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10 Big Findings from the 2023 IPCC Report on Climate Change

March 20, 2023 ***By Sophie Boehm and Clea Schumer*** Cover Image by: Anirut Thailand/

Finding *Topic* Climate

More on
adaptation
Climate Resilience
climate science
climatewatch-pinned

March 20 marked the release of the final installment of the Intergovernmental Panel on Climate Change's (IPCC) Sfixth Assessment Report (AR6), an eight-year long undertaking from the world's most authoritative scientific body on climate change. Drawing on the findings of 234 scientists on the physical science of climate change, 270 scientists on impacts, adaptation and vulnerability to climate change, and 278 scientists on climate change mitigation, this IPCC synthesis report provides the most comprehensive, best available scienitfic assessment of climate change.

It also makes for grim reading. Across nearly 8,000 pages, the AR6 details the devastating consequences of rising greenhouse gas (GHG) emissions around the world — the destruction of homes, the loss of livelihoods and the fragmentation of communities, for example — as well as the increasingly dangerous and irreversible risks should we fail to change course.

But the IPCC also offers hope, highlighting pathways to avoid these intensifying risks. It identifies readily available, and in some cases, highly cost-e ective actions that can be undertaken now to reduce GHG emissions, scale up carbon removal and build resilience. While the window to address the climate crisis is rapidly closing, the IPCC affirms that we can still secure a safe, livable future.

Here are 10 key findings you need to know:

1. Human-induced global warming of 1.1 degrees C has spurred changes to the Earth's climate that are unprecedented in recent human history.

Already, with 1.1 degrees C (2 degrees F) of global temperature rise, changes to the climate system that are unparalleled over centuries to millennia are now occurring in every region of the world, from rising sea levels to more extreme weather events to rapidly disappearing sea ice.

Is THIS Reality ? maybe a "kindergarten thesis" > aimed specifically as a draft for Australia "GREENIES" . . . for political purpo !
> some interesting points but "assumptions " completely unproven non-substantiated assumptions & extrapolations ! at Trillions $ COST WW

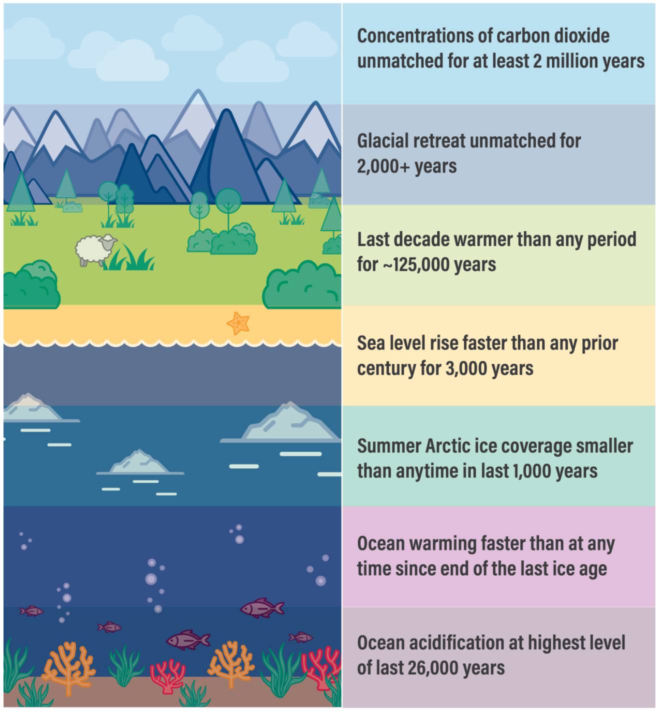
ignorance of CO2 "beneficial"Greening Effects ! The EARTH is NOT a "HOT HOUSE" per se !
> or Any sort of enclosed controlled Greenhouse . . . "except by GOD perhaps"

Phased in NUCLEAR ENERGY IS THE ANSWER to ANY SUCH perceived catastophies !

copied "verbatim" from the Web 02Aug23 > *some reformating was required ! for readability*

& surely U can't copyright "Shit" like this ! >"pseudo" science !

U 'r Comments > Feedback are Welcome ! . . . **but BE-A-WARE !**



Source: IPCC AR6.

Additional warming will increase the magnitude of these changes. Every 0.5 degree C (0.9 degrees F) of global temperature rise, for example, will cause clearly discernible increases in the frequency and severity of heat extremes, heavy rainfall events and regional droughts. Similarly, heatwaves that, on average, arose once every 10 years in a climate with little human in uence will likely occur 4.1 times more frequently with 1.5 degrees C (2.7 degrees F) of warming, 5.6 times with 2 degrees C (3.6 degrees F) and 9.4 times with 4 degrees C (7.2 degrees F) — and the intensity of these heatwaves will also increase by 1.9 degrees C (3.4 degrees F), 2.6 degrees C (4.7 degrees F) and 5.1 degrees C (9.2 degrees F) respectively.

Rising global temperatures also heighten the probability of reaching dangerous tipping points in the climate system that, once crossed, can trigger self-amplifying feedbacks that further increase global warming, such as thawing permafrost or massive forest dieback. Setting such reinforcing feedbacks in motion can also lead to other substantial, abrupt and irreversible changes to the climate system. Should warming reach between 2 degrees C (3.6 degrees F) and 3 degrees C (5.4 degrees F), for example, the West Antarctic and Greenland ice sheets could melt almost completely and irreversibly over many thousands of years, causing sea levels to rise by several meters.

2. Climate impacts on people and ecosystems are more widespread and severe than expected, and future risks will escalate rapidly with every fraction of a degree of warming.

Described as an "an atlas of human suffering and a damning indictment of failed climate leadership" by United Nations Secretary-General António Guterres, one of AR6's most alarming conclusions is that adverse climate impacts are already more far-reaching and extreme than anticipated. About half of the global population currently contends with severe water scarcity for at least one month per year, while higher temperatures are enabling the spread of vector-borne diseases, such as malaria, West Nile virus and Lyme disease. Climate change has also slowed improvements in agricultural productivity in middle and low latitudes, with crop productivity growth shrinking by a third in Africa since 1961. And since 2008, extreme floods and storms have forced over 20 million people from their homes every year.

Every fraction of a degree of warming will intensify these threats, and even limiting global temperature rise to 1.5 degree C is not safe for all. At this level of warming, for example, 950 million people across the world's drylands will experience water stress, heat stress and desertifcation, while the share of the global population exposed to flooding will rise by 24%.

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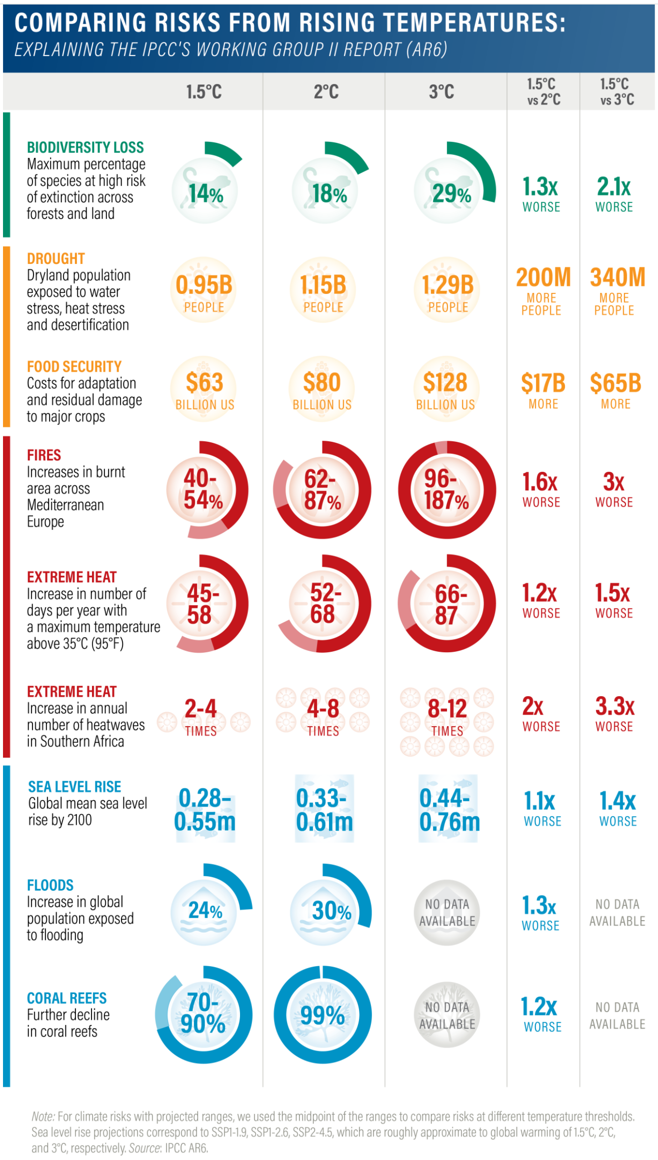


Similarly, overshooting 1.5 degrees C (2.7 degrees F), even temporarily, will lead to much more severe, oftentimes irreversible impacts, from local species extinctions to the complete drowning of salt marshes to loss of human lives from increased heat stress. Limiting the magnitude and duration of overshooting 1.5 degrees C (2.7 degrees F), then, will prove critical in ensuring a safe, livable future, as will holding warming to as close to 1.5 degrees C (2.7 degrees F) or below as possible. Even if this temperature limit is exceeded by the end of the century, the imperative to rapidly curb GHG emissions to avoid higher levels of warming and associated impacts remains unchanged.

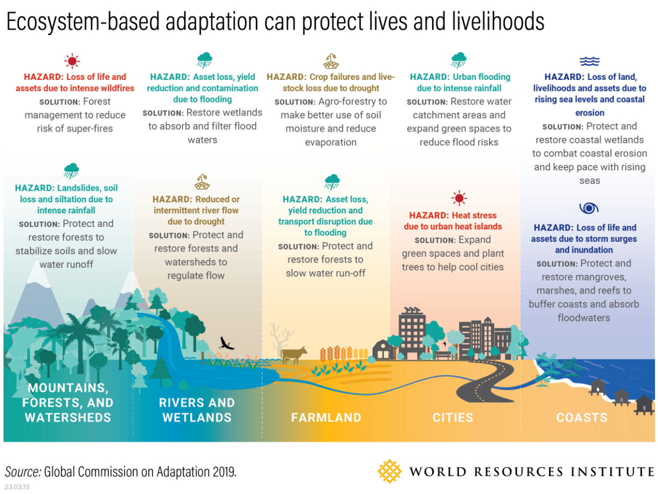
3. Adaptation measures can effectively build resilience, but more finance is needed to scale solutions.

Climate policies in at least 170 countries now consider adaptation, but in many nations, these efforts have yet to progress from planning to implementation. Measures to build resilience are still largely small-scale, reactive and incremental, with most focusing on immediate impacts or near-term risks. is disparity between today's levels of adaptation and those required persists in large part due to limited nance. According to the IPCC, developing countries alone will need $127 billion per year by 2030 and $295 billion per year by 2050 to adapt to climate change. But funds for adaptation reached just $23 billion to $46 billion from 2017 to 2018, accounting for only 4% to 8% of tracked climate finance.

The good news is that the IPCC finds that, with sufficient support, proven and readily available adaptation solutions can build resilience to climate risks and, in many cases, simultaneously deliver broader sustainable development benefits.

Ecosystem-based adaptation, for example, can help communities adapt to impacts that are already devastating their lives and livelihoods, while also safeguarding biodiversity, improving health outcomes, bolstering food security, delivering economic bene ts and enhancing carbon sequestration. Many ecosystem-based adaptation measures — including the protection, restoration and sustainable management of ecosystems, as well

Meaningful collaboration with Indigenous Peoples and local communities is critical to the success of this approach, as is ensuring that ecosystem-based adaptation strategies are designed to



4. Some climate impacts are already so severe they cannot be adapted to, leading to losses and damages.

Around the world, highly vulnerable people and ecosystems are already struggling to adapt to climate change impacts. For some, these limits are "soft" — effective adaptation measures exist, but economic, political and social obstacles constrain implementation, such as lack of technical support or inadequate funding that does not reach the communities where it's needed most. But in other regions, people and ecosystems already face or are fast approaching "hard" limits to adaptation, where climate impacts from 1.1 degrees C (2 degrees F) of global warming are becoming so frequent and severe that no existing adaptation strategies can fully avoid losses and damages. Coastal communities in the tropics, for example, have seen entire coral reef systems that once supported their livelihoods and food security experience widespread mortality, while rising sea levels have forced other low-lying neighborhoods to move to higher ground and abandon cultural sites.

Coral has turned into rubble in the shallow waters off the coast of Indonesia. Increased temperatures from climate change means that mortality has increased in coral reef systems in coastal communities. Photo by Velvetfish/iStock.

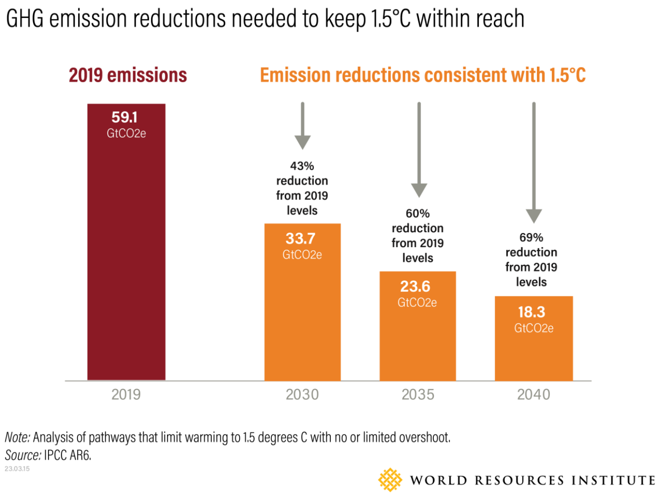
Whether grappling with soft or hard limits to adaptation, the result for vulnerable communities is oftentimes irreversible and devastating. Such losses and damages will only escalate as the world warms. Beyond 1.5 degrees C (2.7 degrees F) of global temperature rise, for example, regions reliant on snow and glacial melt will likely experience water shortages to which they cannot adapt. At 2 degrees C (3.6 degrees F), the risk of concurrent maize production failures across important growing regions will rise dramatically. And above 3 degrees C (5.4 degrees F), dangerously high summertime heat will threaten the health of communities in parts of southern Europe.

Urgent action is needed to avert, minimize and address these losses and damages. At COP27, countries took a critical step forward by agreeing to establish funding arrangements for loss and damage, including a dedicated fund. While this represents a historic breakthrough in the climate negotiations, countries must now figure out the details of what these funding arrangements, as well as the new fund, will look like in practice — and it's these details that will ultimately determine the adequacy,

5. Global GHG emissions peak before 2025 in 1.5 degrees C-aligned pathways.

 e IPCC finds that there is a more than 50% chance that global temperature rise will reach or surpass 1.5 degrees C (2.7 degrees F) between 2021 and 2040 across studied scenarios, and under a high-emissions pathway, speci cally, the world may hit this threshold even sooner — between 2018 and 2037. Global temperature rise in such a carbon-intensive scenario could also increase to 3.3 degrees C to 5.7 degrees C (5.9 degrees F to 10.3 degrees F) by 2100. To put this projected amount of warming into perspective, the last time global temperatures exceeded 2.5 degrees C (4.5 degrees F) above pre-industrial levels was more than 3 million years ago.

Changing course to limit global warming to 1.5 degrees C (2.7 degrees F) — with no or limited overshoot — will instead require deep GHG emissions reductions in the near-term. In modelled pathways that limit global warming to this goal, GHG emissions peak immediately and before 2025 at the latest. ey then drop rapidly, declining 43% by 2030 and 60% by 2035, relative to 2019 levels.

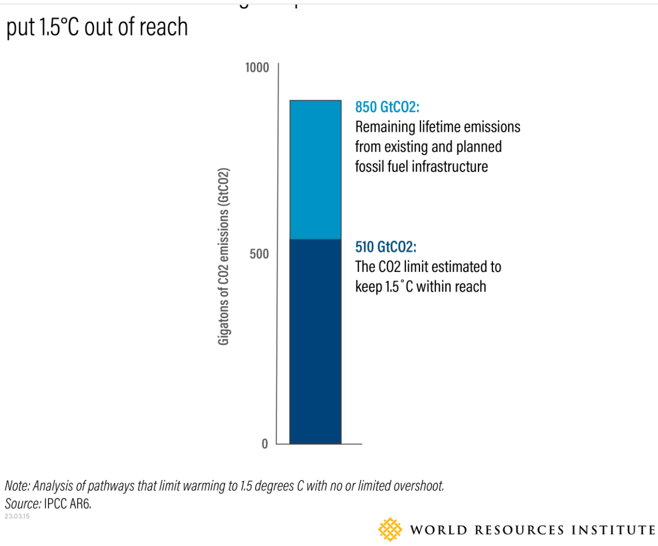


While there are some bright spots — the annual growth rate of GHG emissions slowed from an average of 2.1% per year between 2000 and 2009 to 1.3% per year between 2010 and 2019, for example — global progress in mitigating climate change remains woefully off-track. GHG emissions have climbed steadily over the past decade, reaching 59 gigatonnes of carbon dioxide equivalent (GtCO2e) in 2019 — approximately 12% higher than in 2010 and 54% greater than in 1990.

Even if countries achieved their climate pledges (also known as nationally determined contributions or NDCs), WRI research nds that they would reduce GHG emissions by just 7% from 2019 levels by 2030, in contrast to the 43% associated with limiting temperature rise to 1.5 degrees C (2.7 degrees F). And while handful of countries have submitted new or enhanced NDCs since the IPCC's cut-o date, more recent analysis that takes these submissions into account nds that these commitments collectively still fall short of closing this emissions gap.

6. The world must rapidly shift away from burning fossil fuels — the number one cause of the climate crisis.

In pathways limiting warming to 1.5 degrees C (2.7 degrees F) with no or limited overshoot just a net 510 GtCO2 can be emitted before carbon dioxide emissions reach net zero in the early 2050s. Yet future carbon dioxide emissions from existing and planned fossil fuel infrastructure alone could surpass that limit by 340 GtCO2, reaching 850 GtCO2.



A mix of strategies can help avoid locking in these emissions, including retiring existing fossil fuel infrastructure, canceling new projects, retrofitting fossil-fueled power plants with carbon capture and storage (CCS) technologies and scaling up renewable energy sources like solar and wind (which are now cheaper than fossil fuels in many regions).

In pathways that limit warming to 1.5 degrees C (2.7 degrees F) — with no or limited overshoot — for example, global use of coal falls by 95% by 2050, oil declines by about 60% and gas by about 45%. ese gures assume signi cant use of abatement technologies like CCS, and without them, these same pathways show much steeper declines by mid-century. Global use of coal without CCS, for example, is virtually phased out by 2050.

Although coal-fired power plants are starting to be retired across Europe and the United States, some multilateral development banks continue to invest in new coal capacity. Failure to change course risks stranding assets worth trillions of dollars.

7. We also need urgent, systemwide transformations to secure a net-zero, climate-resilient future.

While fossil fuels are the number one source of GHG emissions, deep emission cuts are necessary across all of society to combat the climate crisis. Power generation, buildings, industry, and transport are responsible for close to 80% of global emissions while agriculture, forestry and other land uses account for the remainder.

Take the transport system, for instance. Drastically cutting emissions will require urban planning that minimizes the need for travel, as well as the build-out of shared, public and nonmotorized transport, such as rapid transit and bicycling in cities. Such a transformation will also entail increasing the supply of electric passenger vehicles, commercial vehicles and buses, coupled with wide-scale installation of rapid-charging infrastructure, investments in zero-carbon fuels for technologies like fossil-fueled cars. Infrastructure design — like reallocating street space for sidewalks or bike lanes — can help people transition to lower-emissions lifestyles. It is important to note there are many co-benefits that accompany these transformations, too. Minimizing the number of passenger vehicles on the road, in this example, reduces harmful local air pollution and cuts traffic-related crashes and deaths.

Transformative adaptation measures, too, are critical for securing a more prosperous future. e IPCC emphasizes the importance of ensuring that adaptation measures drive systemic change, cut across sectors and are distributed equitably across at-risk regions. e good news is that there are oftentimes strong synergies between transformational mitigation and adaptation. For example, in the global food system, climate-smart agriculture practices like shifting to agroforestry can improve resilience to climate impacts, while simultaneously advancing mitigation.

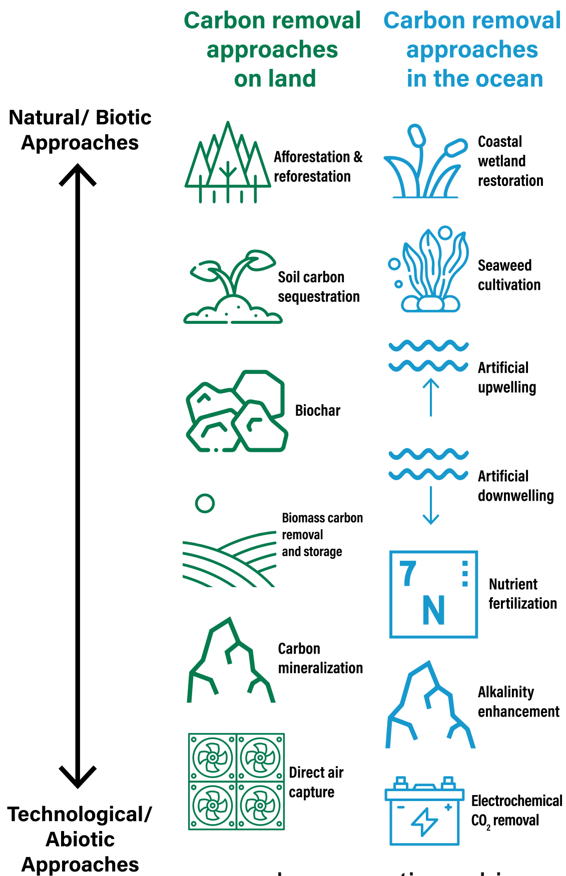
Explore Systems Change Lab

Systems Change Lab monitors, learns from and mobilizes action to achieve the far-reaching transformational shifts needed to limit global warming to 1.5 degrees C, halt biodiversity loss and build a just and equitable economy.

8. Carbon removal is now essential to limit global temperature rise to 1.5 degrees C.

Deep decarbonization across all systems while building resilience won't be enough to achieve global climate goals, though. e IPCC nds that all pathways that limit warming to 1.5 degrees C (2.7 degrees F) — with no or limited overshoot — depend on some quantity of carbon removal. ese approaches encompass both natural solutions, such as sequestering and storing carbon in trees and soil, as well as more nascent technologies that pull carbon dioxide directly from the air.

However over each carbon removal approach to learn more:



Note: is gure includes carbon removal approaches mentioned in countries' long-term climate and strategies as well as other leading proposed approaches.
Note: the natural vs. technological categorization shown here is illustrative rather than definitive and will vary depending on how approaches are applied, particularly for carbon removal approaches in the ocean.

The amount of carbon removal required depends on how quickly we reduce GHG emissions across other systems and the extent to which climate targets are overshot, with estimates ranging from between 5 GtCO2 to 16 GtCO2 per year needed by mid-century.

All carbon removal approaches have merits and drawbacks. Reforestation, for instance, represents a readily available, relatively low-cost strategy that, when implemented appropriately, can deliver a wide range of benefits to communities. Yet the carbon stored within these ecosystems is also vulnerable to disturbances like wild res, which may increase in frequency and severity with additional warming. And, while technologies like bioenergy with carbon capture and storage (BECCS) may over a more permanent removal technologies, alongside existing natural approaches, will therefore require careful understanding of each solution's unique bene ts, costs and risks.

9. Climate finance for both mitigation and adaptation must increase dramatically this decade.

e IPCC nds that public and private nance ows for fossil fuels today far surpass those directed toward climate mitigation and adaptation. us, while annual public and private climate finance has risen by upwards of 60% since the IPCC's Fifth Assessment Report, much more is still required to achieve global climate change goals. For instance, climate finance will need to increase between 3 and 6 times by 2030 to achieve mitigation goals, alone.

is gap is widest in developing countries, particularly those already struggling with debt, poor credit ratings and economic burdens from the COVID-19 pandemic. Recent mitigation investments, for example, need to increase by at least sixfold in Southeast Asia and developing countries in the Pacific, vefold in Africa and fourteenfold in the Middle East by 2030 to hold warming below 2 degrees C (3.6 degrees F). And across sectors, this shortfall is most pronounced for agriculture, forestry and other land use, where recent financial flows are 10 to 31 times below what is required to achieve the Paris Agreement's goals.

Finance for adaptation, as well as loss and damage, will also need to rise dramatically. Developing countries, for example, will need $127 billion per year by 2030 and $295 billion per year by 2050. While AR6 does not assess countries' needs for nance to avert, minimize and address losses and damages, recent estimates suggest that they will be substantial in the coming decades. Current funds for both fall well below estimated needs, with the highest estimates of adaptation nance totaling under $50 billion per year.

Young mangroves ready for planting in Watamu, Kenya. Ecosystem-based adaptation measures like restoration can be low-cost ways to help communities adapt and protect biodiversity. Photo by MariusLtu/iStock.

10. Climate change — as well as our collective efforts to adapt to and mitigate it — will exacerbate inequity should we fail to ensure a just transition.

Households with incomes in the top 10%, including a relatively large share in developed countries, emit upwards of 45% of the world's GHGs, while those families earning in the bottom 50% account for 15% at most. Yet the ffects of climate change already — and will continue to — hit poorer, historically marginalized communities the hardest.

Today, between 3.3 billion and 3.6 billion people live in countries that are highly vulnerable to climate impacts, with global hotspots concentrated in the Arctic, Central and South America, Small Island Developing states, South Asia and much of sub-Saharan Africa. Across many countries in these regions, con ict, existing inequalities and development challenges (e.g., poverty and limited access to basic services like clean water) not only heighten sensitivity to climate hazards, but also limit communities' capacity to adapt. Mortality from storms, floods and droughts, for instance, was 15 times higher in countries with high vulnerability to climate change than in those with very low vulnerability from 2010 to 2020.

At the same time, e orts to mitigate climate change also risk disruptive changes and exacerbating inequity. Retiring coal- red power plants, for instance, may displace workers, harm local economies and recon gure the social fabric of communities, while inappropriately implemented e orts to halt deforestation could heighten poverty and intensify food insecurity. And certain climate policies, such as carbon taxes that raise the cost of emissions-intensive goods like gasoline, can also prove to be regressive, absent of efforts to recycle the revenues raised from these taxes back into programs that bene t low-income communities.

emissions, climate-resilient future. Reconfiguring social protection programs (e.g., cash transfers, public works programs and social safety nets) to include adaptation, for example, can reduce communities' vulnerability to a wide range of future climate impacts, while strengthening justice and equity. Such programs are particularly effective when paired with efforts to expand access to infrastructure and basic services.

Similarly, policymakers can design mitigation strategies to better distribute the costs and benefits of reducing GHG emissions. Governments can pair efforts to phase out coal-fired electricity generation, for instance, with subsidized job retraining programs that support workers in developing the skills needed to secure new, high-quality jobs. Or, in another example, officials can couple policy interventions dedicated to expanding access to public transit with interventions to improve access to nearby, affordable housing.

Across both mitigation and adaptation measures, inclusive, transparent and participatory decision-making processes will play a central role in ensuring a just transition. More specifically, these forums can help cultivate public trust, deepen public support for transformative climate fction and avoid unintended consequences.

Looking Ahead

The IPCC's AR6 makes clear that risks of inaction on climate are immense and the way ahead requires change at a scale not seen before. However, this report also serves as a reminder that we have never had more information about the gravity of the climate emergency and its cascading impacts — or about what needs to be done to reduce intensifying risks.

Limiting global temperature rise to 1.5 degrees C (2.7 degrees F) is still possible, but only if we act immediately. As the IPCC makes clear, the world needs to peak GHG emissions before 2025 at the very latest, nearly halve GHG emissions by 2030 and reach net-zero CO2 emissions around mid-century, while also ensuring a just and equitable transition. We'll also need an all-hands-on-deck approach to guarantee that communities experiencing increasingly harmful impacts of the climate crisis have the resources they need to adapt to this new world. Governments, the private sector, civil society and individuals must all step up to keep the future we desire in sight. A narrow window of opportunity is still open, but there's not one second to waste.

Note: In addition to showcasing findings from the IPCC's AR6 Synthesis Report, this article also draws on previous articles detailing the IPCC's findings on the physical science of climate change, impacts, adaption and vulnerability, and climate change mitigation.

Relevant Work

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