HSBC Global Research

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IPCC climate science

Impacts & adaptation – the 10 points you need to know

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Climate Change - Global

- IPCC report is "dire warning about the consequences of inaction"
- Climate impacts are everywhere; effects will get worse with every increment of warming without climate resilient development
- We think investors should assess their exposure across the whole value chain and work to mobilise more climate finance

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Delayed but impactful: The UN's climate science body, the Intergovernmental Panel on Climate Change (IPCC), has released the second report of its sixth assessment cycle (AR6) on *Impacts, Vulnerability and Adaptation*. It was delayed from 2021 but follows from part one of the report on *IPCC climate science: The twelve key points you need to know* (10 August 2021). The report is important because *best available science* is dotted throughout the *COP26: Glasgow Pact* (15 November 2021) and governments can see the climate impacts for their regions.

Specific but encompassing: The report incorporates key global trends such as "biodiversity loss, overall unsustainable consumption of natural resources, land and ecosystem degradation, rapid urbanisation, human demographic shifts, social and economic inequalities and a pandemic". These are assessed against more regional situations with seven chapters that highlight specific impacts and projections.

Action but limiting: "It is unequivocal that climate change has already disrupted human and natural systems" yet the risks and impacts increase as the world warms. 1.5°C aligned action over the next decade would lower the impacts "but cannot eliminate them all". Further warming leads us towards the limits of adaptation.

Feasible but costly: Most climate actions are still feasible − acting sooner will reduce potential costs in most areas but requires mobilisation of all forms of finance. In our view, governments, businesses and investors must plan more collaboratively for the longer term – assessing exposure and working towards transformational adaption. The next IPCC report is out in April, at which point more response options will be presented.

Figure 1: 10 key points from the IPCC's WGII report on impacts

1. Climate impacts have already been observed across all regions	6. Financing adaptation is important but estimating the costs is challenging
2. Some communities are more vulnerable than others	7. Enabling conditions require political commitment and follow-through
3. Risks and impacts vary by time horizon and grow with rising temperatures	8. Regional impacts differ but allow for more nuanced adaptation approaches
4. Current levels of adaptation and effort are insufficient for long term purposes	9. Adaptation solutions should conform to principles of justice
5. The feasibility of different adaptation options varies and there are limits	10. Climate resilient development is an opportunity

Source: HSBC (based on IPCC, AR6, WGII)

This is an abridged version of a report by the same title published on 1-Mar-22. Please contact your HSBC representative or email AskResearch@hsbc.com for more information.

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The science of climate change according to the IPCC

Box 1: What is the IPCC?

The Intergovernmental Panel on Climate Change (IPCC) was set up in 1988 by two UN agencies (The World Meteorological Organisation, WMO and the UN Environment Programme, UNEP) to assess the science relating to climate change. It publishes the Climate Assessment Reports every 6-7 years. The previous series of reports was the fifth assessment cycle (AR5), which was published over 2013-14. This series is part of the sixth assessment cycle (AR6).

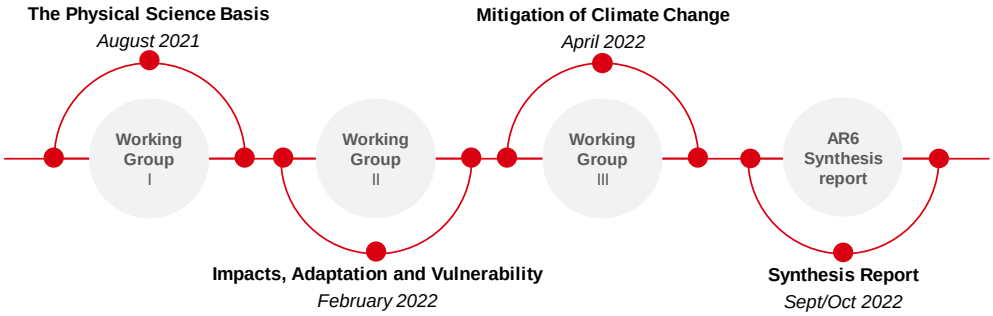
The IPCC consists of hundreds of scientists from a wide range of countries. The body does not conduct its own research but instead assesses the latest scientific papers on the topics in question. Lead authors, nominated by countries, lead reviews with many other scientists. Assessments are subject to multiple drafting and reviews before they are adopted by scientists in conjunction with governments.

Box 2: What is the Sixth Assessment or AR6?

This "Working Group I report on the Physical Science Basis" is part of the IPCC's sixth assessment cycle (AR6). This sixth assessment cycle[1] has already seen the release of three special reports and a refined methodology. The final reports will consist of:

- **Working Group 1 (WG I):** *The Physical Science Basis* (August 2021) – please see our write-up of *The twelve key points you need to know* (10 August 2021)
- **WG II: Impacts, Adaptation and Vulnerability** (28 February 2022)
- **WG III: Mitigation of Climate Change** (April 2022)
- **AR6 Synthesis report** (September/October 2022)

Figure 2: The IPCC's AR6 series of reports



Source: IPCC website

Box 3: IPCC terminology (Likelihood and Confidence)

The IPCC uses specific terminology in describing how it reaches a finding. These are described in terms of '**confidence**' and '**likelihood**'. According to the IPCC, the confidence in the validity of a finding is based on "the type, amount, quality, and consistency of evidence…and the degree of agreement". These are expressed qualitatively in the form of: very low, low, medium, high, very high – confidence. For likelihood, these indicated the "assessed likelihood of an outcome or result" (Figure 3).

1 https://www.ipcc.ch/assessment-report/ar6/

Figure 3: Likelihood scale used by the IPCC

Term	Likelihood of the Outcome	Term	Likelihood of the Outcome
Virtually certain	99-100% probability	Unlikely	0-33% probability
Very likely	90-100% probability	Very unlikely	0-10% probability
Likely	66-100% probability	Exceptionally unlikely	0-1% probability
About as likely as not	33 to 66% probability		

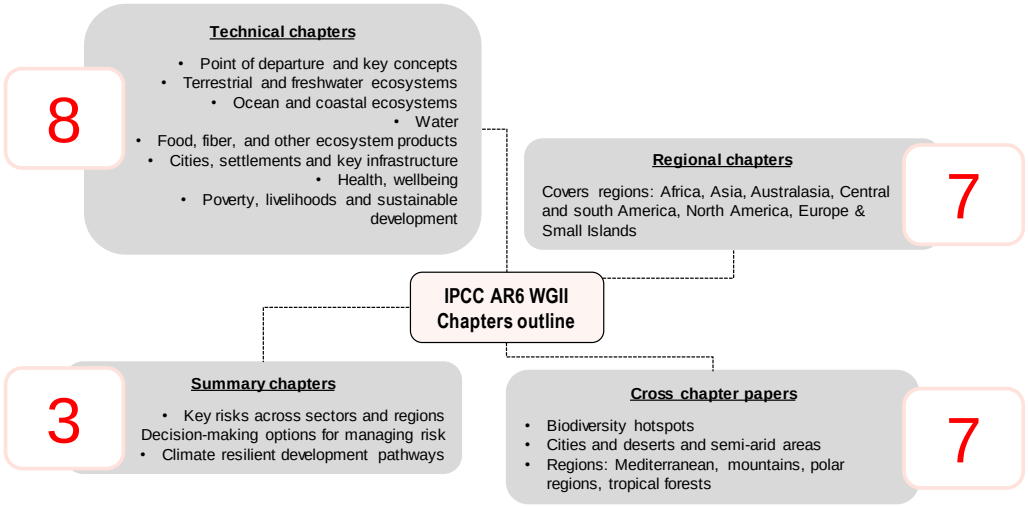
Source: IPCC AR6 methodology

A compendium of eight years of climate science

This WG II report is a compendium of updated climate science since the last report (AR5) in 2013. It incorporates more observations, more advanced climate modelling and touches more regions. The report had some 270 authors from 67 countries of whom 41% were female, 43% were from developing countries and 54% new to the IPCC process.

The full report is over 3,500 pages in total although there is a *Summary for Policymakers* (SPM) that summarises the key messages.

Figure 4: Chapter outline of the WGII full report



Source: IPCC, AR6, WGII

Essential background on adaptation and related concepts

What is adaptation?

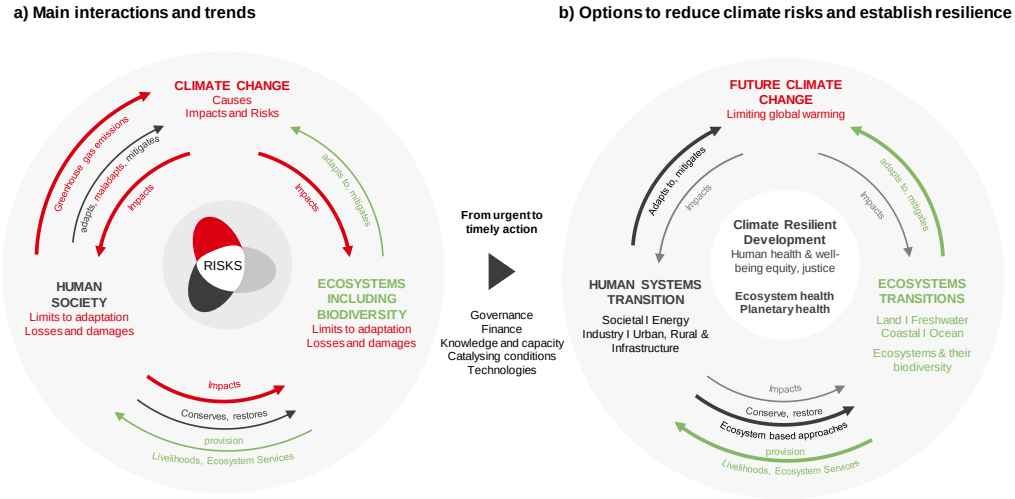
Adaptation is preparing for the impacts of climate change by embedding resilience into physical, economic and social systems.

IPCC definition: **Adaptation** – In human systems, the process of adjustment to actual or expected climate and its effects in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.

Adaptation tries to lower risk

The need to adapt: Humans cause climate change and the impacts affect the natural world and human societies depending on **vulnerability** and **exposure**. The interaction of various climate hazards with exposure and vulnerability contribute to **risk**. Adaptation can mitigate the risks to acceptable (economic and societal) levels and "can be anticipatory or reactive, as well as incremental and/ or transformational"; however, there are limits to adaptation.

Figure 5: The interaction between humans and climate change, and what can be done



Source: IPCC, AR6, WGII, SPM

Degrees of adaptation: The effectiveness of adaptation depends on how much it is able to reduce risk (exposure and vulnerability) and at the same time avoid **maladaptation**.

There can be unintended consequences if adaptation is done improperly

Adapting properly: Maladaptation is the unintended (and usually adverse) effects of adaptation that may lead to an increase in emissions and harm to the environment. These negative effects (risks, vulnerability, exposure) can sometimes be "locked in" for many years or decades.

IPCC definition: **Maladaptation** – Actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas (GHG) emissions, increased vulnerability to climate change, or diminished welfare, now or in the future.

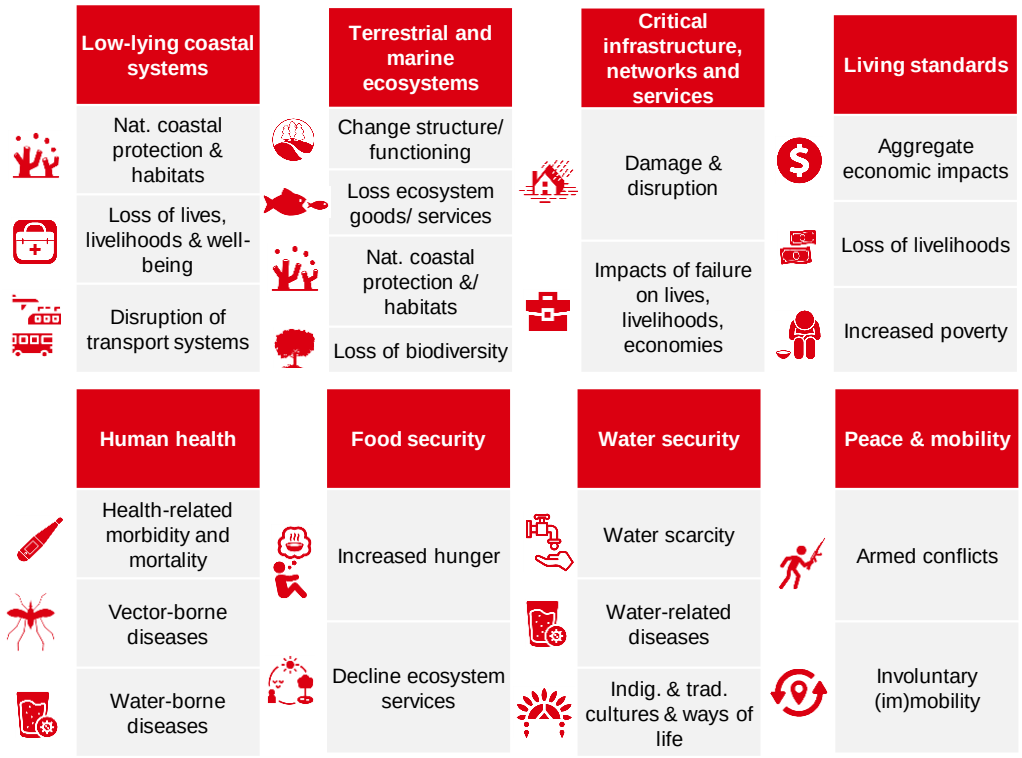
> **Maladaptation can be avoided by flexible, multi-sectoral, inclusive and long-term planning and implementation of adaptation actions with benefits to many sectors and systems. (*high confidence*)**
>
> **IPCC, AR6, WGII, SPM**

127 key climate risks have been identified…

Different types of risk

The WGII report identifies 127 key risks ("those that have potentially severe adverse consequences for humans and social-ecological systems") and categorises them into eight categories of representative key risks.

Figure 6: The IPCC categorises 127 key risks into eight groups



Source: IPCC, AR6, WGII, Chapter 16

…but risks can interact and compound each other

Complex risks result from multiple climate hazards occurring concurrently, and from multiple risks interacting, compounding overall risk and resulting in risks transmitting through interconnected systems and across regions.

Risks do not occur in isolation and the concept of cascading risks (i.e. compounding and complex risk) features in WGII (*SPM B.5*). "**Complex risks result from multiple climate hazards occurring concurrently, and from multiple risks interacting, compounding overall risk**". For example, heat *and* drought affects crop yields, labour productivity, food prices, household income, malnutrition – all of which are interrelated themselves. These risks can sometimes develop or cascade to "trigger tipping points in sensitive ecosystems".

For a full list of definitions, please see the IPCC's glossary (*Annex II* of WGII).

10 key findings from the IPCC's AR6 WGII

1. Climate impacts have already been observed across all regions

Some climate impacts are already irreversible

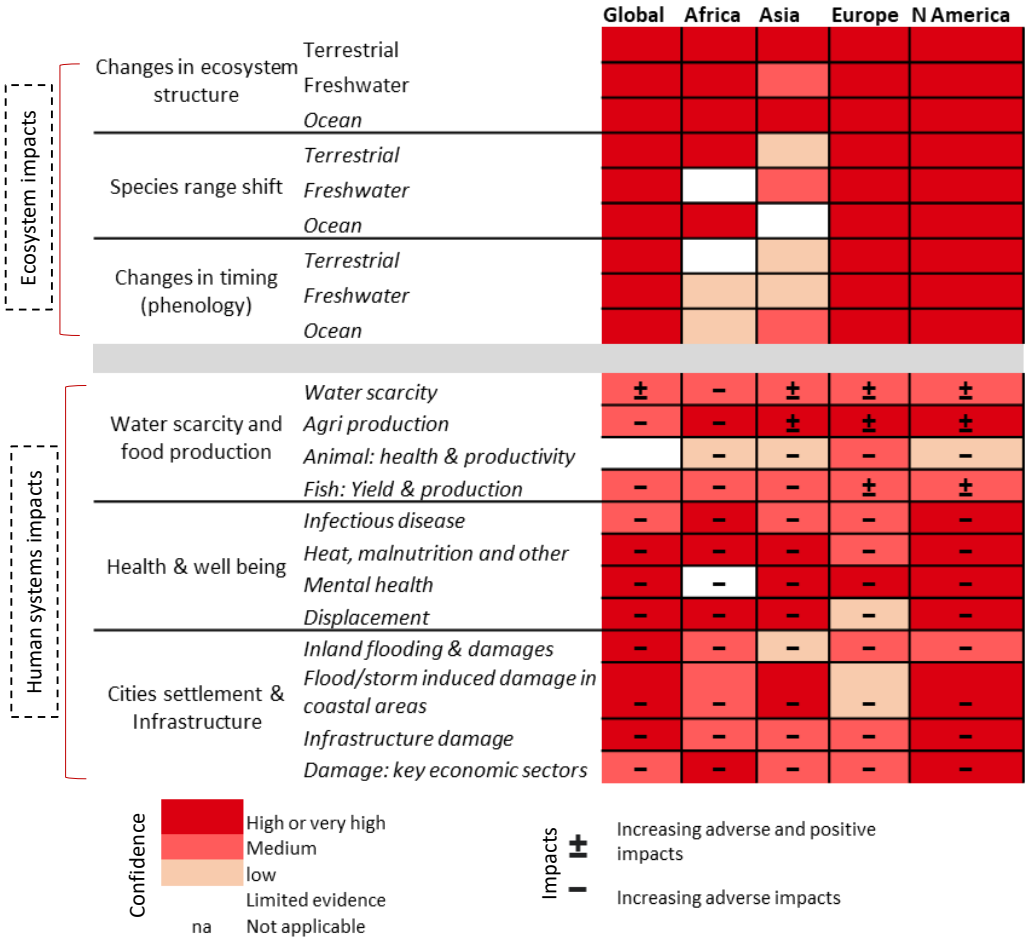
"Human-induced climate change…. **has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability**". While this is not surprising, the statement is qualified by "**the rise in weather and climate extremes has led to some irreversible impacts as natural and human systems are pushed beyond their ability to adapt.** (*high confidence*)".

What's new here is not the events per se, but that some of the changes are already irreversible in the sense that we cannot prepare for them. These include the *timing of natural phenomena* (precipitation patterns, etc) or the *migration of certain species* that may alter the ecosystems as a result.

Impacts can affect ecosystems or human systems (or both)

The types of impact are broadly split into two – those that affect **ecosystems** and those that have a more direct effect on **human systems**. There is clearly overlap between the two because altered ecosystems change the way humans interact with these systems. For example, pollinators having a different range may impact crop yields and food production.

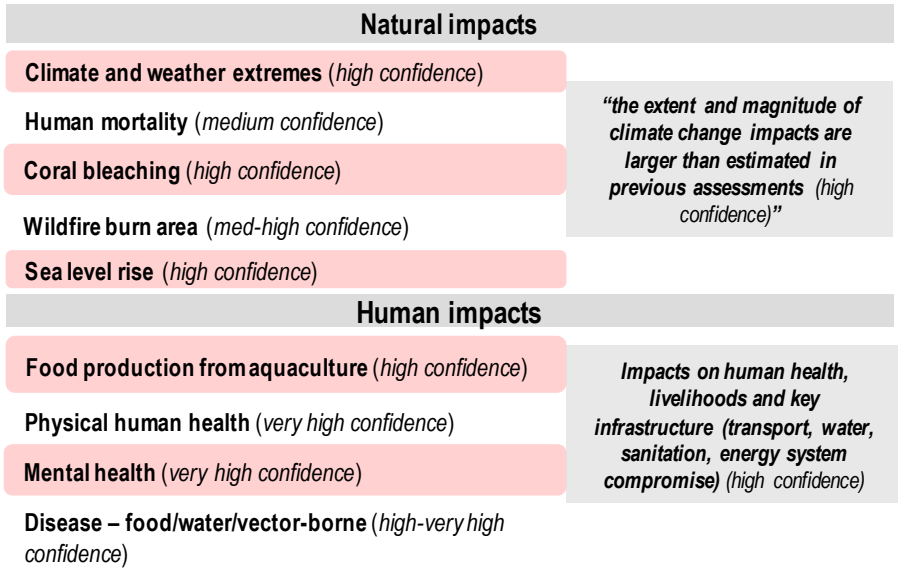
Figure 7: Summary of observed impacts across key regions



Source: IPCC, AR6, WGII, SPM (for full table see Figure SPM.2. in IPCC report)

The IPCC describe multiple impacts that are attributed to climate change, that is, made more frequent or more severe, with varying confidence levels.

Figure 8: Examples of impacts attributable to climate change



Source: IPCC, AR6, WGII, SPM

The effects differ and in some cases are more pronounced at a regional level (see page 12 below), and there are sometimes positive effects such as "lower energy demand" or "advantages in agricultural markets and tourism" – but in general, adverse impacts outweigh positive effects.

2. Some communities are more vulnerable than others

Vulnerability is not uniform…

Vulnerability to climate change depends on geography and how exposed the local natural systems, economy and people are to specific impacts. The "**Vulnerability of ecosystems and people to climate change differs substantially among and within regions** (*very high confidence*)" and the "unsustainable use of natural resources" affects the ability to deal with climate change (*high confidence*) – usually for the worse. For example, deforestation may affect water holding patterns or pollution may magnify insect decline (range and abundance).

…indigenous peoples are often most affected

The impacts are most acute "for Indigenous Peoples and local communities who are directly dependent on ecosystems, to meet basic needs (*high confidence*)." Future impacts also tend to affect the most vulnerable if key infrastructure (water, health, transport, energy, communications) are not built to sufficiently climate-resilient design standards.

> **Approximately 3.3 to 3.6 billion people live in contexts that are highly vulnerable to climate change (*high confidence*)**
>
> **IPCC, AR6, WGII, SPM**

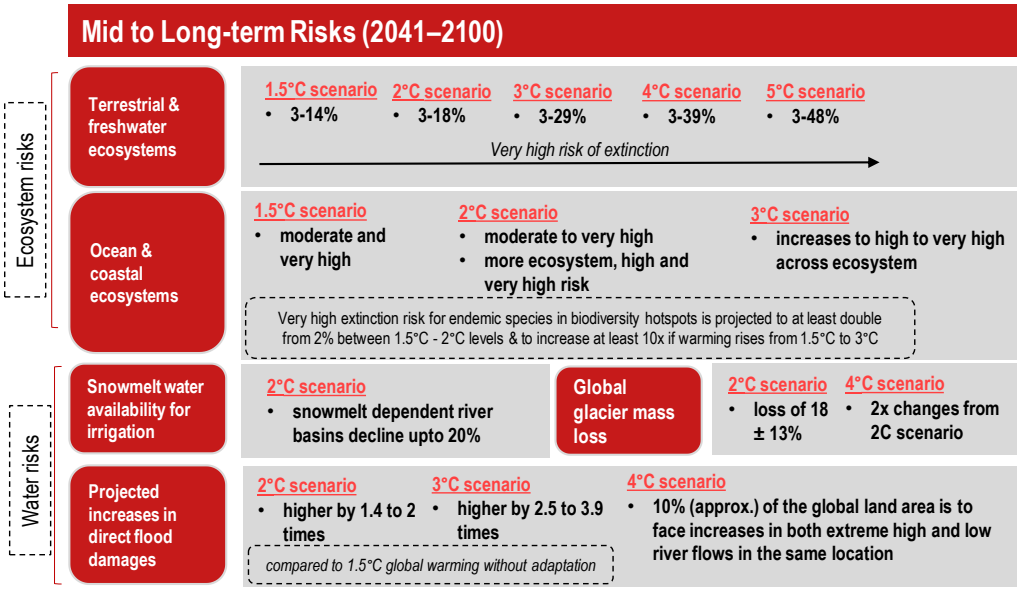
3. Risks and impacts vary by time horizon and grow with rising temperatures

The IPCC report looked at climate risks across various time horizons and settled on a categorisation of: "**near-term (2021–2040), mid-term (2041–2060) and long-term (2081–2100)**." It is important to note that the confidence levels decrease with time (i.e. the further out, the less robust the findings).

Adaptation becomes more challenging with incremental warming

"**Climate resilient development pathways are progressively constrained by every increment of warming**". In other words, the warmer it gets, the more challenging (and costly) adaptation will become (if it is even still feasible, see *page 9*).

Figure 9: Climate impacts increase with warmer temperatures



Source: HSBC (based on IPCC, AR6, WGII, SPM)

Temperature rises may involve an 'overshoot'

The 1.5°C and 2°C temperature goals are for *global mean surface temperature* yet temperature rises are uneven – some locations are warming faster than others. At the same time, limiting warming to these goals may involve a temporary overshoot of the temperature (see Box 4).

Box 4: Emissions pathways and the "overshoot"

Emissions pathways: Scientists use different models to project what could happen to global temperatures with emissions rising under various trajectories or pathways. A *1.5°C pathway* is one which gives a 50% or more probability of limiting warming to 1.5°C (with no overshoot).

Overshoot: An 'overshoot' is where global temperatures temporarily overshoot the 1.5°C target before returning to 1.5°C (or less) **by the year 2100**. The caveat is that the higher the overshoot, the higher the associated risks (i.e. climate impacts).

Impacts are affected by the magnitude of the overshoot

The magnitude of the temperature overshoot is important because the "**Risk of severe impacts increase with every additional increment of global warming during overshoot** (*high confidence*)". The reverse is also true as "Projected impacts are less severe with shorter duration and lower levels of overshoot (*medium confidence*)." We note, however, that the confidence level for 'lower or less' is different from "high or more" as the consequences of climate change are already being felt around the world and the severity of impacts even at current warming is worse than previously anticipated.

Feedback loops and tipping points are also affected by temperatures

Feedback and tipping points: The overshoot may also give rise to negative feedback where "**some impacts will cause release of additional greenhouse gases** (*medium confidence*) **and some will be irreversible, even if global warming is reduced** (*high confidence*)." The irreversible impacts may affect areas "**with low resilience, such as polar, mountain, and coastal ecosystems, impacted by ice-sheet, glacier melt, or by accelerating and higher committed sea level rise** (*high confidence*)." In other words, the impacts could be greater for key regions even if we limit temperature rises to 1.5°C, such that the emissions pathway is important.

What this means for adaptation is that it becomes increasingly difficult (technologically and economically) if 1.5°C is breached, and that it may not even be possible in certain areas above certain temperature rises, i.e. it has reached the limits of adaptation (see *page 10*).

4. Current levels of adaptation and effort are insufficient for long-term purposes

The IPCC finds that current adaptation levels are a start but not commensurate with the long term (and more transformative) adaptation that is required for projected future temperature rises. It finds that short-term adaptation efforts, if not clearly thought out, "**reduces the opportunity for transformational adaptation** (*high confidence*)."

The 'adaptation gap' highlights the insufficiency of current adaptation

There is also a mismatch, called an **adaptation gap,** which exists "**between current levels of adaptation and levels needed to respond to impacts and reduce climate risks** (*high confidence*)." The gap is difficult to quantify because it is set against societal goals that are not clearly articulated. *For reference, at the recent climate talks (COP26), there was a recognition of the need to enhance understanding of the Global Goal of Adaptation.*

IPCC definition: **Adaptation gaps** are defined as the difference between actually implemented adaptation and a societally set goal determined largely by preferences related to tolerated climate change impacts and reflecting resource limitations and competing priorities.

There are many reasons for the adaptation gap, such as lack of clear guidance, lack of clear and agreed goals, even lack of research into what is required at a local level. However, another major reason is the lack of *adaptation finance* as the IPCC finds "**widening disparities between the estimated costs of adaptation and documented finance allocated to adaptation** (*high confidence*)."

> **"At current rates of adaptation planning and implementation the adaptation gap will continue to grow (*high confidence*).**
>
> **IPCC, AR6, WGII, SPM**

5. The feasibility of different adaptation options varies and there are limits

Adaptation options will not last forever

Future adaptation options are available, and these fall into various categories commensurate with the type of climate risk. However, not all options are feasible given technological, economic or societal constraints. Even those that are currently feasible come with the warning that "**feasibility at higher levels of warming may change**".

Figure 10: The feasibility and type of adaptation available by risk type

Key risks	Climate responses and adaptation options	Potential feasibility	Dimension of potential feasibility (medium to high feasibility level)					
			Econ	Tech	Institutional	Social	Environment	Geophysical
Coastal social ecological systems	*Coastal defence and hardening*		✓	✓	✓	✓		✓
	Integrated coastal zone management		✓			✓	✓	✓
Terrestrial and ocean ecosystems	*Forest-based adaptation*		✓	✓	✓	✓	✓	✓
	Sustainable aquaculture and fisheries		✓			✓	✓	✓
	Agroforestry		✓	✓	✓	✓	✓	✓
	Biodiversity and ecosystem connectivity		✓	✓	✓	✓	✓	✓
Food security	*Improved cropland management*		✓	✓	✓	✓	✓	✓
	Efficient livestock systems		✓			✓	✓	✓
Water security	*Water use efficiency and water resource management*		✓	✓	✓	✓	✓	✓
	Improved water use efficiency		✓	✓	✓	/*	✓	✓
Critical infrastructure, networks and services	*Green infrastructure and ecosystem services*		✓	✓		✓	✓	✓
	Sustainable land use and urban planning		✓	✓	✓	✓	✓	✓
	Sustainable urban water management		✓	✓		✓	✓	✓
	Resilient power system		✓	✓	✓	✓	✓	NA
	Energy reliability		✓	✓	✓	✓	✓	NA
Human health	*Health and health system adaptation*		✓	✓		✓	✓	/*
Living standards and equity	*Livelihood diversification*		✓	✓		✓	✓	
Peace and human mobility	*Planned relocation and resettlement*							
	Human migration		✓	✓	✓	✓		NA
Other cross-cutting risks	*Disaster risk management*		✓	✓		✓	✓	✓
	Climate services		✓	✓	✓	✓	✓	✓
	Social safety nets		✓	✓	✓	✓	✓	✓
	Risk spreading and sharing		✓	✓	✓	✓	✓	✓

* Inadequate evidence

Feasibility level: High, Medium, Low

Source: IPCC, AR6, WGII, SPM

Transformational adaptation requires comprehensive planning but quick action

The IPCC finds that implementation times tend to be long for *transformational* adaptation (vs *reactive* fixes), but these require *long-term planning* and *rapid implementation*. There are examples of adaptation options dotted throughout the report with the caveat that options are very much location specific. In our view, the key is to plan collaboratively with the longer term in mind and in conjunction with a wide range of stakeholders.

Figure 11: A summary of adaptation options

Land, Ocean and Ecosystems	Urban, Rural and Infrastructure	Energy System	Cross-cutting Options
Early warning systems	Urban and rural planning	Energy diversification	Resilient health systems
Wetland and river restoration	Livelihood diversification	Demand side management	Heat Health Action Plans
Land-use planning	Community-based adaptation	Smart-grid	Access to potable water
Irrigation management	Urban agriculture and forestry	Robust transmission systems	Improved sanitation systems
Agroforestry	Flood control structures	Resilient infrastructure	Vaccine development
Landscape diversification	Coastal protection structures	Updated design standards	Disaster risk management
Ecosystem-based adaptation	Advance and planned relocation	Efficient water use	Resilient infrastructure planning
Sustainable forest management	Social protection programs		

Source: HSBC (based on IPCC, AR6, WGII, SPM)

There are limits to adaptation

Hitting the limits: The IPCC warns that resilience has limitations and not every climate impact can be adapted for. "**With increasing global warming, losses and damages will increase and additional human and natural systems will reach adaptation limits** (*high confidence*)". There are what the IPCC calls "soft limits" and "hard limits".

IPCC definition: **Adaptation Limits** are the point at which an actor's objectives (or system needs) cannot be secured from intolerable risks through adaptive actions.

Soft adaptation limits are where options may exist but are currently not available to avoid intolerable risks through adaptive action.

Hard adaptation limits arise where no adaptive actions are possible to avoid intolerable risks.

Higher temperatures mean more limits to adaptation

The limits of adaptation vary across temperatures. For example, 1.5°C may give rise to *hard limits* for freshwater resources for certain regions; at 2°C, growing areas may hit potential *soft limits* for some staple crops; at 3°C water management is both a *hard and soft limit* issue for different regions. The IPCC has *high confidence* that "**Transitioning from incremental to transformational adaptation can help overcome soft adaptation limits**" however.

> **Soft limits to some human adaptation have been reached, but can be overcome by addressing a range of constraints, primarily financial, governance, institutional and policy constraints (*high confidence*)**
>
> **IPCC, AR6, WGII, SPM**

6. Financing adaptation is important but estimating the costs is challenging

Mentions of finance – in terms of resources and constraints – are dotted around the IPCC report; however, there is no definitive number (or even a range) of how much adaptation could cost. This is partly to do with the lack of agreement over '*how much should we adapt*' because views differ as to necessity and sufficiency.

Financial resources are affected by adverse impacts

There is a feedback loop, however, and this is broadly negative in that "**Adverse climate impacts can reduce the availability of financial resources by incurring losses and damages and through impeding national economic growth, thereby further increasing financial constraints for adaptation, particularly for developing and least developed countries** (*medium confidence*)".

> **Projected estimates of global aggregate net economic damages generally increase non-linearly with global warming levels (*high confidence*)**
>
> **IPCC, AR6, WGII, SPM**

The IPCC does not give estimates for the costs of adaptation

How much will this cost? The IPCC finds that adaptation finance needs are higher than they were in the previous AR5 series of reports but does not give estimates. Instead, it states "**enhanced mobilization of and access to financial resources are essential for implementation of adaptation**". It mentions enablers of adaptation in the form of public finance (grants, guarantees, etc), and that adaptation can be accelerated by removing financial barriers.

There is also a nod to the ever-present issue of climate finance at climate negotiations where developed countries say they have given a lot more than developing countries believe they have actually received. "[Adaptation] **gaps are partially driven by widening disparities between the estimated costs of adaptation and documented finance allocated to adaptation**".

> **[On financing] The wide range of global estimates, and the lack of comparability between methodologies, does not allow for identification of a robust range of estimates (*high confidence*)**
> **IPCC, AR6, WGII, SPM**

Ranges of 'value at risk' are wide

There is one mention of dollars in the SPM, and it comes with very specific boundaries (by the year 2100), refers to very specific circumstances (the value of assets at risk within coastal floodplains), is given for a very specific set of conditions (certain emissions pathways), and it only comes with medium confidence.

SPM (*B4.5*) states "By 2100 the value of global assets within the future 1-in-100 year coastal floodplains is projected to be between US$7.9 and US$12.7 trillion (2011 value) under RCP4.5, rising to between US$8.8 and US$14.2 trillion under RCP8.5 (*medium confidence*)."

7. Enabling conditions require political commitment and follow-through

Adaptation would benefit from more enabling conditions…

Although fairly obvious, the IPCC explicitly mentions institutional frameworks and policies, clear goals and priorities, mobilization and access to financial resources, monitoring and evaluation, and inclusive governance processes. This is a challenge to any implementation process and each of these points arguably deserves a chapter of its own.

Figure 12: Enabling conditions that would accelerate adaptation

Political commitment	Institutional frameworks
Public awareness	Policy and legal frameworks
Building business cases for adaptation	Behavioural incentives
Accountability and transparency mechanisms	Economic instruments (e.g. climate risk disclosure)
Monitoring and evaluation of adaptation progress	
Social movements	
Climate-related litigation	

Adaptation finance	Monitoring and evaluation
Removing barriers to access	Monitoring of outcomes
Budget allocation	
Public-private partnerships	

Source: IPCC, AR6, WGII, SPM

…but these are very difficult to implement effectively

Most of these may appear simple; however, they can be very difficult to implement in a meaningful way. For example, *climate risk disclosure* is an enabling condition for institutional frameworks but its implementation has only really begun to take off in earnest over the past few years as regulators make disclosures mandatory for public or listed companies.

8. Regional impacts differ but allow for more nuanced adaptation approaches

One major update in AR6 is the much more specific research available on a local or regional level (with *regional chapters* and *factsheets* available). The risks are broadly split into natural systems (water, food) and human systems (economy and energy); see Figure 13.

Figure 13: Highlights of regional climate impacts and risks

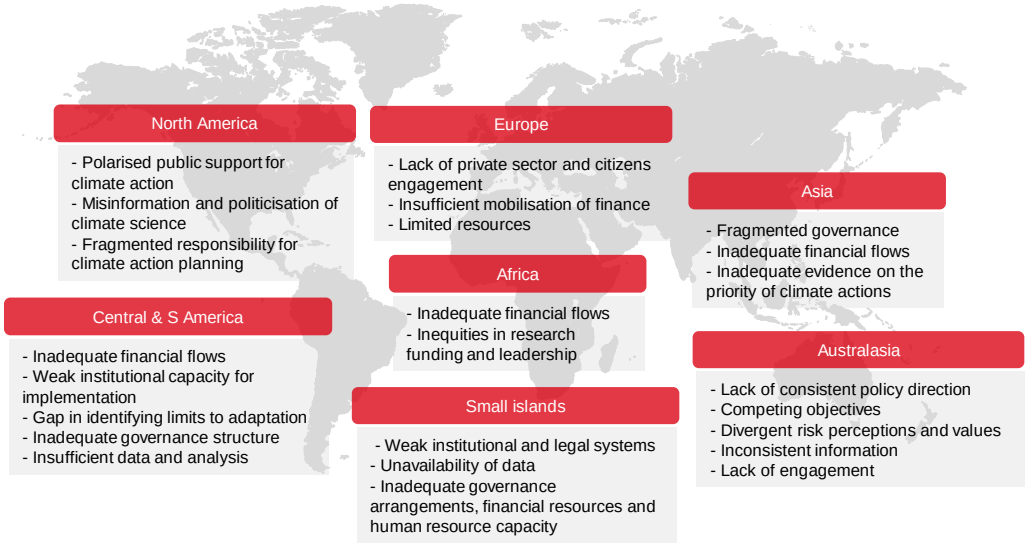
Regions	Water	Ecosystem	Health	Food	Energy	Economy
Asia	River basins in Central Asia could face severe water scarcity challenges by 2050. Drought condition in Asia could increase by 5 - 20% by 2100.	Biodiversity and habitat loss would be increased with warming	Vector- and water-borne diseases, undernutrition and mental disorder would be increased with rising temperature, rainfall and hazards	Food availability and prices will be adversely impacted by floods, droughts and heat stress	Energy demand is increasing due to rising temperature and decrease in precipitation. Most of the developing countries in Asia are exposed to high energy insecurity.	Change in food availability and price will likely affect the overall economic growth of South Asian countries as they are mainly agricultural driven economies
Africa	Water variability is projected to progressively amplify under all climate scenarios and induces varying number of people exposed to water stress	Above 1.5°C, half of assessed species are projected to lose over 30% of their population of habitat area	Vector-borne disease and heat-related deaths will rise with warming	Warming above 2°C will result in yield reduction for staple crops across most African countries	Energy demand in Africa is expected to increase with a potential increase in heat stress	GDP per capita is projected to be at least 5% higher by 2050 if global warming is limited to 1.5C instead of 2C
Australasia	The water availability is impacted by inter-annual/decadal variability of river flows	Extensive coral bleaching events and loss of temperate kelp forests have occurred	Increase in heat-related mortality and morbidity due to heatwaves	Disruption and decline in crop production in south-western, southern and eastern mainland Australia due to hotter and drier weather	Projected increases in frequency and intensity of heatwaves, fires, droughts and storms would increase risk for energy supply and demand	Socio-economic costs arising from climate variability and change have increased
Europe	More than a third of population in southern Europe will be exposed to water scarcity at 2ºC global warming limit	Terrestrial and marine habitat loss increases due to warming	The number of deaths and people at risk of heat stress will increase	Substantive agricultural production losses are projected for most European countries over this century due to heat and drought stress, despite gains in Northern Europe	Onshore wind energy potential is projected to decrease due to reduced surface wind speeds while creating new opportunities for offshore wind	Without adaptation, potential economic damage has been estimated to be in between EUR7bn and EUR17bn for the next 50 years
North America	Intensified droughts and earlier runoff from diminished snowpack will increase water scarcity during summer	Marine, freshwater and terrestrial ecosystem will be altered by climate change	Health risks are projected to increases under all emissions scenario but magnitude depends on implementation of adaptation strategies	Climate change will intensify production losses of key crops, livestock, fisheries and aquaculture products	Climate change is increasing the demand for electricity and vulnerability of energy infrastructure such as drilling platforms and pipelines	Extreme events are adversely affecting economic activities including outdoor labour and tourism, and have disrupted supply-chain infrastructure and trade
Central and South America	Water scarcity and competition are projected to be increased due to glacier retreat, rising temperature and precipitation variability	Coral reefs are expected to lose their habitat and suffer more bleaching events due to ocean warming. The vulnerability of terrestrial ecosystems is projected to increase due to extreme events and fires.	Warming increases the suitability of transmission of vector-borne diseases. Endemic and emerging climate-sensitive infectious diseases are projected to increase	Overall agricultural production and suitable farming areas are projected to be worsen	Energy consumption is projected to increase for cooling and incidence of fires	Change in timing and magnitude of precipitation and rising temperature reduce agricultural production, affecting the economies of larges cities in South America
Small Islands	Freshwater stress is projected to be imposed by the increased aridity	There will be severe coral bleaching annually and further loss of reef-building corals	Changing weather pattern will result in more disease vectors	Food insecurity is likely to become more acute in many small islands due to increased aridity	Energy transition in the Pacific islands demonstrate development synergies such as reduced dependency on volatile fossil fuel markets	Ecosystem degradation is likely to decrease resources availability resulting in impacts upon economies

Source: IPCC, AR6, WGII

Adaptation solutions also vary by region

Adaptation solutions cannot be applied uniformly across all regions as there are many nuances to take into account. These cover economic and social development as well as cultural and equity differences. For example, the WGII report summarises political commitment and policy objectives (Figure 14).

Figure 14: Regional barriers to adaptation



Source: HSBC (based on IPCC, AR6, WGII report)

9. Adaptation solutions should conform to principles of justice

Adaptation solutions should be more inclusive

Equitable solutions: The IPCC report focuses on framework solutions – i.e. multi-sector and integrated solutions, or nature-based solutions, or system-oriented solutions; however, most of these come with the concept of inclusion, equity and justice. The IPCC summarises its findings into three principles (on SPM pg5):

- **distributive justice,** which refers to the allocation of burdens and benefits among individuals, nations and generations
- **procedural justice,** which refers to who decides and participates in decision-making
- **recognition,** which entails basic respect and robust engagement with and fair consideration of diverse cultures and perspectives

The IPCC does not elaborate on the concepts of justice but believes that the knowledge, impacts, planning and implementation of adaptation should take into account disparities, such as "gender, ethnicity, disability, age, location and income".

> **Opportunities for climate resilient development are not equitably distributed around the world (*very high confidence*)**
>
> **IPCC, AR6, WGII, SPM**

For example, **Indigenous Peoples** are mentioned throughout the report when discussing issues such as the impacts of climate change, increasing vulnerability, developmental constraints, conservation, prevention of maladaptation, knowledge of risks, climate resilient development, integrated action and partnerships.

10. Climate resilient development is an opportunity

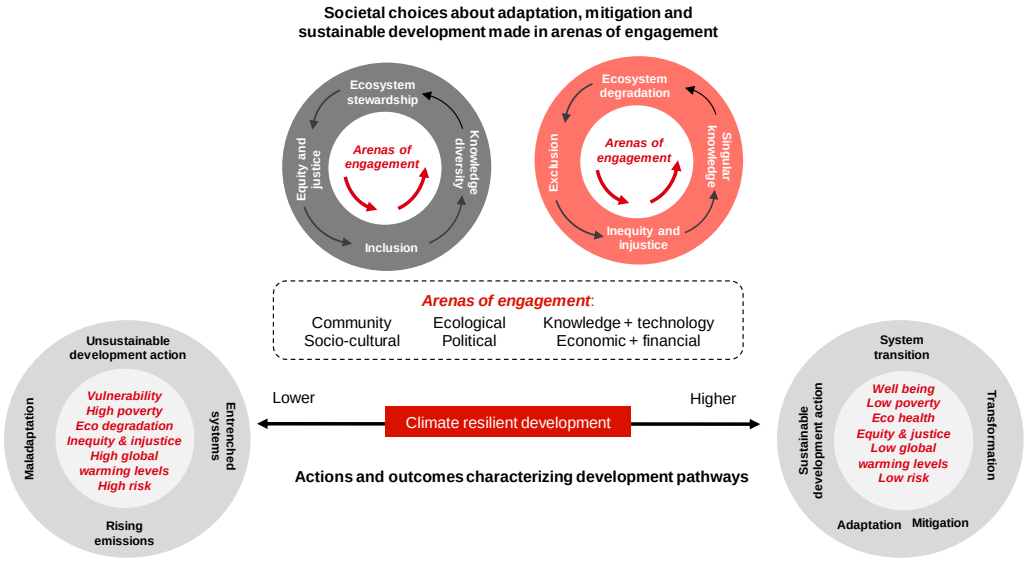
The SPM devotes a whole section (D) to climate resilient development as it addresses issues such as equity, system transitions, infrastructure across human society, natural ecosystems and planetary health.

IPCC definition: **Climate resilient development** is the process of implementing greenhouse gas mitigation and adaptation measures to support sustainable development.

> **Climate Resilient Development integrates adaptation measures and their enabling conditions**
>
> **IPCC, AR6, WGII, SPM**

The IPCC finds that climate resilient development is “more urgent than previously assessed” and “progressively constrained by every increment of warming”; it discusses how the opportunities are not equitably distributed yet the window of opportunity is rapidly narrowing.

Figure 15: Climate resilient development benefits and reinforces positive outcomes



Source: IPCC, AR6, WGII, SPM

Many other issues are discussed in the IPCC WGII report

The report also has seven cross-chapter papers which summarise and assess the impacts and risks surrounding a particular topic. The seven papers cover:

1. *Biodiversity hotspots (land, coasts and oceans)*
2. *Cities and settlements by the sea*
3. *Deserts, semi-arid areas, and desertification*
4. *Mediterranean region*
5. *Mountains*
6. *Polar regions*
7. *Tropical forests*

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