minimise the risk of passing climate tipping points?*
*(2) What efforts (changes to current plans) are needed to move onto these pathways?*
*(3) How and where (in what forum) should formal discussions about (Paris-aligned) mitigation pathways that minimise the risks of passing climate tipping points take place?*
*(4) Could a set of tipping risk-minimising mitigation pathways be included as a standard for the assessment of progress towards the achievement of the global goals in future Global Stocktake processes?*

**(b) Short-lived climate Pollutants (SLCPs)**

Outside of the UNFCCC, intergovernmental efforts to manage SLCPs are an important dimension of global climate mitigation efforts, especially because they can have short-term effects on global atmospheric temperature. At the same time, SLCPs, including methane, tropospheric ozone, and black carbon, can have disproportionate regional impacts on particular tipping systems. For example, black carbon deposition is particularly effective at melting snow and ice. Hence the mitigation of specific SLCPs can have a disproportionate benefit in preventing specific ESTPs - ice sheet and glacier melt in this case.

Mitigating SLCPs can also contribute to limiting global warming pressure on most ESTPs. According to IPCC AR6 WG1, across the Shared Socioeconomic Pathway climate scenarios, "the collective reduction of methane, ozone precursors, and hydrofluorocarbons (HFCs) can make a difference of 0.2°C with a *very likely* range of [0.1 to 0.4]°C in 2040 and 0.8°C with a *very likely* range of [0.5 to 1.3]°C at the end of the 21st century".

On global and regional levels, several institutions address SLCPs. A focal arena is the Climate and Clean Air Coalition (CCAC), a state-led transnational partnership established under UNEP in 2011, which has become a key actor in global policy advocacy and knowledge exchange on SLCPs. In addition, other international fora have made concrete steps to mitigate specific SLCPs. For instance, in the Northern hemisphere, black carbon emissions are integrated into the targets to reduce particulate matter pollution under the Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone. In 2015, the Arctic Council agreed on the Framework for Action on Enhanced Black Carbon and Methane Emission Reductions. In 2016, the Montreal Protocol on Substances that Deplete the Ozone Layer was complemented with the Kigali Amendment on the phase-out of HFCs. Further, under the Paris Agreement, some countries have included SLCP mitigation targets or policies in their NDCs, and the COP28 decision on the Outcome of the First Global Stocktake (FCCC/PA/CMA/2023/L.17) reiterated the need to substantially reduce methane emissions by 2030. In addition, various global cooperation efforts, including the Global Methane Pledge, have been launched to address methane emissions. Elevated action on SLCPs is essential because the effects are felt more rapidly than those of $CO_2$ abatement.

Other short-lived pollutants, such as sulphates and particulates, can have cooling effects, and their elimination would unmask warming (also on short time scales) (IPCC SR1.5 2018), and corresponding tipping risks. For example, reducing sulphate emissions from shipping for health reasons has a climate trade-off. This creates challenges for policy design that require careful consideration.

*Key questions for discussion of topic (b):*

*(1) How could the action on SLCP mitigation, in particular methane, be accelerated under the UNFCCC and the Paris Agreement? How should SLCPs be addressed in the next round(s) of NDCs?*
*(2) How could other existing governance frameworks for SLCPs be strengthened to minimise the risks of triggering specific climate tipping points?*
*(3) What are the financial, technological, and capacity-building needs of developing countries to accelerate action on SLCP mitigation, in particular methane, and how can they be met through existing and novel channels and mechanisms?*
*(4) What is the role of non-Party stakeholders in accelerating action on SLCP mitigation, in particular methane?*

### (c) Carbon Dioxide Removal

Given the likelihood of overshooting the aspirational global temperature target of 1.5°C, and the significant increase of tipping-point risks above this level of global warming, drawing temperatures back down to or below 1.5°C will be a necessary component of effective strategies to minimise tipping risks. This requires immediate efforts to develop and scale just and sustainable capacities for $CO_2$ removal, while seeking to minimise potential side-effects of carbon removal on other drivers of tipping processes.

With some exceptions, the bulk of emissions pathways for reaching ambitious global temperature goals include temporary temperature overshoot, followed by recovery in the latter half of the century resulting from deployment of novel carbon sinks at a speculative scale (IPCC AR5, 2014; IPCC, 2018; IPCC AR6, 2022). Carbon removal is emerging as a key pillar of climate assessments and policy. IPCC AR6 argued across all three working groups that carbon removal will play an essential role in strategies that limit warming to no more than 1.5ºC and is an important feature of "well below 2ºC" scenarios. Correspondingly, countries increasingly integrate carbon sinks into their net-zero goals, NDCs, and mid-century strategies. For now, they predominantly repurpose land use and ecosystem management practices as carbon removal. Engineered carbon removal prototypes and practices are piloted at small scales, but these remain immature or speculative as socio-technical systems.

Carbon removal is understood as playing two roles. First, it can balance residual emissions in a net-zero state. The currently projected scale of such residuals and removals is substantial at close to 20 percent of current emissions. The second role is to reverse overshoot of carbon budgets (reducing ultimate outcome temperatures). The more removal capacity required for the first task, the greater the challenge of providing sufficient, rapid, sustainable capacity for the second. The development of removal approaches also requires careful governance to avoid their use as a substitute for achievable mitigation, rather than a supplement. One analysis of the risk of mitigation deterrence through carbon removal estimates as much as 1.4ºC additional warming (over the 1.5ºC goal) could result.

The prospects for scaling current efforts to develop carbon removal technologies to the multi-gigaton levels foreseen in integrated assessment modelling in pathways in line with well below 2ºC or 1.5ºC are uncertain. Capacities can be expected to be constrained by technical, environmental, and social limitations. So far, limited attention has been given to policy beyond research and development.

Assessment of the relationship between carbon removal and tipping points is nascent. While large-scale CDR efforts might have desirable effects on global temperatures, it faces significant scaling challenges and would likely operate more slowly than many other mitigation approaches. These challenges likely limit its potential as a prevention tool in comparison to GHG emission reduction.

Carbon removal techniques could also have other positive and negative effects on ecosystems and hence tipping point risks. For example, some carbon-removal approaches, such as forest conservation and afforestation, could increase forest resilience and counteract tipping

dynamics. But opposite effects are also possible. At scale, most carbon-removal techniques compete for land and/or low-carbon energy supplies, with negative effects on both sustainability and justice. Moreover, large-scale conversion of natural forests for the purpose of Bioenergy with Carbon Capture and Storage (BECCS) might increase ecosystem vulnerability and the possibility of forest loss, and afforestation in drylands and grassland ecosystems could make tipping more likely in those ecosystems. Proposals for large-scale oceanic carbon removal through alkalinisation or fertilisation also raise questions about their interactions with tipping point drivers, effectiveness, and ecosystem disruption. Overall, there is so far limited research on the nature and net balance of such effects.

*Key questions for discussion of topic (c):*

*(1) What kinds of policy measures are needed to foster the development of just and sustainable carbon removal capacities?*
*(2) How can carbon removal be maximised without negative impacts on other environmental and social interests, especially the resilience of systems vulnerable to tipping?*
*(3) How can the potential mitigation deterrence effects of carbon removal development be effectively prevented?*

## 4. Summary

The prevention of climate tipping points poses unique challenges to global climate mitigation policy that demand dedicated consideration by Parties to the Paris Agreement and decisive, near-term policy changes. For example, a tipping point such as abrupt permafrost thaw can trigger self-propelling, irreversible changes that render it impossible to recover the original state of the system in question. The impacts of tipping processes not only have severe consequences for human wellbeing, they also make it considerably harder to return below the 'overshoot' temperature target. Based on these scientific insights, it is timely to initiate a dialogue among Parties to the Paris Agreement about the implication of climate tipping points for global mitigation ambition. The MWP dialogues provide a suitable context for the exploration and discussion of this new set of challenges.

*Manjana Milkoreit*
Department of Sociology and Human Geography, University of Oslo; Norwegian Institute of International Affairs, Norway

*Tim Lenton*
Global Systems Institute (GSI), University of Exeter, UK; Earth Commission

*David I. Armstrong McKay*
GSI, University of Exeter, UK; Stockholm Resilience Centre (SRC), Stockholm University, Sweden; Earth Commission

*Sina Loriani*
Potsdam Institute for Climate Impact Research; Member of the Leibniz Association, Germany; Earth Commission

*Jesse F. Abrams*
GSI, University of Exeter, UK; Earth Commission

*Steven J. Lade*
Fenner School of Environment and Society, Australian National University; SRC, Stockholm University, Sweden

*Jonathan F. Donges*
Potsdam Institute for Climate Impact Research, Germany; SRC, Stockholm University, Sweden

*Sara Constantino*
Department of Public Policy, Northeastern University

*Duncan McLaren*
Emmett Institute, University of California - Los Angeles School of Law.

*Yulia Yamineva*
Center for Climate Change, Energy and Environmental Law, University of Eastern Finland, Finland

*Viktoria Spaiser*
School of Politics and International Studies, University of Leeds, UK