# Executive Summary

A tipping point is a critical threshold beyond which a system reorganises, often abruptly and/or irreversibly and a tipping element is an Earth system component that is susceptible to a tipping point. Key tipping elements include the collapse of the West Antarctic and Greenland Ice Sheets, the melting of the Arctic Permafrost, the collapse of the Atlantic Meridional Overturning Circulation and the dieback of the Amazon Forest. **The goal of this report is to review the state of knowledge on climate system tipping points and to make recommendations for a wide range of stakeholders, on how climate risk management strategies can adequately reflect the risks of crossing tipping points.**

**The crossing of climate system tipping points may lead the climate to change regionally or globally, both by substantially affecting the Earth system and as a result of tipping cascades, leading to potentially catastrophic impacts. Tipping points impacts will also cascade through socio-economic and ecological systems over timeframes that are short enough to defy the ability and capacity of human societies to adapt, leading to severe effects on human and natural systems.** At the regional level, individual tipping points are associated with different types of potentially severe regional or local impacts, such as extreme temperatures, higher frequency of droughts, forest fires and unprecedented weather. At the global scale, tipping points would lead to world-wide impacts through e.g. contributing to additional greenhouse gas emissions into the atmosphere and temperature feedback loops or to faster sea-level rise.

**Recent state-of-the-art research shows that important tipping points are already "possible" at current levels of warming and may become "likely" within the Paris Agreement range of 1.5 to 2°C warming, questioning the previously well-accepted notion that climate tipping points have a low probability of being crossed under low levels of warming.** Despite marked improvements in the understanding of the high risks associated with climate tipping points, global policies explicitly targeting risks of tipping points remain virtually non-existent. Being traditionally classified as low-probability, climate system tipping points are often misinterpreted as having a high-probability of not occurring and therefore omitted from climate policy decision making. Yet, the current scientific evidence unequivocally supports unprecedented, urgent and ambitious climate action to tackle the risks of climate system tipping points.

**In terms of climate mitigation, the existence of climate system tipping points means it is vital to limit the global temperature increase to 1.5°C, with no or very limited overshoot. This effectively reduces the number and shapes of possible emissions pathways towards 1.5°C and renders lenient interpretations of the Paris Agreement temperature goal incompatible with its resilience goal, as, in the face of tipping points, simply reaching the temperature target does not ensure a resilient planet and society.** Committing to net-zero emissions by mid-century is not enough in itself; it is about achieving net-zero with urgent, early and deep reductions in emissions already this decade. Near-term policies in line with the mitigation targets in current Nationally Determined Contributions (NDCs), put limiting warming to 1.5°C without overshoot out of reach altogether. It is therefore critical that 2030 ambition in NDCs is considerably strengthened in the very near term, and that commensurate policies are implemented at relevant timescales to meet these revised targets.

**Transformational adaptation is particularly important to build resilience and prepare for the potential severe impacts of crossing tipping points.** Even if global warming levels are kept to 1.5°C with no or limited overshoot, some climate system tipping points and their associated impacts may already be unavoidable at current levels of warming. Transformational adaptation is that which leads to a change in the fundamental characteristics of human and natural systems so that the capacity of these systems to cope with potential hazards is increased. It could therefore necessitate stringent measures to reduce impacts, that have the potential to disrupt in the short-term current economic and social activities, but which have the ability to avoid drastic losses in the short- and mid-term and to generate a range of benefits to human well-being and to planetary health in the long-term.

**Technological development and innovation have a crucial role to play in contributing to a better understanding of the climate system in general as well as in the development and implementation of approaches to reduce and manage the risks of crossing climate system tipping points.** Indeed, technologies for better monitoring and modelling of the climate system, such as remote observation equipment, high computing power, mapping software and telecommunication systems, are and will remain essential for characterising how the risk of crossing of climate tipping points may evolve over time and space. In addition, carbon dioxide removal technologies play a key role in limiting warming to 1.5°C with no or very limited overshoot. This is through creating "negative emissions", which can help accelerate – rather than displace – early deep emissions reductions and balance out harder-to-abate sectors that will continue to emit during the first half of the century. Concerns around CDR technologies however exist; investments are needed to enhance understanding of these trade-offs and to better evaluate the risks associated with, on the one hand overcoming barriers to scale-up these technologies, and on the other failing to employ them.

**This report concludes that current scientific understanding of climate system tipping points challenges the generally accepted notion that tipping points have a low probability of being crossed under moderate levels of warming, which adds further urgency to the climate challenge and requires a shift in how tipping points are treated in climate policy today.** For climate strategies to adequately reflect tipping-point risks, they need to drive drastic cuts in emissions this decade, including through enhanced NDCs and accelerated transformations towards net-zero, while also adapting to climate impacts. Scaling up and further developing technologies supporting these transformations and for monitoring tipping elements is also key. Given the potential for catastrophic impacts associated with climate system tipping points, missing the opportunity to implement such strategies could lead to immeasurable economic and ethical costs in the near-future.