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EXECUTIVE SUMMARY

Overview of the Thematic Study
In the context of the Mid-Term Review of the Sendai Framework, this thematic study has been developed to provide insights into planetary boundaries science and how best to elevate the importance of risk-informed development in the key global regimes such as the SDGs, the Paris Agreement, the post-2020 Global Biodiversity Framework, Financing for Development, Decade for Water Action and One Health. Equally important, the thematic study explores how the planetary boundaries paradigm relates to the priorities for action of the Sendai Framework – understanding risk, risk governance, investing in disaster risk reduction, and prevention. Key insights and recommendations have been framed to respond to key gaps and to identify how best to draw on planetary boundaries science to strengthen the implementation of the Sendai Framework, offer policy guidance and practical action to accelerate the implementation of the Sendai Framework, and to support the transition from creating risk to building resilience in a COVID-19 transformed world.

This thematic study is divided into three parts. Part 1 provides a detailed overview of the planetary boundaries framework. It explains the current state of planetary boundaries science, the overarching value of the framework and its specific relevance for deepening insights into the systemic nature of risk and also distils key messages for the Sendai Midterm Review about the challenges and opportunities for elevating risk-informed decision-making in all spheres of sustainable development.

Part 2 explores insight from planetary boundaries science in relation to the Sendai Framework’s Goal and Outcome. It also sets out detailed recommendations for drawing on planetary boundaries science to strengthen the implementation of the Sendai Framework’s four Priorities for Action.

Part 3 of the Thematic Review addresses the relationship of planetary boundaries and the systemic nature of risk with the key regimes noted above. Each of the regimes is described in terms of how planetary boundaries and systemic risk has or has not been integrated therein, the opportunities for elevating risk-informed decision-making and improving synergies between the regimes. Part 3 also consolidates the overarching messages for operationalising the planetary boundaries paradigm in these key regimes.
Key observations drawn from the Thematic Study

The landscape of the systemic nature of risk
In the years following the adoption of the Sendai Framework in 2015, our understanding of the global risk landscape has changed significantly. Planetary boundaries science is now detecting the first flashing warning lights on the Earth System dashboard, telling us humanity is already pushing beyond our world’s safe operating space for multiple planetary boundaries and approaching tipping points. These are not only challenging existential and ecosystem limits, but ultimately compromising the planet’s capacity to support humanity (Global Challenges Foundation, 2022).

The impacts of anthropogenic climate change on natural disaster risk have accelerated notably in the time since, whilst the world has witnessed effects of the Covid-19 pandemic cascading across different sectors of society. This highlights the need for better understanding and consideration of the systematic nature of risk, and the planetary tipping points which exist across the various interconnected and interdependent Earth Systems.

Despite progress, risk creation is outstripping risk reduction. Disasters, economic loss and the underlying vulnerabilities that drive risk, such as poverty and inequality, are increasing just as ecosystems and biospheres are at risk of collapse. Global systems are becoming more connected and therefore more vulnerable in an uncertain risk landscape.

Despite commitments to build resilience, tackle climate change and create sustainable development pathways, current societal, political and economic choices are doing the reverse. Intensive and extensive risks are growing at an unprecedented rate. Human actions continue to push the planet towards its existential and ecosystem limits, intensifying risk. In the face of intensifying climate change impacts and increasing system threats, we need to reflect the systemic nature of risk in how we deal with it.

The pandemic demonstrates how unmanaged risks can ricochet across systems in a disaster event, amplifying crises. What began as a health crisis has now had severe effects on economic and social systems and food security, hindering the achievement of multiple SDGs and highlighting the need to identify and prevent the creation of new risk, whilst simultaneously reducing existing risk.
Understanding the potential for cascading impacts and developing ways to isolate, measure, manage and prevent systemic risk has become a new challenge. Traditional approaches to governing risk are being overwhelmed by the compounding and cascading nature of systemic risk and the decisions that flow from it, which also contribute to reaching thresholds and tipping points. The interconnectedness of the networks that run through all of today’s systems amplifies this challenge. The climate emergency and the systemic impacts of the COVID-19 pandemic point to a new reality, where understanding and reducing risk in a world of uncertainty is fundamental to achieving genuinely sustainable development. The best defence against future shocks is to transform systems now, to build resilience by addressing climate change, biodiversity loss and pollution and to reduce the vulnerability, exposure and inequality that drive disasters.

The importance of the planetary boundaries framework

The Planetary Boundaries framework provides insight about the complexities of the Earth System, and can provide the Sendai Framework with guidance on how best to manage the systemic nature of risk and promote resilience. Planetary boundaries provide a powerful framework that defines limits beyond which humanity must not transgress if we are to sustain the life support systems for the human species.

Planetary boundaries are interrelated geophysical and biological parameters, which are coupled in a complex network of interacting Earth system processes that interact in abrupt and non-linear ways. The knowledge of how planetary boundaries interact is helping to deepen understanding about the vulnerabilities of the complex Earth system to systemic risk, the imperative of understanding interacting planetary boundaries and the challenges of safeguarding the integrity of Earth’s life-support systems.

With reinforcing loops triggering more complicated cascades of change, we are now pushing the planet away from the Holocene state of relative equilibrium and into the unknown and perilous world of the Anthropocene where the risk of the whole planet system collapsing is becoming more plausible. Seen through a planetary boundaries lens, we are beginning to understand how these cascades and feedbacks are amplifying human impacts on the Earth system. Ultimately this means a significantly smaller and potentially less reliable safe operating space for future human impacts on the Earth system.
If the Sendai Framework is to be fit for purpose, robust disaster risk/resilience policy interventions and institutions must be grounded in the *new insights of Earth system dynamics*. This is essential if we are to reduce human perturbations, navigate humanity away from a “hothouse Earth” and *towards a resilient and sustainable future* and thereby avoid planetary collapse.

The implication for global regimes like the Sendai Framework, the SDGs, the Paris Agreement, and the post-2020 Global Biodiversity Framework is that they must do more to foresee harm instead of only addressing it in an “ex post facto” approach. They must become fully functioning adaptive systems, which more effectively:

- Manage coupled natural and social systems.
- Respect planetary tipping points.
- Understand the dynamic interconnections of Earth system components.
- Embrace the complexity of interacting planetary boundaries
- Safeguard the integrity of Earth’s life-support systems.

**The contextual shifts needed to elevate risk-informed development and enhance resilience**

By drawing on planetary boundaries insights, we can improve efforts to manage the interconnected risks of the Anthropocene, whilst preemptively mitigating future disaster risk by reducing the likelihood of tipping key Earth systems into unstable states due to human pressures.

However, in order to do so requires rethinking how we manage systems across all facets of society, from reorganising financial and governance structures so that they recognise the intrinsic value of nature, to considering how we utilise and safeguard digital systems in an increasingly cyber-connected world. The Sendai Framework has an important and continuing role to play in laying the groundwork for these transformative changes, which are described accordingly.

**Transforming our relationship with nature**

- We have collectively failed to engage with nature sustainably, to the extent that our demands far exceed its capacity to supply us with the goods and services we all rely on. This has driven the ecological decline of the past half-century and beyond and
led to the emergence of major new risks.

- Redefining the relationship between people and nature will require redressing this imbalance and risk-informing the choices we make. Deep changes across societies, economies and communities must be taken to achieve this shift: how we live in our cities, how we produce food, how and what we learn, and the knowledge and rights that inform our choices.

- Planetary boundaries provide an important conceptual framework within which to understand that necessary shift in values. The imperative to restore our relationship with nature has particular relevance for planetary boundaries. In the Anthropocene biosphere, society must be viewed as part of the biosphere, not separate from it. Humans are not just linked with nature, but “intertwined across temporal and spatial scales” (Folke et al., 2021, p.837).

**Transforming our understanding of systemic risk**

- The systemic and uncertain risks facing the world today can have cascading impacts across systems and sectors. An integrated perspective that incorporates the inherently complex nature of climate-related and other natural and man-made hazards, vulnerability, exposure and impacts, is needed to better understand and respond to systemic risk.

- The era of hazard-by-hazard risk reduction is over. We need to improve our understanding of anthropogenic systems in nature. We must identify precursor signals and correlations to better prepare, anticipate and adapt. Understanding the degree of cascading risk and developing ways to isolate, measure and manage or prevent systemic risk is a new challenge. The interconnected nature of the systems of today amplifies this challenge.

- The planetary boundaries framework helps us to understand the complexity, instability and unpredictability of complex Earth system dynamics. Against this backdrop, deepened understanding of the interrelated geophysical and biological parameters provides important insights about vulnerabilities of the complex Earth system to risk of a systemic nature, the imperative of understanding interacting planetary boundaries and the challenges of safeguarding the integrity of Earth’s life-support systems (Kim & Kotzé, 2020).
Transforming financial systems

- Many systemic risks, including the transgression of planetary boundaries, are driven in part by dysfunctional aspects of the financial system, such as the short-termism, paramountcy of self-interested behaviours and outdated tools. These tools include cost-benefit analyses or discount rates, which “impede looking beyond a time horizon of a few years or using alternative indicators than purely monetary ones” (Chenet, 2019, p.8).

- Archaic linear and fossil-based economic and finance models of the past are no-longer an option in a world of increasing planetary crisis, climate risks, growing socio economic uncertainties, inequalities and poverty. One of the most important starting points for transformation of the financial system is to correct the gross misallocation of capital that is depleting natural resources and ecosystems, and which in turn are fuelling disaster risk around the world.

- Transforming economic systems is essential to address the triple planetary crisis. An economic system governed only by metrics of GDP and growth rates is not compatible with a risk-informed sustainable, nature-positive and carbon neutral development pathway. It fails to reflect the real cost of risk, the multiple monetary and non-monetary values of ecosystem services, the global public goods that sustain life on earth, and the fact that investments in risk reduction pays off.

Transforming global environmental governance

- What is new about the risk landscape is that humans are facing a planetary emergency for the first time in our history. With human pressures reaching dangerous levels, “we see signs that humanity may no longer be able to count on the capacity of the biosphere to continue dampening greenhouse gas emissions and hold onto its carbon stocks.”(Rockstrom et al., 2021, p.2).

- The novel challenges of Earth system transformation require a fundamental transformation of the systems of global environmental governance which were inadequate in the Holocene, more so now that we have entered the Anthropocene with the new set of global risks and insecurities posed by the complex, multidimensional intertwined social, digital, economic and environmental challenges of the 21st century.
The sheer complexity of global catastrophic risk is overwhelming conventional environmental governance systems, which were originally designed to address incremental environmental change, rather than non-linear processes and the complex interactions between planetary boundaries.

With at least four planetary boundaries now having been transgressed, it is clear that global environmental governance must discard outdated assumptions of Holocene stability, and instead embrace complexity, instability and unpredictability as the new normal.

The Sendai Framework provides an important window of opportunity for transformative change in the way that disaster risk is governed. Increasing the adaptability of governance processes to deal with the interconnected social-ecological dimensions of the Earth system is an important first step.

**Integrating a resilience approach into other global environment and development processes**

The Sendai Framework presents a disaster risk governance and management paradigm to be applied across international and national agendas and sectors. The Sendai Framework has at its core the importance of integrating risk reduction in other approaches and agendas, for example those pursuing poverty reduction, sustainable development, efforts to address climate change, public health, food and nutrition, not to mention the centrality of disaster risk reduction to the sustainable development of SIDS, LLDCs and LDCs.

However, the parallel development of key global agendas such as the SDGs, the Paris Agreement, the post-2020 Global Biodiversity Framework, Financing for Development, One Health have been constrained because of the limited coherence between these processes. It is becoming increasingly evident that new efforts are needed to replace the business-as-usual/siloed approaches in order to build synergies and mutually beneficial opportunities across policies and practices, and most importantly to advance risk-informed decision making at all scales and in all spheres.
Risk and resilience can serve as useful framing concepts for addressing crises more proactively and for supporting United Nations system-wide efforts to achieve the 2030 Agenda and all of the key global environment and development processes. When combined with effective efforts to make progress on the Sustainable Development Goals, it could help promote a more comprehensive and integrated system-wide engagement, as called for by the 2030 Agenda. By putting resilience at the core of planning, as opposed to one of adaptation, sustainable development or disaster risk reduction, actors can pursue solutions that contribute to all of the global sustainability agendas.
Part 1 - Understanding the planetary boundaries framework

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1.1. About the planetary boundaries framework

The origins
First developed in 2009 by an international team of scientists led by Dr. Johan Rockström, the planetary boundaries framework defines a safe operating space for humanity based on the “intrinsic biophysical processes that regulate the stability of the Earth system” (Steffen et al., 2015, p.1). In 2015, a group led by Will Steffen and Johan Rockström published an update of the initial research with some adjustments and elaborations. This work focused on the underpinning biophysical science which had evolved significantly in the previous five years. It articulated for several of the boundaries “a two-tier approach, reflecting the importance of cross-scale interactions and the regional-level heterogeneity of the processes that underpin the boundaries” (Steffen et al., 2015, p.1).

The planetary boundaries framework provides important insights into the complexity of the Earth system. The biosphere is understood and analyzed in terms of its “biogeochemical cycles and self-regulating ecological systems, its physical circulation
systems, and its biophysical features.” The concept highlights the fact that these processes are characterised by “non-linear, often abrupt dynamics are set in motion that cause the planet to depart from what is called the “safe operating space”” (Brand et al., 2021, p.4).

The scientific underpinnings
The planetary boundaries framework is grounded in rigorous scientific research drawing from extensive empirical studies in the Earth sciences, ecological economics, and theories of complex systems resilience. The original research publications have been cited hundreds of times, and prompted the publication of many other scientific publications. The planetary boundaries research has also catalysed rigorous exploration of planetary boundaries from many disciplinary perspectives, demonstrating a “strong demand for improved knowledge and quantification or characterization of complex systemic behaviour”, alongside “the limitations of current tools (models, Earth observation products, monitoring networks, and other data)” (Cornell, 2015).

The nine planetary boundaries
Nine planetary boundaries have been identified as critical for maintaining the relatively stable, albeit dynamic, equilibrium of the Earth system (i.e. climate change, rate of biodiversity loss, interference with the nitrogen and phosphorus cycles, stratospheric ozone depletion, ocean acidification, global freshwater use, change in land use, chemical pollution, and atmospheric aerosol loading) (Rockström, 2009). For each of these processes, measurable ‘boundaries’ of anthropogenic perturbations are defined, beyond which the risk of destabilisation of the Earth System on a planetary scale increases dramatically (Rockström, 2009).

Earth system science has now confirmed that we have definitively transgressed planetary boundaries for four of the nine geophysical processes (biosphere integrity, biogeochemical flows, climate change, and land-system use change) that are “essential to maintaining the Earth’s atmosphere, oceans and ecosystems in the delicate balance that has allowed human civilizations to flourish” (Asher, 2021). Additional boundaries that probably have been transgressed are ocean acidification and freshwater use. In the 2015 assessment of the PBs, ocean acidification was rapidly approaching the boundary itself. Since then, emissions of CO2 have continued to increase, with the oceans absorbing about 25% of these emissions, thus causing ocean acidification to increase, most likely beyond its boundary value. Additionally, ongoing research has suggested that we may have breached the novel entities boundary (Persson et
al., 2022, p.1) as well as a newly-proposed sub-boundary (green water) within the freshwater boundary (Wang-Erlandsson et al., 2022, p.2).

Most recently, an international research team led by Professor Johan Rockström et al have confirmed in a new analysis published in Science that multiple climate tipping points could be triggered if global temperature rises beyond 1.5°C above pre-industrial levels (Mckay et al., 2022).

The new analysis indicates that Earth may have already left a ‘safe’ climate state when temperatures exceeded approximately 1°C warming. The international research team synthesised evidence for tipping points, their temperature thresholds, timescales, and impacts from a comprehensive review of over 200 papers published since 2008, when climate tipping points were first rigorously defined. They have concluded that the tipping points which may be triggered at today’s temperatures include: melting of the Greenland and West Antarctic ice sheets, widespread abrupt permafrost thaw, collapse of convection in the Labrador Sea, and massive die-off of tropical coral reefs. Altogether, this shows humanity is rapidly pushing beyond our world’s safe operating space for multiple planetary boundaries and is quickly approaching irreversible tipping points (Mckay et al., 2022).

1.2. The overarching value of the planetary boundaries framework

Deepened understanding of the Earth system
Unlike other global change assessments, which still embed assumptions of linear trends, the planetary boundaries framework is deepening our understanding of the Earth system in several ways. The nine planetary boundaries themselves represent a collective manifestation of the complex Earth system. As a “system of systems”, the Earth system itself is characterised by geo-physical boundaries that are neither isolated, nor lone-standing entities. Instead they are coupled in a complex network of interacting Earth system processes that interact in complex, abrupt and non-linear ways.
Against this backdrop, deepened understanding of the interrelated geophysical and biological parameters provides important insights about vulnerabilities of the complex Earth system to risk, the imperative of understanding interacting planetary boundaries and the challenges of safeguarding the integrity of Earth’s life-support systems (Kim & Kotzé, 2020).

Transformation of decision-making processes
The planetary boundaries framework is helping to accelerate the recognition and acceptance of environmental limits in policy-making at all scales. Planetary boundary metrics are increasingly recognized as essential for “tracking planetary well-being and biophysical resource use” and for establishing the basis of robust “absolute decoupling and transformational transitions of social norms (i.e. sustainable per capita consumption lifestyles)” (Li et al., 2021, p.10).

The value of the planetary boundaries concept is also reflected in the extent to which it is starting to transform decision-making processes and behaviour change. It has widened the political and academic debate on the ecological crisis beyond climate change to a more comprehensive account of ecological and biogeochemical forces induced by human pressures. It has also drawn attention to the fact that human societies have become dependent for their flourishing on the “stable environmental conditions” – “i.e., ecological and geological conditions – of the Holocene and that there are identifiable thresholds within which this stability is secured” (Brand et al., 2021). This framing stresses the deep connections between geology and biology (Chakrabarty, 2020) and has inspired scholars from the humanities and social sciences to analyse interconnections between human and non-human agents in a critical dialogue with the natural sciences (Haraway and Tsing 2019).

Examples of uptake of the planetary boundaries framework
- Since its original publication in 2009, planetary boundaries have received widespread attention from policy-makers and institutions. Notably, there have been well over 200 scholarly articles that “substantially engage, apply and build on the planetary boundary concept” (Li et al., 2021, p.2). Additionally, there are over 45 studies that develop life cycle assessment methods with many closely linked to planetary boundaries framing.

- At the global level, numerous analyses have been conducted to demonstrate the importance of achieving the SDGs within the ambit of the planetary boundaries. Planetary boundaries research has also elevated the importance of meta-level
transformation for long-term success of the SDGs, especially in light of predictions that the world will not reach the SDGs by 2030 nor by 2050 and that the global safety margin will continue to decline unless transformative change of the economic and financial systems is achieved (Randers et al., 2018). Planetary boundaries research is increasingly cited in UNDP publications including the 2022 UN Human Development Report and the UNDP Special 2022 Report “New threats to human security in the Anthropocene: the concept of the Anthropocene” which focuses on the new risk landscape wherein humans have now become central drivers of planetary change.

- The UN Environment’s sixth Global Environment Outlook “Healthy Planet, Healthy People” embeds planetary boundaries throughout the report which focuses on the inextricable link between the environment and human survival and progress. Some of the key planetary boundaries messages that are framed throughout GEO-6:
  - “The need for humanity to remain within the planetary boundaries’ safe operating space and the need to eradicate poverty and accelerate social and economic development are linked by the concept of “a safe and just space for humanity.”
  - “Current methods of generating material prosperity have undermined ecosystem health and caused massive environmental damage, crossing several of these planetary boundaries, to the point where the development of human societies and the ‘safe operating space’ for human life on Earth is at risk”.
  - Current economic pathways are “simply not sustainable in a world already crossing planetary boundaries on a number of dimensions, a situation which threatens to undermine economic growth if not addressed”.

GEO-6 emphasises that integrated and systems-based approaches are essential to enable cross linkages to be explored and system-wide effects to be managed, “so that policies can effectively support a number of social, economic and environmental goals to support human well-being, ensuring that various preconditions for this well-being are in place” (UNEP, GEO-6, 2018, p.5).

- Equally, there have also been a growing number of efforts to operationalise planetary boundaries at regional, national, sub-national, city, sector, company to product levels (Li et al, 2021). For example, planetary boundaries uptake at the EU level has been particularly significant. The EU’s 8th Environment Action Programme, the legally agreed common agenda for environment policy until 2030 explicitly states that the “long-term priority objective is that, by 2050 at the latest, Europeans
live well, within planetary boundaries, in a well-being economy where nothing is wasted” (European Commission, “Environment action programme to 2030”, 2022).

- Planetary boundaries science also lies at the core of the European Environment Agency’s report “The European Environment state and outlook 2020”. The report anchors its sustainability vision of ‘living well within the limits of the planet’. The report urges European countries to put Europe back on track to meeting its medium and longer-term environmental policy goals and targets to avoid irreversible change and damage. The report also features a standalone sub-chapter in its scene setting: ‘Is Europe living within the limits of the planet?’ which assesses Europe’s environmental footprints in relation to planetary boundaries. The report provides insights into understanding how the concept of planetary boundaries can be operationalised in Europe and reaches the conclusion that “Europe has achieved high levels of human development (‘living well’)” but at the expense of “overshooting its share of global SOS for several PBs, even under generous assumptions of assigned shares” (European Environment Agency, “The European Environment state and outlook 2020”, 2020), with Europe currently exceeding its limits for the nitrogen, phosphorus and land systems boundaries and did not overshoot the freshwater boundary.

- At the country level, several national governments have begun efforts to operationalise planetary boundaries at the national level, including Switzerland, Sweden, the Netherlands, Australian cities, South Africa, Finland, New Zealand (Li et al, 2021, p.4). The focus has been on downscaling, translating and applying the planetary boundaries to their respective national contexts, In many of these cases, the planetary boundaries framework is increasingly regarded as the essential underpinning of environmental governance regimes.

- In the private sector, there is widespread uptake by the energy and power sector of the planetary boundaries, especially the climate change boundary and equally among producers of consumer goods such as L’Oréal, Alpro, Mars, Unilever (Li et al, 2021, p.4).
1.3. The value of planetary boundaries for understanding the systemic nature of risk

**Understanding the role of humans in the new risk landscape**

One of the defining characteristics of the risk landscape is that we are living in an age where despite some progress “risk creation is outstripping risk reduction” (UNDRR, GAR 2022, p.xiii). Seen through a planetary boundaries lens, the challenge in this new risk landscape is that disasters, economic loss, poverty and inequality are increasing “just as ecosystems and biospheres are at risk of collapse” (UNDRR, GAR 2022, p.xiii).

The planetary boundaries framework provides an important basis for understanding just how perilous the risk landscape actually is at present. It is characterised by the increasing transgression of individual boundaries. Humanity has passed at least four of the nine biophysical limits that have enabled the Earth system to function in a stable, Holocene-like state. As a result, humanity has propelled itself into the so-called Anthropocene, where anthropogenic forces are pushing “coupled human-environmental systems beyond thresholds of known stability and into zones of non-linear and potentially “catastrophic” environmental change” (Rockström, 2021).

Planetary boundaries science is now detecting the first flashing warning lights on the Earth System dashboard, “telling us humanity is already pushing beyond our world’s safe operating space for multiple planetary boundaries and approaching tipping points” (Asher, 2021). These are not only challenging existential and ecosystem limits, but ultimately compromising the planet’s capacity to support humanity (Global Challenges Foundation, 2022).

COVID-19 is a manifestation of the Anthropocene, where “unsustainable exploitation of natural habitats, human trade, and risky handling of animals colliding with a globalized, hyper-connected world of travel and trade have created the perfect conditions for risks to emerge and spread” (Rockström & Matthews, *From risk to resilience*, 2021).

**The pathway towards resilience**

Without increased action that is focused on building resilience to systemic risk, we will start to hit the “ceiling of the hardwired biogeochemical processes and systems that regulates the state of the planet” (Rockström, 2009). However, instead of reducing risk and building resilience, our societal, political, economic and financial systems continue to steer us in a dramatically different
direction. We are challenging existential and ecosystem limits, thereby “compromising the planet’s capacity to sustainably support” humanity (Global Challenges Foundation, 2022).

The first priority for building resilience in a planetary boundaries framework should be to actually avoid transgressing the remaining boundaries. How we manage to do that depends on our understanding of where we are falling short in building resilience to future shocks and stresses. Most post-COVID recovery plans are focused on returning to pre-crisis states but do little to build resilience to future shocks.

It is equally important that we deepen understanding of underlying risk drivers. This means focusing on how our economies and financial systems create and aggravate vulnerability and increase disaster risk instead of how best to reduce risk and build resilience to the new risk landscape. The scale and magnitude of interconnections and interdependencies that are now unfolding around the world underscore the need to improve and evolve our understanding of “the full topography of risks through time” to ensure that we better prepare, anticipate and adapt (Gordon, 2020). At no time in the history of human civilization has this been more important because the COVID-19 pandemic has demonstrated the extent to which most countries were ill-prepared to deal with multiple overlapping and cascading crises.

**Planetary boundaries reinforce importance of restoring our flawed relationship with nature**

The importance of renewing humanity’s relationship with nature has been elevated in recent years by high-level processes such as the Dasgupta Review on the Economics of Biodiversity, the recent negotiations on the Post-2020 Global Biodiversity Framework, the UN General Assembly annual debates on the importance of living in harmony with nature, and the 2019 IPBES Global Assessment Report on Biodiversity and Ecosystem Services.

All of these authoritative processes point to how this flawed relationship stems from the way we view nature, as a source of goods and services to be exploited and as a resource that should "work" for humans, with humanity positioned in perpetual dominance. The Dasgupta Review views nature as an asset comparable to produced capital and “recognises that nature is more than a commodity. It has an intrinsic value that rests in its very existence” (Dombrowski, 2021). But the Review also recognizes that recognition of the intrinsic value depends on a profound change in human values.
Planetary boundaries provide an important conceptual framework within which to understand that necessary shift in values. In the Anthropocene biosphere, society must be viewed as part of the biosphere, not separate from it. Humans are not just linked with nature, but “intertwined across temporal and spatial scales” (Folke et al., 2021, p.837). Related to this understanding of our place within the biosphere is the recognition that the “environment is not something outside the economy or society, or a driver to be accounted for when preferred, but rather the very foundation that civilizations exist within and rely upon.” (Folke et al., 2021, p.836).

In the Anthropocene, because humans have become the dominant geological force, we now have an even stronger stewardship responsibility to enhance biosphere resilience and to “work towards stabilizing the Earth system and its biosphere in a state that, hopefully, is safe for humanity to operate within, albeit a warmer state than the Holocene and one with a human-dominated biosphere” (Folke et al., 2021, p.844). Equally, the relevance of restoring our relationship with nature for the goals of disaster risk reduction is clear. Nature has always been our strongest defence against disaster risk. The potential of nature-based solutions for disaster risk reduction shows that biodiversity provides us with resilience and safety nets (CBD, 2021). All the more reason why we must urgently transform our flawed relationship with nature and view and value nature as an indispensable ally in collective efforts to reduce risk and build resilience. This shift in values is essential in managing emerging risks, improving risk reduction and resilience building efforts around the world.

1.4. The importance of planetary boundaries for elevating risk-informed sustainable development

The importance of a risk informed and integrated approach to sustainable development
The integration of disaster risk reduction in sustainable development strategies through risk-informed decision-making is a critical element to ensure implementation of the 2030 Agenda and other closely related global mandates. Decision-making processes at all scales need to be risk-informed in order to address the triple planetary threat and achieve the objectives of sustainable development sustainability, resilience building, poverty eradication and leaving no one behind.

Because risk creation is created from the complex interactions between social and economic processes, and the natural environment, aligning policy for implementation of the Sendai Framework, the Paris Agreement, the SDGs and other global agreements is critical
for substantially improving risk reduction and enhancing our ability to deal with systemic and cascading risks (Handmer et al., 2019, p.5).

The transformation from the focus on reducing hazards and risks to catalysing risk-informed sustainable development has highlighted the importance of not just reducing all types of risk, but building resilience and reducing inequalities. The global policy environment is much different than it was before 2015 and the adoption of the Sendai Framework, the Paris Agreement and the SDGs (DRR, “Risk-informed Sustainable Development and Planetary Health”, 2021, p.20), and the Sendai Framework’s aim to promote the integration of a strengthened risk-informed approach in sustainable development is now more important than ever.

Equally, planetary boundaries science plays a critical role in deepening understanding of the profound changes in the global risk landscape where the trend is towards complex and systemic risks whose impacts cascade through social, economic and environmental systems (Folke et al. 2021). Seen from a planetary boundaries lens, the growing interconnectivity and interdependence across and within human, technological and biophysical systems and the potential for physical and socioeconomic tipping points underscores the imperative of broadening the risk reduction imperative beyond the traditional domain of disaster risk reduction and into the spheres of consumption and production, population growth, biodiversity loss, ecological degradation, disease outbreaks, food insecurity, political instability and conflict, financial instability and inequality. These are all factors that are increasing exposure and vulnerability to disasters and eroding development progress across the world. “A risk-informed and prevention-oriented approach to economic, climate and development policy at all levels enables transformation towards a world where fewer hazards trigger disasters. Investing in DRR and its integration at the core of the implementation of the Sustainable Development Goals (SDGs) is a prerequisite for developing sustainably.” (UNDRR, “A Risk-Informed Approach to Development in a COVID-19 Transformed World”, 2022, p.2).

The pathway towards strengthening the integration of risk-informed decision-making in other policy spheres
The biggest task for The Sendai Framework in terms of risk reduction is to increase its influence in decision making in other global regimes, driving a more integrated, coherent direction towards building risk. However, risk science on its own cannot achieve this goal. The pathway towards integrating risk-informed decision making requires a wider range of scientists, regime-specific experts and member states and civil society to work outside their traditional policy domain and networks.
Because resilience does lie at the heart of the global regimes, resilience should be elevated as a unifying force for global sustainability regimes, enabling key parties to explore and implement mutually reinforcing policy. Resilience provides a means of “building linkages and coordination to increase their effectiveness individually and collectively”. Tools are being developed to enable the use of shared targets and indicators across the agendas and allow for alignment of policy and management processes in practice. This in turn will help to overcome siloed approaches that have previously characterised the domains of climate change, disaster risk reduction and sustainable development (Le Tissier & Whyte, 2022, *Why Does Making Connections Through Resilience Indicators Matter?*, n.p.). Equally important is the need for deeper interdisciplinary analysis to support a “more holistic understanding of risk, identifying and controlling cascading and systemic risk across sectors” (ISC, n.d., *Policy Brief: Achieving Risk Reduction Across Sendai, Paris and the SDGs*). This necessarily involves governments addressing existing regimes horizontally and vertically with new forms of coordination in the form of inter-agency task forces and inter-ministerial coordination mechanisms (ESCAP, 2018, *Policy coherence for disaster risk reduction and resilience: from evidence to implementation*).

### 1.5. Planetary boundary insights for the Sendai Mid-Term Review

- If the Sendai Framework is to be fit for purpose, robust disaster risk/resilience policy interventions and institutions must be grounded in the new insights of Earth system dynamics. We need to improve and evolve our understanding of the full topography of risks through time to ensure that we better prepare, anticipate and adapt.

- The planetary boundaries framework provides an important basis for understanding just how perilous the new risk landscape actually is at present. This is essential if we are to reduce human perturbations, navigate humanity away from a “hothouse Earth” and towards a resilient and sustainable future, thereby avoiding planetary collapse.

- The implementation challenge for the Sendai Framework is how to improve effectiveness in keeping humanity from crossing planetary boundaries whilst at the same time, promoting awareness about the need for deep structural changes in and of society and its normative systems and related institutions that are necessary to navigate the Anthropocene. Another equally
important implementation challenge for the Sendai Framework is how best to promote and support the integration of risk reduction throughout the key global regimes.

- By drawing on planetary boundaries insights, we can improve efforts to manage the interconnected risks of the Anthropocene, whilst preemptively mitigating future disaster risk by reducing the likelihood of tipping key Earth systems into unstable states due to anthropogenic activity.

- Planetary boundaries also provide important insights about building resilience. The planetary boundaries implications for global regimes like the Sendai Framework is that they must do more to foresee harm instead of only addressing it in an “ex post facto” approach. They must become fully functioning adaptive systems, which more effectively:
  - Manage coupled natural and social systems.
  - Respect planetary tipping points.
  - Understand the dynamic interconnections of Earth system components.
  - Embrace the complexity of interacting planetary boundaries.
  - Safeguard the integrity of Earth’s life-support systems
  - Recast human societies as an integral, interacting component of a complex, adaptive Earth System and as indispensable ally in collective efforts to reduce risk and build resilience.
  - Navigate humanity away from a “hothouse Earth” and towards a resilient and sustainable future and thereby avoid planetary collapse.

- Planetary boundaries provide important insights about how keeping humanity in the safe operating space will require rethinking how we manage systems across all facets of society, from reorganising financial and governance structures so that they recognise the intrinsic value of nature, to considering how we utilise and safeguard digital systems in an increasingly cyber-connected world. The Sendai Framework has an important and continuing role to play in laying the groundwork for these transformative changes, which are described accordingly.
  - Transforming our relationship with nature
  - Transforming our understanding of systemic risk
○ Transforming economic and finance systems
○ Transforming global environmental governance

● Equally, the Sendai Framework’s approach to deepening resilience should include proactive, adaptive, holistic policies and practices that ensure:
  ○ “High level of diversity in terms of access to assets, inclusion in decision-making and the availability of economic opportunities” (UNDRR, Resilience, 2017).
  ○ “Blended forms of knowledge used to anticipate and manage change” (UNDRR, Resilience, 2017).
  ○ “Level of redundancy allowing areas to fail without leading to the whole system collapse (similar to the concept of residual risk)” (UNDRR, Resilience, 2017).
  ○ “Investing in diversity provides flexibility and the space for innovations to respond to change” (Rockström & Matthews, From risk to resilience, 2021).
  ○ Ensuring that “multiple options reinforce each other, thereby creating alternatives in the face of uncertain shocks and stresses” (Rockström & Matthews, From risk to resilience, 2021).
  ○ “Inclusivity and equity [...] for building trust and supporting collective action in responding to risk and change. More equal societies are less prone to instability and conflict” (Rockström & Matthews, From risk to resilience, 2021).
  ○ “Adaptive learning [to enable us] to detect changes, learn from them, and tailor strategies” (Rockström & Matthews, From risk to resilience, 2021).

● And finally, the Mid-Term Review provides an opportunity to catalyse shift in humanity’s relationship with nature by:
  ○ Reflecting on the transformative changes needed to keep humanity in a safe operating space.
  ○ Reflecting on the role that this shift in values will play in managing emerging risks to the Earth system improving risk reduction and resilience building efforts around the world.
  ○ Starting to think differently about human relationships with the greater Earth community, moving away from our purely extractive relationship with nature, towards an ethos of planetary stewardship to ensure collective, planetary well-being and health.
Reflecting on the transformative changes needed in our governance, economic, finance systems to promote the ethos of stewardship and to reflect nature's true value in these spheres and to ensure that decision-making in all spheres is risk-informed.
Part 2 – Planetary boundaries insights for the Sendai Framework for Disaster Risk Reduction

Inside Part 2 – Planetary boundaries insights for the Sendai Framework

2.1. Planetary boundaries insights for the Sendai Framework Outcome
2.2. Planetary boundaries insights for the Sendai Framework Goal
2.3. Planetary boundaries insights for the four Priorities for Action

2.1. Planetary boundaries insights for the Sendai Framework Outcome

The outcome for the Sendai Framework is described as follows:

*The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.*

As per the Sendai Framework, the realisation of the outcome requires “strong commitment and the involvement of political leadership” in all countries along with the creation of the necessary conducive and enabling environment. The planetary boundaries messages that are summarised in relation to the SF outcome consolidate the most essential insights from the latest planetary boundaries research.

The planetary boundaries insights below add urgency to the imperative of elevating political leadership in a moment in human history where “*We live in an era of great contrasts. Never before have we faced catastrophic environmental risks on a planetary scale, and seldom has there been such potential for innovation to allow us to avert serious risks*” (Rockström, 2022).
The regularly updated scientific underpinnings of the planetary boundaries framework have proven essential to inform and support the sustainability goals of the Sendai Framework as well as other key global agreements such as the SDGs, the Paris Agreement, the post-2020 Global Biodiversity Framework, Addis Ababa Agenda for Financing for Development, One Health Initiative and the UN Decade for Water Action. Given worsening ecological decline trends, it is clear that planetary boundaries science is needed more than ever to redress severe implementation gaps, especially where problematic trends are not being halted or reversed.

Providing the environmental limits within which humanity can safely operate, the planetary boundaries framework provides an important basis for deepening understanding of the new systemic risk landscape, which is reflected by the increasing transgression of planetary boundaries.

These messages highlight how new forms of leadership are essential to ensure that disaster risk reduction and resilience building ambition levels are massively scaled up at all scales.

### Planetary boundary insights in relation to the Sendai Framework outcome

The planetary boundaries framework provides a new understanding just how perilous the new risk landscape actually is at present. Seen through the lens of planetary boundaries, the new era of risk is not just characterised by cascading impacts. It is marked by the increasing transgression of individual boundaries, which are not only challenging existential and ecosystem limits, but ultimately compromising the planet’s capacity to support humanity.

Humanity is fundamentally changing the Earth’s geo-physical properties, “overwhelming its capacity to provide ecosystem services and support life on Earth. The key challenge for humans in the Anthropocene is to avoid pushing ecosystems or the entire Earth system across tipping points. In the Anthropocene, humans have become the dominant geological force, therefore we now have an even stronger stewardship responsibility to enhance biosphere resilience and to “work towards stabilizing the Earth system and its biosphere
in a state that, hopefully, is safe for humanity to operate within, albeit a warmer state than the Holocene and one with a human-dominated biosphere”

<table>
<thead>
<tr>
<th>The defining characteristic of the new global risk landscape is that we are living in an age where despite some progress “risk creation is outstripping risk reduction”. Seen through a planetary boundaries lens, the challenge in this new risk landscape is that disasters, economic loss, poverty and inequality are increasing “just as ecosystems and biospheres are at risk of collapse”.</th>
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<tr>
<td>As the UN Secretary-General has frequently stated, “Humanity is waging war on nature. This is suicidal. Nature always strikes back – and it is already doing so with growing force and fury”. Making peace with nature is the defining task of the 21st century. However this must start with transforming humanity’s deeply flawed relationship with nature.</td>
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<td>Humanity’s flawed relationship stems from the way we view nature, as a source of goods and services to be exploited and a resource that should &quot;work&quot; for humans, with humanity positioned in perpetual dominance over it. The Dasgupta Review views nature as an asset comparable to produced capital and “recognises that nature is more than a commodity. It has an intrinsic value that rests in its very existence”. However the full recognition of the intrinsic value depends on a profound change in human values.</td>
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<tr>
<td>Our flawed relationship with nature means that instead of reducing risk and building resilience however, our societal, political, economic and financial systems continue to steer us in a dramatically different direction. We are challenging existential and ecosystem limits, thereby “compromising the planet’s capacity to sustainably support” humanity.</td>
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<td>The change in values starts with an understanding of humanity’s place within the biosphere. The environment is not something outside the economy or society, or a driver to be accounted for when preferred, but rather the very foundation that civilizations exist within and rely upon.</td>
</tr>
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<td>The change in values will be essential to transforming economic and financial systems in order to address the triple planetary crisis. They continue to be governed only by metrics of GDP and growth rates that are not compatible with a risk-informed, sustainable, equitable, nature-positive and carbon neutral development pathway. They fail to reflect the real cost of risk, the multiple monetary and non-monetary values of ecosystem services, the global public goods that sustain life on earth, and the fact that investments in risk reduction pays off.</td>
</tr>
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</table>
The new risk landscape requires a fundamental transformation of global environmental governance, which was inadequate in the Holocene, more so now that we have entered the Anthropocene with the new set of global risks and insecurities posed by the complex, multidimensional intertwined social, digital, economic and environmental challenges of the 21st century. With at least four planetary boundaries now having been transgressed, it is clear that global environmental governance must discard outdated assumptions of Holocene stability, and instead embrace complexity, instability and unpredictability as the new normal.

### 2.2. Planetary boundary insights in relation to the Sendai Framework goal

The Sendai Framework highlights one central goal to guide the achievement of the expected outcome of the Sendai Framework:

> Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience.

As per the Sendai Framework, the achievement of this goal requires the enhancement of the “implementation capacity and capability of developing countries” including the mobilization of support through international cooperation to support national implementation. The planetary boundaries messages consolidated below provide a scientific underpinning of the essential pre-conditions for strengthening implementation of the Sendai Framework.

### Planetary boundary insights in relation to the Sendai Framework goal

After decades of increasing frequency and amplitude of extreme events, from rising global environmental change to COVID-19, the big development since 2015 is the increasing recognition that the Earth system is moving from a relatively stable state to a relatively unstable one. COVID-19 is a manifestation of the Anthropocene where “unsustainable exploitation of natural habitats, human trade, and risky handling of animals colliding with a globalised, hyper-connected world of travel and trade have created the perfect conditions for risks to emerge and spread”.

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The development of robust evidence, innovation and knowledge on planetary boundaries and their complex interactions is essential to deepen understanding of the complexity of the Earth system and the new systemic risk landscape.

The scale and magnitude of interconnections and interdependencies that are now unfolding around the world underscore the need to improve and evolve our understanding of “the full topography of risks through time” to ensure that we better prepare, anticipate and adapt. The systemic and uncertain risks facing the world today can have cascading impacts across systems and sectors. An integrated perspective that incorporates the inherently complex nature of climate-related and other natural and man-made hazards, vulnerability, exposure and impacts, is needed to better understand, prepare, anticipate and adapt to the systemic nature of risk.

Increased understanding of planetary boundaries is essential to support the conceptual shift from managing disasters to managing disaster risk, strengthening prevention and building resilient societies and ecosystems. Without increased action that is focused on building resilience to systemic risk, we will “hit the ceiling of the biophysical coping capacity of the whole Earth System”.

Systemic risk governance must overcome the false dichotomy between humans and their environment and embrace non-anthropocentric ethical care principles, which prioritise protection of the “more-than-human world” in addition to human well-being. Transformation of governance structures is essential to better reflect the value of nature in decision-making. Systemic risk governance must be strengthened to address the new global risks and insecurities that have been generated by transgression of key planetary boundaries.

Risk and resilience can serve as useful framing concepts for addressing crises more proactively and for supporting United Nations system-wide efforts to achieve the 2030 Agenda and all of the key global environment and development processes. When combined with effective efforts to make progress on the Sustainable Development Goals, it could help promote a more comprehensive and integrated system-wide engagement, as called for by the 2030 Agenda. By putting resilience at the core of planning, as opposed to one of adaptation, sustainable development or disaster risk reduction, actors can pursue solutions that contribute to all three global agendas. Sectoral approaches to planning, centred on resilience, provide an opportunity to foster better policy integration.

Transforming economic systems is essential to address the triple planetary crisis. An economic system governed only by metrics of GDP and growth rates is not compatible with a risk-informed sustainable, nature-positive and carbon neutral development pathway. One of the most important starting points for transformation of the financial system is to correct the gross misallocation of capital that is depleting natural resources and ecosystems, and which in turn are fuelling disaster risk around the world.
2.3. Planetary boundaries insights for the Sendai Priorities for Action

2.3.1 Overview of the planetary boundary insights relevant for the Sendai Priorities for Action

Planetary boundaries provide new insights about the complexities of the Earth system, which is essential for the Sendai Framework’s effectiveness:

- The knowledge of how planetary boundaries interact is helping to deepen understanding about the vulnerabilities of the complex Earth system to systemic risk.
- We are now beginning to understand how reinforcing loops are triggering complicated cascades of change, amplifying human impacts on the earth system and reducing our safe operating space for anthropogenic impacts on the environment.
- For the Sendai Framework to be fit for purpose, UNDRR should ground disaster risk/resilience policy interventions and institutions in the new insights of Earth system dynamics.

Planetary boundaries can provide important guidance for the Sendai Framework in managing the systemic nature of risk and promoting resilience:

- The Sendai Framework must be equipped to deal with a risk landscape that is in a constant state of flux. Now more than ever, we are operating in a world of unknowns. The capacity of Sendai to navigate the uncertain future which will be marked by many “yet-to-emerge or growing existential risks” will define its success or failure (Citi, 2021, p.14).
- Another key challenge for the Sendai Framework will be to deepen understanding of the interconnections between different categories of global risks and their interdependencies and feedback loops. This is an important foundation for improving risk assessment and risk mitigation planning (WEF, 2021, *Global Risks Report*, p.17).
- Planetary boundaries thinking encourages the embracing of systems thinking, in a manner that is equipped to deal with complexity and uncertainty. This is critical for understanding cascading risk and developing ways to manage it more effectively. This will require moving away “from an obsession with prediction and control” towards an embrace of a
three-dimensional shape of risk, that is increasingly characterised by “multiplicity, ambiguity and uncertainty” (Gordon, *Why do we need a new view to understand the systemic nature of risk?*, 2020).

- Since risk cannot be eliminated from systems, greater efforts will be needed to manage, monitor and of course prepare for the systemic risk. At the same time the “flip side of systemic risk is systemic recovery” (UNDRR, 2022, *Understanding and managing cascading and systemic risks: lessons from COVID-19*). This will be facilitated by greater efforts to: identify synergies; maximise co-benefits between different global regimes; understand risk interdependencies; and ultimately to enhance resilience across sectors and scales.

**Humans and nature are integral and interdependent components of the Earth system, meaning Sendai has an urgent role to help restore our relationship with nature:**

- The importance of transforming humanity’s relationship with nature should be formally recognized in intergovernmental processes.
- The UNDRR should encourage transformative changes in governance, economic and financial systems to promote the ethos of stewardship and to reflect nature's true value in these spheres.

**Transforming the finance system in accordance with planetary boundaries will ensure that investments are risk-informed:**

- To reduce the capital that is flowing towards the old carbon-economy, by encouraging a better, more purpose-driven and decentralised way of increasing risk-informed investment.
- Focusing on the importance of a resilient biosphere in financing decisions will help change our perceptions on risk, which in turn requires us to move away from archaic perspectives that our living biosphere is unaffected by economic and finance decision-making.

**Transforming global environmental governance for the Anthropocene will enable the Sendai Framework to promote biosphere resilience:**

- Coordination and coherence between international environmental institutions should be increased, to avoid protecting one boundary at the cost of another.
- Systematic risk governance should promote resilience by addressing the underlying drivers of environmental degradation, and ensuring that solutions are integrative and generate positive impacts at other scales, and in other sectors.
Governance that is fit for the Anthropocene should promote different metrics of growth, such as ‘well-being economics’ and ‘biosphere economics’ where biosphere resilience and human well-being are placed front and centre.

2.3.2 Specific recommendations for the four Sendai Framework Priorities for Action

1. Recommendations for Integrating planetary boundaries into Sendai Framework Priority for Action 1- Understanding disaster risk

The cascading impacts of risks across systems and sectors mean that the era of hazard-by-hazard risk reduction is over. We must identify precursor signals and correlations to better prepare, anticipate and adapt. Understanding the degree of cascading risk and developing ways to isolate, measure and manage or prevent systemic risk is the new challenge now faced by the world. The scale and magnitude of interconnections and interdependencies that are now unfolding around the world underscore the need to improve and evolve our understanding of “the full topography of risks through time” to ensure that we better prepare, anticipate and adapt (Gordon, 2020, Why do we need a new view to understand the systemic nature of risk?).

Message 1.1
Increased understanding of planetary boundaries supports the conceptual shift from managing disasters to managing disaster risk, strengthening prevention and building resilient societies and ecosystems

- Work with governments to design disaster risk reduction interventions as fully functioning adaptive systems that more effectively manage coupled socio-natural systems, respect planetary tipping points, understand the dynamic interactions of the Earth system and embrace the complexity and uncertainty of interacting planetary boundaries.
- Support governments to strengthen their scenario analysis development skills to develop effective DRR policy interventions and support governments to understand the complexity of risk, to determine the planetary boundary impact or GCR impact on key global targets. This also helps generate potential future interventions that have implications for ecosystems and human well-being.
- Strengthen coherent and coordinated approaches that will help catalyse the shift from managing disaster to managing risk.
- Governments are supported in translating planetary boundaries into national level policy targets.
- When translating planetary boundary processes to the scales needed for implementation, governments should examine each of the biophysical, socio-economic and ethical dimensions separately before determining the analytical tools and integrative techniques needed to preserve connections and build bridges across these different dimensions.
- Increased coordination and cooperation, not just horizontally across goals, targets and sectors, but vertically across scales and regions.

**Message 1.2**
Robust evidence, innovation and knowledge on planetary boundaries and their complex interactions deepens understanding of the complexity of the Earth system, and the new systemic risk landscape.

- Contribute to planetary boundaries scientific research in conjunction with scientific and technical organisations and other partnerships. Provide support to governments to assess if they are living within their safe operating space. National level transgression of planetary boundaries will often differ significantly from the global level, but they should be used as a starting point to define rigorous national policy targets and disaster risk reduction objectives.
- Support governments and key stakeholders to strengthen capacity for risk assessments and analyses that consider the relevance of planetary boundaries for understanding new insights of Earth system dynamics.
- Encourage measurement of environmental accounting of countries’ impact on both national and international level.
- An open-source method to develop climate risk assessment should be combined with a framework to identify opportunities for key stakeholders.
- Support governments in mapping, monitoring and projecting the biosphysical dimension of planetary boundaries in order to bridge global to local scales. Equally, Earth System models that combine physical climate, vegetation dynamics, ocean biochemistry and hydrological processes can help to understand coupled Earth system processes.
- Support governments in developing nexus approaches to integrate the management of environmental resources and society’s needs for energy, food and water security, using social equity and a guiding principle when decisions are being made about allocation of limited resources.

**Message 1.4.**
Planetary boundaries must be mainstreamed in disaster risk/resilience policy interventions and institutions. Governments and other stakeholders need to integrate planetary boundaries into decision-making processes across and within sectors.
2. Recommendations for integrating planetary boundaries into the Sendai Framework Priority for Action 2 - Strengthening disaster risk governance to manage disaster risk

As humanity finds itself facing the onset of a planetary emergency for the first time in our history, the sheer complexity of global catastrophic risk is overwhelming conventional environmental governance systems, which were originally designed to address incremental environmental change rather than non-linear processes and the complex interactions between planetary boundaries. Tackling this emergency requires a fundamental transformation of the systems of global environmental governance which were inadequate in the Holocene, more so now that we have entered the Anthropocene with the new set of global risks and insecurities posed by the complex, multidimensional intertwined social, digital, economic and environmental challenges of the 21st century. With at least four planetary boundaries now having been transgressed, it is clear that global environmental governance must discard outdated assumptions of Holocene stability, and instead embrace complexity, instability and unpredictability as the new normal.
**Message 2.1.**
Disaster risk governance needs to be strengthened to address the *new global risks* and insecurities that have been generated by transgression of key planetary boundaries.

- Support Governments and key stakeholders in understanding how the complexity of global catastrophic risk is overwhelming conventional environmental governance systems, which were originally designed to address incremental environmental change.
- Support them in understanding how the planetary boundaries framework can serve governance reform efforts by providing a powerful framework that defines limits beyond which humanity must not transgress.
- To align decision-making processes and different realities we need multilevel governance, where both the vertical and the horizontal flows are integrated (including communities and NGOs).
- We need a guiding framework and standard of practice, as well as comparative tools to monitor and evaluate actions at every level.
- Ensure that systemic risk governance promotes resilience by addressing the underlying *drivers* of environmental degradation, and ensures that solutions are integrative and generate positive impacts at other scales and which ensure that we do not transgress the remaining planetary boundaries.
- In order to ensure significant practical application, the planetary boundaries must be translated and operationalised to match the scale and levels where most governance decisions are made (Kim and Kotze, 2020).
- Of particular importance is the need to develop robust allocation principles to ensure the fair share of the safe operating space as well as the responsibility in relation to protecting the boundaries.

**Message 2.2**
National governments need to be supported to transform governance systems to embrace *complexity, instability* and unpredictability of Earth system dynamics.

- Support deeper collaboration between Governments and planetary boundaries scientists to expand the knowledge base about the non-linear processes and complex interactions between planetary boundaries, the vulnerabilities of the Earth system to the new risk landscape, and the imperative of underpinning governance systems with the imperative of safeguarding the integrity of Earth’s life support system.
- Governance systems should be designed as fully functioning complex adaptive systems that effectively manage other complexly
This starts with aligning governance systems with the characteristics of the Earth system by first discarding “trite assumptions of Holocene stability, and embrace instead complexity, instability and unpredictability”. This means respecting “planetary scale tipping points” and recognizing “the dynamic interconnections of Earth system components while embracing the complexity of interacting planetary boundaries and safeguarding the integrity of Earth’s life-support systems” (Kim & Kotze, 2020, p.14).

Existing environmental treaty regimes should be strengthened by bolstering the legal boundaries that correspond with the planetary boundaries, by strengthening and better coordinating existing legislation with the view to creating the safe policy space. (Kim and Kotze, 2020)

Support international organisations in developing polycentric coordination as an effective approach to governing interaction planetary boundaries, especially in terms of information sharing to coordinate governance actions (Galaz, 2021) although some hierarchical steering through a strong institutional core will help to counterbalance inherent problems in purely polycentric models.

**Message 2.3**

**Planetary stewardship must lie at the core of decision making**

- Support the disaster risk community with deepened understanding of (i) how human societies need to be recast as integral component of the Earth system; (ii) how recasting humanity will require a fundamental transformation in our relationship with nature towards the ethos of planetary stewardship; (iii) how this values shift from purely extractive relationship with nature towards ethos of planetary stewardship can ensure greater planetary well-being; (iv) how transformative changes are needed in our governance, finance and economic systems to promote the ethos of stewardship and to reflect nature’s true value in these spheres.

**Message 2.4.**

**Transformation of governance systems must better reflect the value of nature**

- Support governments to encourage a shift away from GDP as a sole measure of growth, instead encouraging a transition to focus on ‘Healthy Growth’, with metrics such as natural capacity, productive capacity and social capacity included to compliment GDP.
- By including nature loss in our considerations of economic health, we will be able to better identify and incentivize economic activities that are beneficial to the environment and to human well-being. In doing so, we will be able to greatly reduce our losses to future disaster risk.
**Message 2.5**  
Increased capacities of governments, UN partners, and other stakeholders to ensure that systemic risk governance promotes resilience.

- Work with national government to ensure that systemic risk governance actively promotes resilience by:
  - Ensuring that solutions are integrative and generate positive impacts at other scales, in other sectors, and other geographies.
  - Empowering and including those interests that have traditionally been excluded (i.e. “all State and non-State interests including those in the global North and the global South, of present and future generations, and of humans and more-than-humans” (Kim & Kotze, 2020, p.14).
  - Support all actors to deepen understanding of resilience as the core of the safe operating space of the planetary boundaries and how this requires strong environmental institutions at all scales.
- Mapping synergies between various environmental governance mandates can support the development of an integrated action plan.
- The Sendai Framework’s approach to deepening resilience should include: proactive, adaptive, holistic policies and practices that ensure diversity, blended forms of knowledge, space for innovation, multiple solutions that reinforce each other; adapting learning to build resilience to future shocks.

### 3. Recommendations for integrating planetary boundaries into the Sendai Framework Priority for Action 3 - Investing in disaster risk reduction for resilience

For disaster risk reduction efforts to have lasting impact, a tangible increase in investment is required, both to disaster resilience and to nature protection efforts. Presently however, investment in the reduction of the disaster risk is hampered by a global financial system which systematically undervalues the importance of nature, instead funding enterprises which actively increase disaster risk by degrading nature. A transformation is therefore required to ensure that the finance system is nature positive and carbon neutral, supporting green and risk-averse investment, instead of encouraging the opposite.

**Message 3.1** Accelerate financing for disaster risk reduction and ensure that public and private investments are informed by planetary boundaries.
Governments take steps to redress the serious misallocation of capital that is depleting natural resources and ecosystems and which in turn are fuelling disaster risk around the world.

- Greater efforts are needed to quantify the financial flows that are adversely affecting the biosphere.
- Consider mandatory reporting requirements for financial institutions on climate and nature-risk exposures
- Robust risk assessment in public infrastructure spending.
- ‘Think Resilience’ approach that should become mandatory in all public procurement processes, as well as private sector investment, for example through integration under the Task Force for Climate Related Disclosures and Net-Zero initiative.

Governments honour international current climate and nature financing commitments and increase global investments in those sectors by four-fold by 2050.

Work with key actors to ensure that the true value of ecosystem goods and services is reflected in national accounting and to develop new measures of wealth that reflect the importance of natural capital.

Governments ensure that post-COVID recovery investments double the share of investments on reducing greenhouse gas emissions, nature protection and disaster risk reduction and resilience building.

Governments are supported in developing planetary boundaries-informed financing strategies to leverage innovative instruments such as payment for ecosystem services, environmental tax reform, tradable permits, insurance instruments, debt and equity instruments, resilience bonds and green loans.

This is a once-in-a-century global economic crisis. A large-scale international finance planning effort can mobilise capital markets, help to prevent global depression and accelerate a sustainable economic recovery. Action by private finance leaders over the last 18 months or so has put net-zero finance on a positive trajectory for some asset owners, asset managers, underwriters and banks (Waygood, 2021).

There now needs to be a broadening of net-zero action across actors, particularly investment consultants, stock exchanges and credit rating agencies.

**Message 3.2** Contribute to the *transformation of a risk-informed financial system* that supports planetary stewardship/resilient biosphere

- Support governments to make full use of the tools that currently exist in terms of natural capital accounting, ecosystem service
valuation, new metrics for inclusive wealth and natural capital, aligning social and environmental obligations to the fiduciary obligations of financial institutions and corporations, tools for embedding the deep uncertainty ingrained in biosphere dynamics, as well as disclosure tools (Galaz & Collste, 2022, p.2)

- Transformation into a climate-friendly financial system requires a robust approach, involving elimination of subsidies for non-climate-neutral projects as well as adjusting the national tax systems to incentivize climate-friendly decision making. By aligning financial decision-making with planetary boundaries, we can “build the foundations for systemic change and establish a new norm for financial regulation and responsible investing” (WWF, 2019, p.3)

- Address the opportunities for embedding decision making with the real cost of risk, the full value of ecosystems and new GDP metrics, and develop a new set of global standards that enable businesses and financial institutions to fully integrate nature-related considerations into decision-making and financial disclosures.

- Companies, investors and policymakers need to look beyond shareholder value maximisation, modern portfolio theory and GDP (AIQ, 2022).

- One way for investors to help redefine the system is to embrace macro stewardship – the practice of actively engaging governments, policymakers, NGOs, academics and other key influencers to correct market failures on sustainability issue (AIQ, 2022).

- To collaborate with the OECD to convene a UN Finance Assembly (including finance minister participants of the Helsinki Principles, central bank governors of National finance ministries and central banks (NGFS) and CEOs of SIFIs) (Waygood, 2021).

- We can no longer consider the economy as a closed system independent from demography and planetary resources, or to implement policies to change these three areas separately (AIQ, 2022)

- To correct those market failures, the financial system must engage with governments, policymakers, and global regulatory bodies to reset the rules and align incentives and penalties with sustainable behaviours (AIQ, 2022)

- “The poorest countries in the world must have economic growth of at least five per cent per year to end extreme poverty in a generation. With the right incentives, this economic growth can be based on a clean energy system and regenerative food system” (Stocknes, 2021)

- We must remove the negative feedback loops dampening their progress, namely subsidies for incumbent technologies and fuels, as well as regulatory monopolies (AIQ, 2022)

- Support a transition toward a regenerative real economy that supports a resilient biosphere and that reduces and mitigates
current harm to the planet, thereby reducing the risk of cascading and systemic shocks. This will require concrete efforts to:

- Move towards a long-term outlook that integrates economic, social and environmental justice and opportunity for all.
- Align all financing policies with Sendai, SDG as well as climate and biodiversity priorities.
- Ensure that the traditional finance architecture stops penalising vulnerability with high interest rates and heavily discounting the future and instead recognizes that resilience building is costly at first but brings tremendous longer-term rewards and reduced costs.
- Strengthen prudential regulation to ensure the stability of the financial sector in the face of growing risks.
- Highlight how investment flows create disaster risk in terms of exposure and vulnerability of communities, supply chains and natural ecosystems.

4. Recommendations for integrating planetary boundaries into Sendai Framework Priority for Action 4 - Enhancing disaster preparedness for effective response and to “Build Back Better” in recovery, rehabilitation and reconstruction

As the frequency of disasters increases due to the ongoing effects of anthropogenic climate change, improving resilience must become a key focus of disaster risk efforts, ensuring that solutions are proactive, not reactive. Crises such as the Covid-19 pandemic highlight the manner in which disasters can mobilise communities and institutions (both public and private) to accelerate transformative change, and demonstrates the potential for us to “Build Back Better” in the face of an evolving landscape of risk. Sustainability regimes must recognise the shared benefits of enhancing disaster preparedness to minimise future risk, alongside the wide-ranging consequences of failing to respect planetary tipping-points, and in doing so can identify new synergies and opportunities to collaborate, working to build a more sustainable and resilient future.
<table>
<thead>
<tr>
<th>Message 4.1.</th>
<th>A systemic approach to developing resilience informs the implementation of the Sendai Framework and other key global regimes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Elevate the importance of risk and resilience as useful framing concepts for addressing crises more proactively and for supporting United Nations system-wide efforts to achieve the 2030 Agenda and all of the key global environment and development processes.</td>
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<td>• Ensure that policy decisions iteratively identify options that are most robust to present and future shocks under conditions of deep uncertainty.</td>
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<td>• Focus on integrating value systems that could be extended to both national and subnational policies.</td>
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<td>• Support governments in strengthening their capacities for novelty and innovation in times of change, to turn crises into opportunities for not only adapting, but also transforming into sustainable futures.</td>
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<table>
<thead>
<tr>
<th>Message 4.2.</th>
<th>Global sustainability regimes increase coordination and collaboration to capture untapped synergy potential</th>
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<tbody>
<tr>
<td>• UNDRR has a key role to play in increasing integration between Sendai Framework and other regimes to help foster more risk resilient societies by avoiding overlap and gaps, while enhancing synergies in the implementation of the key intergovernmental agreements.</td>
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<td>• Deepen understanding of the extent to which the goals of the key regimes are dependent on the continuation of the “Holocene as the only state we know for sure can support our modern world”. Humanity’s future on Earth depends on our ability to maintain “a stable planet that continues to support life and human well-being”. This means ensuring rapid and large-scale transformation in the way we produce and use energy, extract natural resources, trade, consume, eat, and interact with nature.</td>
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<td>• Support understanding of enhanced coherence would be useful to identify and resolve contradictions when they occur between the goals and generate cohesive policy priorities and actions that contribute positively to multiple outcomes.</td>
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<td>• Deepen understanding and capacity for managing cascading and systemic risks and enhance efforts to: identify synergies; maximise co-benefits between different global regimes; understand risk interdependencies; and ultimately to enhance resilience across sectors and scales.</td>
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Message 4.3  Key policy regimes demonstrate awareness of the importance of planetary boundaries to understanding the new risk landscape that affects the achievement of their fundamental goals.

- Collaborate with MEA Secretariats and Governments to ensure that global regimes more effectively: manage coupled natural and social systems respect planetary tipping points; embrace complexity of interacting planetary boundaries; safeguard integrity of Earth’s life support systems; and navigate the uncertain future which will be marked by many yet-to-emerge or growing existential risks.
- Ecosystems and ecosystem management are currently missing from Sendai Framework Priority area 4, and should be integrated to reflect the important role that healthy ecosystems play in mitigating disaster risk.
- Focus on linking frameworks that have embedded Planetary Boundaries thinking with other global target regimes. E.g. the Ramsar Wetlands Convention’s peatland restoration target.
- Deepen understanding of the disaster risk implications of transgressing the planetary boundaries, especially the possibility of crossing thresholds, and triggering non-linear, abrupt environmental change within continental- to planetary-scale systems.
- Deepen understanding of the interconnections between different categories of global risks and their interdependencies and feedback loops. This is an important foundation for improving risk assessment and risk mitigation planning and the need for a multi-disciplinary approach when considering disaster preparedness. Planetary boundaries are also critical for understanding the constantly shifting and highly interconnected relationship between human societies and ecosystems.
3.1. Sustainable Development Goals

How is systemic risk relevant for the SDGs
The confluence of crises, dominated by COVID-19, climate change, and conflicts, are creating “spin-off impacts on food and nutrition, health, education, the environment, and peace and security” (UN, 2022, The Sustainable Development Goals Report 2022, p.3). These impacts in turn have undermined every one of the SDGs, reversing years of progress in improving development conditions around the world. The impacts of disasters undermine hard-won development gains. But conversely, poverty is also one of the key drivers of disaster risk, contributing to the increase in risk conditions (UNDRR, 2015, Disaster risk reduction and resilience in the 2030 agenda for sustainable development, p.15). Now that the SDGs are even further off-track, this could mean that future disasters will have even greater impact on development aspirations. This year’s Social Progress Index (published by the Social Progress Imperative) further predicts that inaction on climate change, human rights, and conflict around the world means that the SDGs will not be achieved until at least 2082. The consequences of COVID-19 could add another 10 years, setting back the 2030 target of meeting the SDGs by over 60 years (Cavano, 2020).
This potential scenario is an important reminder of how the systemic nature of risk can play out in the most pernicious of ways. The multiple, cascading and intersecting crises of climate change, nature loss, and the coronavirus, as well as the war in Ukraine have placed the SDGs in grave jeopardy. Each of the crises and their complex interactions have created subsequent crises in poverty, food and nutrition, health, education, peace and security.

What are the planetary boundaries risk insights that are relevant for the SDGs
Achievement of the SDGs depends on keeping humanity in a safe operating space. Seen through a planetary boundaries lens, achieving the SDGs is completely dependent on the continuation of the “Holocene as the only state we know for sure can support our modern world”. Humanity’s future on Earth depends on our ability to maintain “a stable planet that continues to support life and human well-being” (Rockstrom, 2021, Protecting planetary boundaries: aligning the SDGs to ensure humankind’s future).

Conventional efforts to achieve the SDGs will generate considerable pressure on planetary boundaries. Whatever achievement we reach on the socio-economic SDGs will exert a tremendous toll on the environmental SDGs. From a planetary boundaries perspective this would mean reducing “the Earth system ‘safety margin’ represented by the nine planetary boundaries.” (Randers et al., 2018, p.10).

The key question to be addressed is what is the pathway to achieving the SDGs within planetary boundaries by 2050? Resilience scientists have identified a scenario that could at least ensure SDGs are met by 2050. This will require five transformational policies (Stockholm Resilience Centre, 2018, Achieving the Sustainable Development Goals, p.6):

- Doubling investments in renewable energy in order to halve emissions every decade from 2030 onwards
- Increasing productivity in food systems to reduce its impact on climate change
- New nature-positive and carbon neutral development models
- Inequality reduction through redistribution of wealth and resources
- Increase in investment in girls and women to stabilise world population
How to embed risk-informed decision-making in the SDGs and strengthen synergies with the SDGs

Risk-informed decision-making for the SDGs is a critical step towards forwards because it prepares vulnerable communities for future risks (i.e. forced displacement, food and water insecurity, urbanisation, conflict etc) and enables them to develop “proactive measures to mitigate risks and to build the resilience of communities and the landscapes they occupy and depend on - and do this through a process led by them” (GNDR, 2022, p.7).

- Risk-informed development can only be achieved if decision-making processes are informed by the knowledge of risk, the capacity to take measures to mitigate systemic risk and to ensure that decision-making processes reflect diverse perspectives. The way that planetary boundaries framework can assist in the strengthening risk-informed development is by contributing to a holistic understanding of risk, which is embedded in a systemic and multi-risk perspective, and which captures emerging, dynamic, complex and cascading risks.

- Greater synergies are needed to ensure that both the SDGs and the Sendai Framework address the underlying drivers of risk and future levels of risk and resilience in order to ensure that progress and achievements can mutually support each regime. The implications of SDG failure for disaster risk reduction and vice versa highlights the importance of the Sendai Framework in promoting coherence and joined-up approaches for disaster risk reduction and the SDGs.

- Sendai global targets and priorities for action can contribute to the achievement of the SDGs and targets through a stronger focus on resilience-building and risk reduction measures. But this will require a significant improvement in the management of disaster risks if we are to minimise the impacts of disaster loss on efforts to reduce poverty and achieve sustainable development. Disaster risk reduction must lie at the heart of the SDGs since development that is not risk-informed cannot be sustainable (UNDRR, 2015, Disaster risk reduction and resilience in the 2030 agenda for sustainable development, p.13).
3.2. UN Framework Convention on Climate Change (UNFCCC)

**How is systemic risk relevant for UNFCCC**

Most recently, an international research team led by Professor Johan Rockström et al have confirmed in a new analysis published in Science that multiple climate tipping points could be triggered if global temperature rises beyond 1.5°C above pre-industrial levels (Armstrong McKay DI et al, 2022. *Exceeding 1.5°C global warming could trigger multiple climate tipping points*, n.p.). The new analysis indicates that Earth may have already left a ‘safe’ climate state when temperatures exceeded approximately 1°C warming. The international research team synthesised evidence for tipping points, their temperature thresholds, timescales, and impacts from a comprehensive review of over 200 papers published since 2008, when climate tipping points were first rigorously defined. They have concluded that the tipping points which may be triggered at today’s temperatures include: melting of the Greenland ice sheets, West Antarctic ice sheets, widespread abrupt permafrost thaw, collapse of convection in the Labrador Sea, and massive die-off of tropical coral reefs. Altogether, this shows humanity is rapidly pushing beyond our world’s safe operating space for multiple planetary boundaries and is quickly approaching irreversible tipping points (Armstrong McKay DI et al, 2022. *Exceeding 1.5°C global warming could trigger multiple climate tipping points*, n.p.).

**What are the planetary boundaries risk insights that are relevant for UNFCCC**

Planetary boundaries research confirms that humanity is pushing beyond our world’s safe operating space for multiple planetary boundaries and approaching tipping points. As one of the two core boundaries (the other is biodiversity), climate change on its own can push the Earth system to spiral into a state, i.e. "Hothouse Earth" that has never been experienced for the entirety of human existence, and which may not be able to support humanity. Reinforcing loops such as the increase in deforestation or accelerated loss of ice sheets, will in turn trigger more complicated cascades of climate change. (Rockström, 2021)

Another key insight from the planetary boundaries framework is that not only does climate have a significant influence on all other natural systems, but also that other natural systems have a significant influence on climate. This means that in order to effectively
mitigate climate risks, we need to understand the other systemic factors which influence either the generation of hazards or the deterioration of vulnerability.

**How to embed risk-informed decision-making in the UNFCCC and build synergies with the Sendai Framework**

There is growing recognition that joined-up approaches to disaster risk and climate action are essential because both have the “overarching goal of reducing vulnerability and building resilience as a means to achieve long-term sustainable development”. The reality is that these two regimes are often implemented in silos using “parallel institutional structures, policy and legal instruments, communities of practices and approaches at the global, regional, national, sectoral and local levels. And thus, creating duplication, confusion and in some cases competition that can result in limited impacts on the shared goal” (UNDP, 2020, Risk-Informed Development: A Strategy Tool for Integrating Disaster Risk Reduction and Climate Change Adaptation into Development, United Nations Development Programme).

Governments are increasingly developing joint strategies or processes that facilitate greater co-ordination across the two policy areas. The starting point for risk-informed decision-making on climate change is to ensure that climate change risks and their management into everyday decision-making around development. (UNDP, 2020, Risk-Informed Development: A Strategy Tool for Integrating Disaster Risk Reduction and Climate Change Adaptation into Development, United Nations Development Programme). It is equally important to ensure that risk-informed approaches actually strengthen the core elements of risk governance (e.g. processes, institutions and stakeholders) to overcome implementation challenges and strengthen mainstreaming outcomes (UNDP, 2020, Risk-Informed Development: A Strategy Tool for Integrating Disaster Risk Reduction and Climate Change Adaptation into Development, United Nations Development Programme).

Additional insights for elevating risk-informed approaches into climate policy making are summarised accordingly:

- The mainstreaming objective is achieved when risk is considered a normal and inseparable part of economic activities and development, as something that is continuously acknowledged, assessed and managed when pursuing particular development pathways and practices.
UNDP has developed a tool for integrating disaster risk reduction into climate action. It helps practitioners to: “(i) build knowledge and assess the risks from all natural hazards and climate change across the range of timescales; (ii) build commitment for joint mainstreaming and identify opportunities for linking separate DRR/CCA/development policies, legislation and plans in support of joined-up implementation; (iii) carry out a joint analysis of expenditure, budgeting and resource mobilization for both climate and disaster risks as an integral part of development financing; (iv) strengthen organizational arrangements including coordination and capacity across DRR, CCA and poverty practitioners, including through cohesive procedures, tools and projects; and (v) ensure development stakeholders are at the forefront of mainstreaming.” (UNDP, 2020, Risk-Informed Development: A Strategy Tool for Integrating Disaster Risk Reduction and Climate Change Adaptation into Development, United Nations Development Programme).

Another interesting best practice is the Risk-Informed Early Action Partnership (REAP) partnership that aims to have 50 countries with integrated disaster risk management and climate adaptation laws, policies and plans by 2025 (IFRC, 2021, COP 26: Urgent action needed to develop climate-smart disaster laws).

Realising the benefits of increased coherence in disaster risk reduction and climate action “requires political support and strong leadership by a recognised coordination entity” (OECD, 2020, Common Ground Between the Paris Agreement and the Sendai Framework: Climate Change Adaptation and Disaster Risk Reduction).

Awareness raising and capacity development are also important regarding the benefits and trade-offs of greater coherence that can guide the identification of shared solutions.

Disaster risk reduction and climate action are often implemented at local or sectoral levels. Therefore, government ministeries with a presence at these levels can play an important role in leading efforts to increase coherence (OECD, 2020, Common Ground Between the Paris Agreement and the Sendai Framework: Climate Change Adaptation and Disaster Risk Reduction).
3.3. Post-2020 Global Biodiversity Framework

How is systemic risk relevant for Post-2020 Global Biodiversity Framework
The Kunming Declaration now recognises that the interrelated crises of climate change and nature loss pose existential risks for people and the planet. However, we are living in an age where despite some progress, risk creation is outstripping risk reduction. Seen through the lens of planetary boundaries, the challenge is that disasters, economic loss, poverty and inequality are increasing just as ecosystems and biospheres are at risk of collapse. We are now living in a new risk landscape where anthropogenic forces are pushing “coupled human-environmental systems beyond thresholds of known stability and into zones of non-linear and potentially “catastrophic” environmental change”. Human activities such as deforestation and degradation in the Brazilian Amazon are now transforming biosphere carbon sinks into carbon sources. We may well be approaching a tipping point for biosphere integrity and if we do so, we may no longer be able to depend on the “capacity of the biosphere to continue dampening greenhouse gas emissions and hold onto its carbon stocks” (Rockstrom et al., 2021, p.2). How we manage to avoid this perilous trajectory depends on our ability to build resilience to future shocks and stresses.

What are the planetary boundaries risk insights that are relevant for Post-2020 Global Biodiversity Framework
There are serious disaster risk implications of transgressing the biosphere integrity boundary. Biosphere integrity is crucial to Earth-system functioning. However, with the possible sixth mass extinction of species since the dawn of complex life, we have now definitively crossed the biosphere integrity boundary, testing the resilience of our planet and propelling humanity out of the safe operating space. Because biosphere integrity is a core boundary, this means that on its own, it has the potential on its own to drive the Earth system into a new state. The biosphere “not only interacts with the other planetary boundaries but also increases the capacity of the Earth system to persist in a given state under changes in these other boundaries” (Steffen et al, 2015, p.8). The implications for disaster risk reduction are clear. Transgressing the biosphere integrity boundary can lead to the possibility of crossing thresholds, and triggering non-linear, abrupt environmental change within continental- to planetary-scale systems (Rockstrom et al., 2021).

The key question is how to safeguard and enhance the resilience of the ecological functions in the living biosphere that are critical for a stable planet that can equitably support all life on Earth (Rockstrom et al., 2021). Biosphere resilience is about how to safeguard and enhance the resilience of the ecological functions in the living biosphere that regulate its carbon sinks, which in turn is critical for a stable planet that can equitably support all life on Earth (Rockstrom et al., 2021). Biosphere resilience is not about recovering to business-as-usual. Resilience in relation to the stewardship of complex adaptive systems is about learning to live with and adapt to changing circumstances that may be slow or abrupt, predictable or surprising.

Another important dimension of building biosphere resilience is the transformation of our relationship with nature to one that conserves, restores, and enhances its benefits for people and the planet. Planetary boundaries provide an important conceptual framework within which to understand that necessary shift in values. In the Anthropocene biosphere, society is viewed as part of the biosphere, not separate from it. Humans are not just linked with nature, but “intertwined, and intertwined across temporal and spatial scales” (Folke et al., 2021, p.837). The ethical principle of “biosphere stewardship” flows logically from the transformed relationship with nature. It means moving away from “reducing human pressures only, to managing nature actively to promote multigenerational human wellbeing” and understanding critical biomes as global commons that underpin life on Earth (Rockstrom et al., 2021, p.2).

**Strengthening risk-informed decision making in and synergies with the post-2020 Global Biodiversity Framework**

The urgency of strengthening risk-informed, systems-based approaches to biodiversity conservation cannot be emphasised enough in light of the nature loss crisis. Whilst the Kunming Declaration recognizes that interrelated crises post risks for people and the planet, the importance of a risk-informed approach within the new GBF is still lacking. There is clear evidence that biodiversity conservation and disaster risk reduction are mutually reinforcing and this should be in the new GBF (Moreno, Sonia Pena et al, 2022, *How to Ensure a Resilient Global Biodiversity Framework to Disaster and Climate Risks?*). A risk-informed and prevention-oriented approach to nature protection will enable transformation towards a world where fewer hazards trigger disasters.

The UN General Assembly’s annual segment on disaster risk reduction has affirmed “strong commitment, coordination, and coherence between the implementation of the Sendai Framework and the CBD”. Member States have committed to translate this integration between global policy frameworks, international laws, policies and regulations (Moreno, Sonia Pena et al, 2022. *How to
Ensure a Resilient Global Biodiversity Framework to Disaster and Climate Risks?). This is particularly timely in light of the growing understanding of the danger of not realising synergies and coherence across these regimes “is to risk systemic and cascading impacts that will have a long-lasting negative effect on the livelihoods and wellbeing of people, economies and countries, undermining sustainable development” (Le Tissier, M., Whyte, H., 2022, Why Does Making Connections Through Resilience Indicators Matter?, n.p.).

There are several concrete measures that could help to deepen risk-informed decision making in the Post-2020 GBF and to synergies strengthen with the Sendai Framework (Le Tissier, M., Whyte, H., 2022, Why Does Making Connections Through Resilience Indicators Matter?, n.p.):

- Improve coherence in data collection and analysis and strengthen data management to allow for interrogation across nature loss and disaster risk reduction as well as resolution for more informed policymaking.
- Ensure that risk assessments conducted by the DRR community take nature loss considerations into account and ensure that national biodiversity assessments and strategies take into consideration risk assessments.
- Strengthen risk governance and coordination mechanisms so that they more effectively promote coherence. Ecosystem based approaches and nature-based solutions into national disaster risk reduction strategies.
- Elevate the importance of nature loss and disaster risk reduction within a wider context of outcomes for sustainable development as framed by the SDGs.
- Deepen understanding of how exposure to different types of risks increasingly has interdependencies and cascading effects within and across multiple sectors that cannot be addressed through any one global agreement.
- Strengthen synergies in monitoring and reporting to address interlinkages.

3.4. Financing for Development

The Financing for Development process represents agreements and commitments reached during the three major international conferences on Financing for Development: in Monterrey, Mexico in 2002; in Doha, Qatar in 2008; and in Addis Ababa, Ethiopia in
The process also follows up on the financing for development-related aspects 2030 Agenda and the Sustainable Development Goals (SDGs).

**How is systemic risk relevant for Financing for Development**

As humanity is starting to hit the “ceiling of hardwired biogeochemical processes and systems that regulates the state of the the Earth system” (The Earth Commission Terms of Reference, 2019, p.2), scientists are now seriously assessing the potential risk of global societal collapse and the need to start “preparing for the possibility of the climate endgame” (Carrington, 2022). Instead of reducing risk and building resilience however, our societal, political, economic and financial systems continue to steer us in a dramatically different direction. We are challenging existential and ecosystem limits, thereby “compromising the planet’s capacity to sustainably support” humanity (Global Challenges Foundation, 2022).

Many systemic risks, including the transgression of planetary boundaries, are driven in part by dysfunctional aspects of the financial system, such as the short-termism, paramountcy of self-interested behaviours and outdated tools.

One of the most important starting points for transformation of the financial system is to correct the gross misallocation of capital that is depleting natural resources and ecosystems, and which in turn are fuelling disaster risk around the world. According to the Dasgupta Review on the Economics of Biodiversity, “existing private financial flows that are adversely affecting the biosphere outstrip those that are enhancing natural assets” (Dasgupta, 2021, p.474). The 2021 and 2022 Financing for Sustainable Development Reports (FSDR) of the Inter-agency Task Force on Financing for Development present a sobering picture of the systemic risks that are especially relevant for the financial system and the global economy. Of particular importance is the fact that whilst some capital is flowing towards risk reduction and resilience, far more is continuing to support the old carbon-intensive economy. This stems from many factors, such as the inability and/or unwillingness of financial institutions, governments and private sector actors to grasp the extent to which investment flows are aggravating systemic risk on a scale never seen before.

An important case in point is reflected by companies operating in deforestation prone sectors in the Amazon. They receive considerable financial support from national development banks and other direct subsidies and through international loans and payments. Most of the latter capital flows are “transferred from or via tax haven jurisdictions, creating serious challenges for
transparency and tax fairness, and as a result also for sustainability and biosphere stewardship” (Galaz & Collste, 2022, *Economy and Finance for a Just Future on a Thriving Planet*).

**Planetary boundaries risk insights for Financing for Development**

The financial system as it operates today is woefully inadequate to support planetary boundaries (Chenet, 2019). Close to 15 years since the global financial crisis of 2008, the financial system remains unfit for purpose and “is neither built for nor capable of solving our long-term and common goods problems” (Chenet, 2019, p.8).

The health of human societies, economies and of the planet depend on a financial sector that “supports a transition toward a regenerative real economy building a resilient biosphere and that reduces and mitigates current harm to the planet, thereby reducing the risk of cascading and systemic shocks” (Crona et al., 2021, p.7).

Moving towards alignment will require a fundamental change in how we view and embed systemic risk and reflect the paramount imperative of a resilient biosphere in financing decisions. This starts with understanding where and how the current financial system is aggravating climate and large-scale environmental change through carbon intensive and nature negative investments. This means moving away from “theories, world views, and beliefs systems that are blind to planetary change, or that treat the planet and our living biosphere as external to economic and social development” (Galaz & Collate, 2022, p.49).

**Strengthening risk-informed decision making in and synergies with the Financing for Development process**

Ensuring the alignment of the financial system with the Sendai Framework, the SDGs, the Paris Agreement and the Post-2020 Global Biodiversity Framework, among others, is “not just a matter of more of the same, but of harnessing major change opportunities, given the complexity and dynamism of this system, rather than seeking to blueprint solutions.” (Zadek, 2018)

Moving towards alignment will require a fundamental change in how we view and embed systemic risk and reflect the paramount imperative of a resilient biosphere in financing decisions. This starts with understanding where and how the current financial system is ill-equipped to grasp the monumental risk of aggravating climate and large-scale environmental change through investments.
By aligning financial decision-making with planetary boundaries, we can “build the foundations for systemic change and establish a new norm for financial regulation and responsible investing” (WWF, 2019, p.3)

And finally, in order to restructure financial systems to build risk resilience in human and natural systems, we must address the fundamental flaws in our economic systems which continue to measure and value the wrong assets.

We already have the key tools in terms of natural capital accounting, ecosystem service valuation, new metrics for inclusive wealth and natural capital, aligning social and environmental obligations to the fiduciary obligations of financial institutions and corporations, tools for embedding the deep uncertainty ingrained in biosphere dynamics, as well as disclosure tools (Galaz & Collste, 2022, p.2)

While all actors must manage risks, governments must lead in promoting risk-informed policy frameworks, which address the growing systemic and interlinked risks, improved policy coherence and consistency—as called for by the Addis Ababa Action Agenda. Other domestic measures include the following:

- As climate-related risks increase, policymakers should consider mandatory reporting requirements for financial institutions on climate-risk exposures and mitigation strategies.
- Risk-informed budget reviews to assess the level of domestic financing for disaster risk reduction.
- Ensuring integration of disaster risk reduction as a necessary criterion for COVID19 recovery packages.
- The case for investing in prevention, risk reduction and resilience has been established. However there are significant barriers that must be addressed, such as short-termism, inequities and lack of inclusion in policy making.
- Stronger coherence in the financing and implementation of national and local disaster risk reduction strategies and national adaptation plans.
- Promoting a ‘Think Resilience’ approach that should become mandatory in all public procurement processes, as well as private sector investment, for example through integration under the Task Force for Climate Related Disclosures and Net-Zero initiative.
- Inclusion of robust risk assessment in public infrastructure spending.
To build a more sustainable, inclusive and resilient global economy that works for all, the international financial architecture must be reformed to ensure the international finance system is risk-informed. This means:

- Acknowledging that the worsening debt challenges in many countries reflects the inequities that continue to embed the global economic order.
- Moving away from the short-term profit maximization for the few and moving towards a long-term outlook that integrates economic, social and environmental justice and opportunity for all.
- Ensuring that the traditional finance architecture stops penalising vulnerability with high interest rates and heavily discounting the future and instead recognizes that resilience building is costly at first but brings tremendous longer-term rewards and reduced costs (Ram, 2020, p.11)
- Changing how we measure, and ultimately think of progress because in a world of interlinked and systemic risk, GDP is no longer an effective measure of wealth and shared prosperity.
- Strengthening prudential regulation to ensure the stability of the financial sector in the face of growing risks.
- Reallocating more SDRs for countries most in need.
- Highlighting how investment flows create disaster risk in terms of exposure and vulnerability of communities, supply chains and natural ecosystems.

3.5. UN Decade for Water Action

How is systemic risk relevant for UN Decade for Water Action

Water is a critical component for building risk resilient societies. The language of the UN Water Action Decade highlights that “[w]ater is at the heart of [...] the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction 2015-2030, and the 2015 Paris Agreement” (United Nations Secretary-General’s Plan, 2018, p.1). Water is a “critical determinant of success in achieving most other SDGs” and gaps in access to water supply and sanitation is a risk with cascading effects (HLPW, 2018, p.7). Additionally, water related disasters such as floods and droughts can be detrimental to the progress of sustainable development and exacerbate existing inequalities. The importance of water is also highlighted in the Planetary Boundaries Framework, which includes Freshwater Use as one of the nine boundaries. Ultimately, water management is fundamental to sustainable development, building risk resilient societies, and ensuring that earth systems are respected.
Remaining within the Freshwater Planetary Boundary is critical to avoid exacerbating disaster risk and jeopardising progress toward SDGs:

- Altering river ecosystems in this manner can have wide-ranging impacts, as the resulting loss/introduction of new plant species and changes to land cover within the freshwater environment “can substantially alter evapotranspiration and water fluxes, with resulting changes in stream flow” (Wohl, 2018, p.66).
- Changes to plant species on the riverbank and floodplain also “alters flow resistance, bank stability, sedimentation, and channel form” (Wohl, 2018, p.66), changing the characteristics of a river and potentially increasing the risk of flooding events.

**What are the planetary boundaries risk insights that are relevant for UN Decade for Water Action**

Remaining within the Freshwater Planetary Boundary is critical to avoid exacerbating disaster risk and jeopardising progress toward SDG. The Freshwater Usage Planetary Boundary defines “The level of river flows [needed] to maintain to a fair-to-good ecosystem state” (Steffen et al. 2015, p.7), meaning surpassing this boundary risks severely disrupting freshwater ecosystems. Altering river ecosystems in this manner can have wide-ranging impacts, as the resulting loss/introduction of new plant species and changes to land cover within the freshwater environment “can substantially alter evapotranspiration and water fluxes, with resulting changes in stream flow” (Wohl, 2018, p.66). This further impacts local water security for downstream communities. Changes to plant species on the riverbank and floodplain also “alters flow resistance, bank stability, sedimentation, and channel form” (Wohl, 2018, p.66), changing the characteristics of a river and potentially increasing the risk of flooding events. As such it is vital to both water-based SDGs and disaster risk reduction to ensure freshwater Planetary Boundaries are respected, to avoid compounding disaster risk and undoing progress towards sustainable water management.

New research has suggested the existence of an additional freshwater Planetary Boundary for the ‘green-water’ system (terrestrial precipitation, evaporation and soil water content), “critical for regulating and supporting most terrestrial biosphere processes” (Wang-Erlandsson, 2022, p.1). This proposed Planetary Boundary for acceptable perturbations to the green-water system has already been surpassed, highlighting the urgency for water action before we further disrupt vulnerable water systems.
How to strengthen risk-informed development within the UN Decade for Water Action and improve synergies with the Sendai Framework

We need to better understand, manage, and value water to create risk resilient societies and enhance progress toward the SDGs

○ Communities must invest in water-related data to “understand the quantity, quality, distribution, use, and risks of the water they have” (HLPW, 2018, p.13).
○ At the local level, this involves an integrated approach that includes all stakeholders. Frameworks such as the Water Governance Initiative, hosted by the OECD, can provide governments with principles and practical guidance for effective water management (OECD, 2015).
○ Water governance mechanisms must also be strengthened at the transboundary level through “legal frameworks for international cooperation,” “joint institutions,” and “common standards for water data collection, sharing and analysis on transboundary waters” (HLPW, 2018, p.20).
○ Finally, societies must value water. This entails improving water-related education, reduction of wastage and pollution, and ensuring more sustainable water services (HLPW, 2018, p.13).

Utilising basin-scale Planetary Boundaries to help better manage water resources for SDGs and DRR, and commit to making evidence based decisions about water management

○ The 2015 update to the Planetary Boundaries Framework by Steffen et al. provides a series of local, basin-level limits for sustainable fresh-water usage as a function of mean monthly river flow, with maximum boundaries ranging from 25%-55% depending on river flow rates (Steffen et al., 2015,p.9).
○ These limits allow for a clear benchmark against which water-related SDGs can be monitored, whilst helping to inform local water management to ensure that we don’t stress water systems, thereby creating risk resilient societies.

Building resilience to prepare for and manage water related disasters is critical

○ Globally, financing for DRR has been focused on emergency response and reconstruction, with only “10% [...] for preparedness and resilience” (HLPW, 2018, p.23).
While funding for the former is certainly needed, there must be an increase in focus and resources for preparedness and resilience. “Increased resilience [...] stimulates economic activity, ensures fiscal stability, and provides the foundation for sustainable societies and livelihood” (HLPW, 2018, p.23).

Responsibly managing water use is a critical component for both reducing future disaster risk, and helping achieve sustainable development goals.

The Planetary Boundary for Freshwater Usage should be used as widely as possible as a risk-informed metric for monitoring water-based SDGs, with communities encouraged to invest in water-related data to better understand their water usage.

Financial institutions should be encouraged to improve disclosure of their investments’ exposure and contribution to water-related risks.

Likewise, governments should work together with multi-lateral financial institutions and the private sector to create a comprehensive case for water-related investments.

3.6. One Health

How is systemic risk relevant for UN Decade for One Health

In its current form, the One Health Framework recognises “the critical role that ecosystems play in originating new zoonotic diseases” (UNSG, 2008, p.46), however only briefly acknowledges how climate change “has changed the ecosystems in many regions and has subsequently extended the distribution of several vectors that transmit diseases” (UNSG, 2008, p.18). Research has since emerged indicating that even under the most optimistic warming scenarios, anthropogenic climate change will cause a minimum of at least \(\sim 15,000\) cross-species transmission events of at least one novel virus (Carlson et al., 2022, Climate change increases cross-species viral transmission risk, p.5).

“The public health, livestock, and agriculture sectors, etc., often adopt a ‘crisis response’ model for the prevention and control of emerging infectious diseases, waiting for an outbreak and then taking action” (Zhang et al., 2022, p.2). This model has proved insufficient to deal with the challenges of the Anthropocene. The COVID pandemic has highlighted the importance of understanding
the systemic nature of risk and has highlighted the need to build resilience and preparedness as opposed to simply responding to health-related disasters when they do occur.

**What are the planetary boundaries risk insights that are relevant for UN Decade for One Health**

Respecting Planetary Boundaries would foster environmental, animal, and human health, thereby preventing risk is critical. It is now clear that human health is directly linked to the health of the environment. Pushing planetary boundaries such as climate change, land system change, biosphere integrity, and chemical pollution degrade natural ecosystems and bring wildlife and humans into closer contact, heightening the risk of infectious diseases. A reexamination of our relationship with the greater environment, one in which planetary boundaries are respected, is fundamental to a One Health Approach. The emerging field of Planetary Health, which studies and promotes “policies that protect the health of humans and of the Earth’s natural systems that support them” should be fully integrated into public health spheres (Iyer et al., 2021, p.1). Ultimately, a unified, systems approach is needed to maintain a healthy planet that enables the conditions for healthy societies.

Planetary Boundaries can be used as a metric for monitoring ecosystem health. A key tenet of One Health is enhanced monitoring of emerging infectious diseases, calling it “fundamental to all disease control efforts” (UNSG, 2008, p.23). Despite this, the framework does not offer any suggestions of how to monitor ecosystem health, despite the fact "Intact ecosystems play an important role in regulating the transmission of many infectious diseases" (Patz & Confaloneiri, 2006, p.3). Planetary Boundaries provides a solution to this on both a regional and global scale, offering indicators of the risk of triggering wide scale systemic shifts for environments around the world. Incorporating this into the One Health approach would therefore allow pre-emptive surveillance of the factors impacting disease emergence, as opposed to being limited to reactive surveillance of diseases once they’ve already emerged.

**How to strengthen risk-informed development within the One Health Agenda and to improve synergies with the Sendai Framework**

A systemic approach to managing human-animal-environment health-related risks is needed:

- Public health crises such as the COVID pandemic demonstrate how health risks have the potential of cascading effects that can push societies toward systemic collapse.
The increased strain on planetary boundaries will increase the likelihood of similar infectious disease crises in the future. “To deal with emerging infectious diseases, there should be a shift in traditional thoughts from crisis response to effective prevention” (Zhang et al., 2022, p.2).

The UNDRR is primely positioned to help lead this transition toward risk preparedness and prevention and should work in close collaboration with other actors in the One Health sphere to ensure that systems are in place to prevent and deal with emerging health challenges.

At the same time, UNDRR and One Health actors should highlight the interconnected nature of environmental, animal, and human health and should advocate for policies that respect planetary boundaries as a fundamental means of building resilience.

Ecosystem health should be monitored as an early warning system for future disease risk, with Planetary Boundaries providing a metric for global ecosystem stability.

The UNDRR should lead a transition in disease management from crisis-response to risk preparedness and prevention, alongside building resilience to the cascading impacts of pandemics when they do occur.
### Part 4 - Messages for the Sendai Framework Mid Term Review

#### 4.1. Overview of key messages for the Sendai Framework Mid Term Review

<table>
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<tr>
<th>Overarching messages for the Mid Term Review</th>
<th>Integrating planetary boundaries into Sendai Framework Priority for Action 1 - Understanding disaster risk</th>
<th>Integrating planetary boundaries into the Sendai Framework Priority for Action 2 - Strengthening disaster risk governance to manage disaster risk</th>
<th>Integrating planetary boundaries into the Sendai Framework Priority for Action 3 - Investing in disaster risk reduction for resilience</th>
<th>Integrating planetary boundaries into Sendai Framework Priority for Action 4 - Enhancing disaster preparedness</th>
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<td>If the Sendai Framework is to be fit for purpose, robust disaster risk/resilience policy interventions and institutions must be grounded in the new insights of Earth system dynamics. We need to improve and evolve our understanding of “the full topography of risks through time” to ensure that we better prepare, anticipate and adapt.</td>
<td>Increased understanding of planetary boundaries is essential to support the conceptual shift from managing disasters to managing disaster risk, strengthening prevention and building resilient societies and ecosystems.</td>
<td>Disaster risk governance needs to be strengthened to address the new global risks and insecurities that have been generated by transgression of key planetary boundaries.</td>
<td>Significantly scaled up efforts are needed to accelerate financing for disaster risk reduction and ensure that public and private investments are informed by planetary boundaries.</td>
<td>A systemic approach to developing resilience informs the implementation of the Sendai Framework and other key global regimes.</td>
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<td>Among the key implementation challenges for the Sendai Framework is how to improve effectiveness in keeping humanity from crossing planetary boundaries. It has an important role in promoting awareness about the need for deep structural changes in society to navigate the Anthropocene.</td>
<td>Robust evidence, innovation and knowledge regarding planetary boundaries and their complex interactions is essential to deepen understanding of the complexity of the Earth system, and the new systemic risk landscape.</td>
<td>National governments need to be supported to transform governance systems to embrace complexity, instability and unpredictability of Earth system dynamics. Increase capacities of governments, UN partners, and other stakeholders to ensure that systemic risk governance promotes resilience.</td>
<td>All actors must contribute to the transformation of a risk-informed financial system that supports planetary stewardship/resilient biosphere.</td>
<td>Global sustainability regimes need to significantly increase coordination and collaboration to capture untapped synergy potential.</td>
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<tr>
<td>Another equally important implementation challenge is how</td>
<td>Planetary boundaries must be mainstreamed into disaster risk/resilience policy interventions</td>
<td>Planetary stewardship must lie at the core of decision making. Transformation of</td>
<td></td>
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best to promote and support the integration of risk reduction throughout the key global regimes. Decision-making processes at all scales need to be risk-informed in order to address the triple planetary threat and achieve the objectives of sustainability, resilience building, poverty eradication and leaving no one behind. (UNDP, 2018, Risk-informed Decision-Making for Sustainable Development).

| and institutions. Governments and other stakeholders need to integrate planetary boundaries into decision-making processes across and within sectors. | governance systems must better reflect the value of nature. | planetary boundaries to understand the new risk landscape that affects the achievement of their fundamental goals. |

Because resilience lies at the heart of the global regimes, it should be elevated as a unifying force for global sustainability regimes (UNFCCC, 2017, Opportunities and options for integrating climate change adaptation with the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction 2015–2030). Resilience provides means for “building linkages and coordination to increase their effectiveness individually and collectively”.

|  |  |  |
### 4.2. Overview of key messages for elevating risk-informed development in key global regimes

<table>
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<tr>
<th>SDGs</th>
<th>UN Framework Convention on Climate Change (UNFCCC)</th>
<th>Post-2020 Global Biodiversity Framework</th>
<th>Financing for Development</th>
<th>UN Decade for Water Action</th>
<th>One Health</th>
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<tr>
<td><strong>Risk-informed decision-making for the SDGs</strong> is a critical step towards forwards because it prepares vulnerable communities for future risks (i.e. forced displacement, food and water insecurity, urbanisation, conflict etc) and enables them to develop “proactive measures to mitigate risks and to build the resilience of communities and the landscapes they occupy and depend on - and do this through a process led by them”</td>
<td>There is growing recognition that joined-up approaches to disaster risk and climate action are essential because both have the “overarching goal of reducing vulnerability and building resilience as a means to achieve long-term sustainable development”.</td>
<td>Whilst the Kunming Declaration recognizes that interrelated crises post risks for people and the planet, the importance of a risk-informed approach within the new GBF is still lacking. There is clear evidence that biodiversity conservation and disaster risk reduction are mutually reinforcing, and this should be in the new GBF.</td>
<td>Ensuring the alignment of the financial system with the Sendai Framework, the SDGs, the Paris Agreement and the Post-2020 Global Biodiversity Framework, among others, is “not just a matter of more of the same, but of harnessing major change opportunities, given the complexity and dynamism of this system, rather than seeking to blueprint solutions.” (Zadek, 2018)</td>
<td>We need to better understand, manage, and value water to create risk resilient societies and enhance progress toward the SDGs.</td>
<td>The UNDRR is well-positioned to help lead the transition toward risk preparedness and prevention, and should work in close collaboration with other actors in the One Health sphere to ensure that systems are in place to prevent and deal with emerging health challenges.</td>
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<td><strong>Greater synergies are needed to ensure that both the SDGs and the Sendai Framework address the underlying drivers of risk and future levels of risk and resilience in order to ensure that progress and achievements can mutually support each regime.</strong></td>
<td>The reality is that these two regimes are often implemented in silos using “parallel institutional structures, policy and legal instruments, communities of practices and approaches at the global, regional, national, sectoral and local levels. And thus, creating duplication, confusion and in some cases competition that can result in limited impacts on the shared goal” (UNDP, 2020, Risk-Informed Development: A Strategy Tool for Integrating Disaster Risk Reduction and</td>
<td>A risk-informed and prevention-oriented approach to nature protection will enable transformation towards a world where fewer hazards trigger disasters.</td>
<td>By aligning financial decision-making with planetary boundaries, we can “build the foundations for systemic change and establish a new norm for financial regulation and responsible investing”</td>
<td>Utilising basin-scale Planetary Boundaries to help better manage water resources for SDGs and DRR, and commit to making evidence based decisions about water management</td>
<td>At the same time, UNDRR and One Health actors should highlight the interconnected nature of environmental, animal, and human health and should advocate for policies that respect planetary boundaries as a fundamental means of building resilience.</td>
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</tbody>
</table>
The implications of SDG failure for disaster risk reduction and vice versa highlights the importance of the Sendai Framework in promoting coherence and joined-up approaches for disaster risk reduction and the SDGs.

The starting point for risk-informed decision-making on climate change is to ensure that climate change risks and their management are embedded into everyday decision-making around development.

It is equally important to ensure that risk-informed approaches actually strengthen the core elements of risk governance (e.g. processes, institutions and stakeholders) to overcome implementation challenges and strengthen mainstreaming outcomes (UNDP, 2020, Risk-Informed Development: A Strategy Tool for Integrating Disaster Risk Reduction and Climate Change Adaptation into Development, United Nations Development Programme).

Ensure that risk assessments conducted by the DRR community take nature loss considerations into account and ensure that national biodiversity assessments and strategies take into consideration risk assessments.

In order to restructure financial systems to build risk resilience in human and natural systems, we must address the fundamental flaws in our economic systems which continue to measure and value the wrong assets.

Communities must invest in water-related data to understand the quantity, quality, distribution, use, and risks of the water they have.

Ecosystem health should be monitored as an early warning system for future disease risk, with Planetary Boundaries providing a metric for global ecosystem stability.

The planetary boundaries framework can assist in the strengthening of risk-informed development by contributing to a holistic understanding of risk, which is embedded in a systemic and multi-risk perspective, and which captures emerging, dynamic, complex and cascading risks.

Realising the benefits of increased coherence in disaster risk reduction and climate action “requires political support and strong leadership by a recognised co-ordination entity” (OECD, 2020, Common Ground Between the Paris Agreement and the Sendai Framework: Climate Change Adaptation and Disaster Risk Reduction).

Strengthen risk governance and coordination mechanisms so that they more effectively promote coherence, ecosystem based approaches and nature-based solutions into national disaster risk reduction strategies.

The UNDRR should lead a transition in disease management from crisis-response to risk preparedness and prevention, alongside building resilience to the cascading impacts of pandemics when they do occur.
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