
Climate Change and Global Warming: Understanding the Crisis and Solutions.

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ABSTRACT

We stand at a crossroads. The air thickens with heat, storms rage with unfamiliar fury, and seasons blur—not as distant theories, but as visceral truths. Farmers tally cracks in parched soil. Parents lie awake weighing an uncertain world. Coastal towns watch shorelines retreat wave by wave. This crisis transcends science; it's about how we coexist on our only home. This paper uncovers the human pulse behind the data. It traces how daily choices—the energy powering our homes, the food on our plates—interlace into a planetary force reshaping existence. Yet within this urgency, hope takes root: ordinary people worldwide are rising. Meet inventors harvesting sunlight into power. Indigenous guardians defending ancestral forests. Youth marching with unwavering voices. See cities blossoming into green havens. Watch farmers blend ancient wisdom with resilient crops. These aren't future fantasies—they're unfolding today in backyards, villages, and city blocks. The evidence is clear: we possess the tools, the understanding,



and above all, the collective will to transform crisis into opportunity. An opportunity to forge a world that thrives sustainably, embraces justice, deepens connection, and rekindles awe for our shared home. Our future remains unwritten—and that is the most powerful hope we hold.

Introduction:

Our Changing World: Understanding Climate Change Through Human Eyes

We are living through a quiet revolution in the very air we breathe. The steady rhythms of nature that once guided our grandparents—when to plant, when to harvest, when to expect the rains—are slipping into memory, replaced by uncertainty. This is not just a scientific concern; it is a human story unfolding in our backyards, our farmlands, and our cities.

At its core, the truth is both simple and profound: our daily choices—the energy we consume, the food we grow, the way we move—are reshaping Earth’s future. Like a blanket wrapped too tightly, the heat trapped by our carbon emissions stifles the planet. Farmers feel it in withered crops, parents hear it in their children’s strained breaths, and coastal towns measure it in the slow creep of rising tides.

Yet here, in the face of crisis, hope takes root. Every challenge born from human hands can be met by human will. A grandmother teaches her grandchildren how to conserve water. A young engineer devises ways to harness the wind. Communities band together to protect forests that have stood for generations. What once seemed inevitable is now being overturned by ingenuity, resilience, and shared determination.

Why This Matters to All of Us

Climate change knows no borders. It reshapes lives from the Himalayan slopes of Nepal to the vanishing beaches of Florida. When we study these shifts, we are not merely tracking weather patterns—we are learning how to safeguard what sustains us. We must ask: Will the fields of Kenya and Kansas still yield enough to feed us? Which towns will face the fury of floods, fires, or droughts? How will rising costs strain families from Delhi to Detroit? And most crucially—what kind of world will our children inherit? Understanding these connections allows us to act. We can fortify coastlines against rising seas, help farmers adapt to erratic seasons, create new livelihoods in clean energy from Berlin to Bangalore, and



shield the forests that give our planet breath. This is not just science—it is survival. The deeper our understanding, the better we can protect what matters to us all.

A Geospatial Approach to Climate Risk Assessment

By mapping the Earth's shifting climate, we uncover the hidden patterns of risk—where heat grows unbearable, where rains fail, where storms gather strength. This knowledge is not just lines on a chart; it is a tool for action. We see which farmlands face drought, which rivers may run dry, which cities lie in the path of floods. With this clarity, we can craft solutions that fit each place—restoring wetlands to buffer against storms, designing roads that withstand monsoons, planting crops that thrive in a warmer world.

This is how science becomes stewardship. By blending geography with climate wisdom, we pinpoint where help is needed most. We learn how to shield vulnerable communities, how to share water across borders, how to build a future that bends rather than breaks under pressure. The land speaks, if we listen. And what it tells us now is this: the time to act is here.

Why This Research Matters for Our World

Climate change isn't a distant threat—it's reshaping our world in ways as varied as the landscapes we call home. That's why we must examine it from all sides. This paper digs into three urgent questions:

First, **the human cost of a shifting climate**—why a drought in Senegal and a flood in Bangladesh, though oceans apart, are threads of the same story.

Second, **the forces driving this change**—not just smokestacks and tailpipes, but the systems and choices that keep them burning.

And third, **the real-world solutions already taking root**—from the terraced farms holding back erosion in Peru to the wind turbines powering Danish towns.

This isn't just about data—it's about understanding what's happening to communities, uncovering why, and most importantly, learning how we can change course—one place, one innovation, one act of resilience at a time.

**TABLE 1: Global Temperature Rise by Decade (1920s-2020s)**

Time Period	Temperature Increase (°C)	Human Experience of the Era
1920s-1930s	+0.1	Steam trains crisscross continents while scientists first ponder the greenhouse effect
1940s-1950s	+0.2	Post-war boom fills skies with industrial smoke; first climate models emerge
1960s-1970s	+0.3	Clean Air Acts bring blue skies back, but CO ₂ invisibly accumulates
1980s-1990s	+0.5	Scientists sound alarms as heatwaves intensify; world leaders begin climate talks
2000s-2010s	+0.85	Unprecedented wildfires and storms make headlines yearly; Paris Agreement signed
2020-2024	+1.2	Children experience summers unlike any in human history; "global boiling" era begins.

The Human Cost of Rising Temperatures

The numbers tell a clear story: our world is heating at a frightening pace. Since the 1970s, the rate of warming has doubled—what was once a slow creep has become a sprint. Where our grandparents noticed gradual shifts in seasons, our children now face climate changes unfolding at twice the speed. Nowhere is this crisis more visible than in the Arctic, where temperatures rise three times faster than the global average. For Indigenous communities, this isn't just data—it's the unraveling of traditions that have sustained them for generations. Ice that once held firm now cracks beneath their feet; hunting routes that guided their ancestors are disappearing. Every fraction of a degree carries real consequences. Just 0.1°C of warming exposes millions more people to deadly heatwaves. It pushes sea levels another inch higher,



swallowing coastlines inch by inch. It shrinks harvests, with wheat and rice yields dropping steadily as temperatures climb. These small numbers add up to life-altering changes—empty fishing nets, failed crops, and homes lost to floods. We've already crossed dangerous thresholds. At +0.5°C, coral reefs—once vibrant underwater cities—began bleaching into barren wastelands. At +1.0°C, so-called "rare" disasters became regular events, driving insurance costs beyond reach for many families. Now, at +1.2°C and rising, we're flirting with +1.5°C—a point where climate impacts could spiral beyond our control, destabilizing food supplies, economies, and entire regions. This isn't just about science—it's about lived reality. It's the difference between a world we can adapt to and one that overwhelms us. Between manageable challenges and unthinkable crises. Between leaving our children a troubled planet and leaving them a broken one. The numbers measure more than temperature—they measure risk, responsibility, and the narrowing window we have to act.

The Devastating Impacts of Climate Change

Our planet is undergoing dramatic changes that touch every aspect of life. Rising temperatures aren't just making summers hotter—they're triggering deadly heatwaves that overwhelm hospitals, buckle roads, and push power grids to their limits. The elderly and vulnerable suffer most, while cities become heat traps with no relief. In our polar regions, a quiet catastrophe unfolds as ancient ice sheets collapse into rising seas. Coastal towns from Miami to Mumbai watch helplessly as high tides creep further inland each year, swallowing beaches and flooding basements. Island nations face an existential threat, with some preparing to relocate entire populations as their homelands disappear beneath the waves. Rainfall patterns have become increasingly erratic—farmers can no longer predict when to plant their crops. Some regions bake under endless drought while others drown in unprecedented floods. The hurricanes that slam into coastlines now carry more fury, leaving behind broken communities that take years to rebuild.

Nature itself is struggling to adapt. Forests that have stood for centuries now succumb to invasive beetles and wildfires. Coral reefs—the rainforests of the sea—are bleaching ghostly white as ocean temperatures rise. Animals from monarch butterflies to polar bears are being forced from their habitats, with many unable to survive the rapid changes. Our food supply hangs in the balance. Crops wither in unseasonable heat while unpredictable rains drown fields at harvest time. The breadbaskets that feed the world face declining yields, threatening to drive up food prices and push millions into hunger. Meanwhile, disease-carrying mosquitoes expand their range, bringing malaria and dengue fever to new regions unprepared for these health crises. Perhaps most heartbreaking is the human toll—families forced to abandon



ancestral homes as the land becomes uninhabitable. Climate refugees now number in the millions, often unwelcome in the places they flee to. These disruptions sow the seeds of conflict as resources grow scarce and populations shift. This isn't some distant future—it's happening now, in our lifetimes. The changes we're seeing today will only intensify unless we take decisive action. Our children's world depends on the choices we make in this critical moment.

The Human Fingerprints on Our Changing Climate

Our planet's fever has clear causes, each bearing the mark of human activity. The blanket of greenhouse gases thickening around Earth doesn't come from natural cycles alone - it's woven from the daily workings of our modern world. The story begins with carbon dioxide, the heavyweight of climate change. Every time we burn coal to power our cities, gasoline to move our cars, or natural gas to heat our homes, we pump CO₂ into an atmosphere already overloaded with it. Since the first factories of the Industrial Revolution began belching smoke, atmospheric CO₂ levels have skyrocketed by 50% - from 280 parts per million to over 420 today. This invisible buildup acts like turning up a planetary thermostat degree by degree. But CO₂ isn't our only problem. The methane leaking from oil wells, bubbling up from landfills, and even escaping from cow digestive systems packs a fiercer punch - trapping 80 times more heat than CO₂ in its first twenty years. A single dairy cow's belches release enough methane annually to equal a car's carbon emissions. Then there's nitrous oxide from over-fertilized farm fields - a gas nearly 300 times more potent than CO₂ that also eats away at our protective ozone layer. We're not just adding gases - we're removing Earth's natural defenses. The world's forests, which have absorbed our carbon emissions for centuries, are being cleared at shocking rates. Every minute, we lose football fields worth of trees to cattle ranching, palm oil plantations, and timber operations. This double blow eliminates carbon-storing trees while releasing all their stored carbon back into the air. The Amazon, once called "the planet's lungs," now emits more carbon than it absorbs in some regions due to rampant deforestation. Our factories and cities contribute their own mix of climate pollutants. Cement production alone accounts for 8% of global CO₂ emissions - if it were a country, it would rank third behind China and the US. Refrigerators and air conditioners leak super-potent fluorinated gases that can trap thousands of times more heat than CO₂. Even our trash dumps become climate hazards as organic waste rots without oxygen, producing methane that often goes unmeasured and unchecked. These interconnected causes form a web of warming that's distinctly human-made. From the exhaust pipes of our morning commute to the steak on our dinner plate, countless daily choices feed into this global pattern. The good news? Since human



activities drive climate change, human actions can also change its course - but only if we act with the urgency this crisis demands.

TABLE 2: Human-Driven Climate Disruptions: Sources, Origins, and Consequences.

Source	Primary Origin	Measurable Impact	Human Activity Link
Carbon Dioxide (CO₂)	Fossil fuel combustion (coal, oil, gas)	420 ppm atmospheric concentration (50%↑ since 1850)	Power plants (35%), Transportation (28%), Buildings (17%)
Methane (CH₄)	Livestock digestion, fossil fuel leaks	25x more heat-trapping than CO ₂ (over 100 years)	Agriculture (40% from livestock), Energy sector (35% from extraction/transport leaks)
Nitrous Oxide (N₂O)	Synthetic fertilizer overuse	300x more potent than CO ₂ ; destroys ozone layer	Industrial agriculture (75% from croplands)
Deforestation	Land clearing for agriculture/development	10 million hectares lost annually (size of Portugal)	Beef production (41%), Palm oil (10%), Urban sprawl (15%)
Fluorinated Gases	Refrigerants, industrial processes	Up to 23,000x more warming potential than CO ₂	Air conditioning (55%), Electronics manufacturing (30%)



communities and nations are showing what's possible when we take smart action. Solar panels now power entire villages in Africa, while wind turbines off European coasts generate clean electricity day and night. In Iceland, nearly all electricity comes from the Earth's natural heat through geothermal plants, proving a fossil-fuel-free future exists. Simple changes make a big difference too. Energy-efficient buildings with smart designs stay comfortable year-round while using minimal power. Japan's appliance standards push manufacturers to create ultra-efficient refrigerators and air conditioners that save families money. Factories have learned to capture and reuse heat that once went to waste, cutting both costs and pollution. Some of the most promising solutions come from nature itself. Ethiopia made history by planting 350 million trees in a single day, while Costa Rica doubled its forest cover in just decades. These reborn woodlands clean our air, prevent floods, and create jobs. New technologies also help - in Norway, carbon emissions from industry get trapped and stored safely underground, with projects running successfully for over 25 years. How we move is changing too. Electric buses glide through Chinese cities, while Copenhagen's bike lanes show how pedal power can replace cars. Norway leads the electric vehicle revolution with 8 out of 10 new cars sold being electric. Paris is redesigning itself so everyone lives within a 15-minute walk of daily needs, making traffic jams history. Fast trains zip between European cities at speeds that make short flights obsolete. What makes these solutions work? They deliver immediate benefits - cheaper energy bills, cleaner city air, and good new jobs. They work in rich nations and developing ones alike. Most importantly, they respect local knowledge and needs, whether it's Texas ranchers hosting wind turbines or Indonesian farmers restoring mangrove forests. The evidence is clear from thousands of projects worldwide: we have the tools to cool our planet. Texas produces more wind power than most countries. Kenya's solar microgrids power homes without waiting for big power plants. The challenge isn't finding solutions - it's spreading them fast enough to matter. Every community that adopts these changes makes the next one easier, creating a wave of climate action that's finally matching the scale of our crisis. These aren't theoretical ideas - they're working models we can see, touch, and learn from today. From the solar panels on suburban roofs to the electric buses in crowded cities, the pieces of a cleaner future are coming together. What's needed now is the will to put them everywhere, quickly.



TABLE 3: Climate Mitigation Strategies at a Glance

Strategy	Key Actions	Real-World Examples	Impact Potential
Renewable Energy Shift	<ul style="list-style-type: none"> Solar/Wind farm expansion Geothermal development Phase-out coal plants 	Germany's 50% renewable grid Iceland's 100% geothermal energy	Cuts 70% of energy-sector emissions by 2050
Energy Efficiency	<ul style="list-style-type: none"> Retrofit buildings High-efficiency appliances Industrial heat recycling 	Japan's Top Runner Program NYC's green skyscrapers	Could reduce global energy use by 30%
Carbon Capture (CCS)	<ul style="list-style-type: none"> Trap smokestack emissions Store CO₂ underground Direct air capture tech 	Norway's Sleipner Project Swiss Climeworks plants	Removes 90% of industrial CO ₂ when scaled
Forest Restoration	<ul style="list-style-type: none"> Replant degraded lands Protect old-growth forests Community-led agroforestry 	Costa Rica's 2x forest cover Ethiopia's 350M-tree day	Offsets 30% of annual emissions if expanded
Clean	<ul style="list-style-type: none"> Electric 	Shenzhen's 16,000 e-	Cuts 50% of transport



Strategy	Key Actions	Real-World Examples	Impact Potential
Transportation	buses/vehicles <ul style="list-style-type: none"> • Bike/walkable cities • High-speed rail networks 	buses Paris' 15-minute city plan	emissions by 2040

Building Climate Resilience: Practical Adaptation Strategies

Communities worldwide are developing ingenious ways to adapt to climate changes already upon us. Farmers from India to Iowa are reinventing agriculture for a hotter world, blending drought-resistant crops with ancient techniques. They're reviving traditional dry farming methods while using simple soil sensors to conserve every drop of water - a modern twist on knowledge passed down through generations. Cities are transforming into cooler, safer spaces as temperatures soar. Los Angeles leads with its cool roof initiative, painting over 10 million square feet of rooftops white to reflect heat. Urban planners are planting "climate corridors" of shade trees along streets and designing public squares with cooling water features, creating natural oases in concrete jungles. Coastal communities are fighting rising tides with smart hybrid defenses. Vietnam's mangrove restoration projects now protect 100 miles of coastline, while the Netherland's massive storm surge gates demonstrate how engineering can work with nature. These solutions show we don't have to choose between concrete and ecosystems - the best protection combines both. Early warning systems have become lifelines for vulnerable populations. Bangladesh's mobile alert network gives millions crucial hours to evacuate before cyclones hit, cutting storm deaths dramatically since the 1990s. Similar systems now help wildfire-prone areas and flood zones worldwide, proving technology can save lives when designed for local needs. Water scarcity solutions range from ancient to cutting-edge. Peruvian engineers are restoring pre-Incan water channels to capture mountain runoff as glaciers disappear. Cape Town's crisis taught the world how smart rationing and public cooperation can prevent taps from running dry - lessons now applied from Brazil to Australia. Infrastructure is getting climate-smart upgrades. In Alaska, engineers are pioneering new road designs that won't melt permafrost, while Singapore builds elevated neighborhoods above future flood levels. These innovations show how we can build to withstand the new climate reality rather than keep repairing damage. Grassroots disaster preparedness makes communities shockproof. Filipino villages now train residents in emergency response, stockpile supplies, and map evacuation routes - systems that saved countless lives during recent super typhoons. This local knowledge often proves more vital than



outside aid when disasters strike. Wildlife conservation is adapting too. Yellowstone's new habitat corridors let elk and bears migrate to cooler areas, while marine scientists identify "climate refuge" reefs that could survive warming oceans. Protecting nature's ability to adapt may be our best conservation strategy.

Healthcare systems are evolving for climate impacts. Arizona hospitals now run heatstroke emergency protocols during dangerous heatwaves, while Kenyan clinics train staff to predict malaria outbreaks using weather data. The new frontline of medicine understands climate as a health threat. Indigenous knowledge is proving invaluable. Inuit hunters share ice safety wisdom with scientists tracking Arctic changes, while Pacific navigators help predict storms using ancestral weather reading methods. These time-tested approaches, combined with modern tools, create the most effective adaptation strategies. What ties these solutions together is their practicality - they work now, not in some distant future. They show adaptation isn't about surrender, but about smart, resilient living in a changing world. From high-tech early warnings to ancient water wisdom, humanity is proving it can adapt when it must. The challenge is spreading these life-saving ideas faster than the climate changes.

TABLE 4:Climate Adaptation Framework: Practical Measures & Key Elements

Adaptation Measure	Key Components	Real-World Example	Critical Benefits
Climate-Smart Agriculture	<ul style="list-style-type: none"> • Drought-resistant crops • Soil moisture conservation • Traditional dry farming techniques 	Indian farmers using millet varieties that thrive with less water	Stabilizes food production despite erratic rains
Urban Heat Mitigation	<ul style="list-style-type: none"> • Cool roofs/pavements • Urban tree planting • Shaded public 	Los Angeles' 10,000+ reflective roofs reducing temperatures by 3°C	Prevents heat-related deaths and energy blackouts



Adaptation Measure	Key Components	Real-World Example	Critical Benefits
	spaces		
Coastal Protection	<ul style="list-style-type: none"> • Mangrove restoration • Storm surge barriers • Elevated infrastructure 	Vietnam’s 100+ miles of replanted mangroves blocking typhoon waves	Combines flood defense with biodiversity boost
Early Warning Systems	<ul style="list-style-type: none"> • Community alert networks • Mobile broadcasts • Evacuation route mapping 	Bangladesh’s cyclone warnings cutting deaths by 80% since 1991	Saves lives with hours of advance notice
Water Resilience	<ul style="list-style-type: none"> • Rainwater harvesting • Greywater recycling 	Peru restoring pre-Incan "amunas" to combat glacier loss	Secures water for drinking and irrigation
	<ul style="list-style-type: none"> • Ancient water system revival 		
Disaster-Ready Communities	<ul style="list-style-type: none"> • Local rescue training • Emergency supply caches • Flood-proof 	Philippine barangay units responding effectively to Typhoon Rai	Reduces dependence on external aid



Adaptation Measure	Key Components	Real-World Example	Critical Benefits
	homes		
Wildlife Corridors	<ul style="list-style-type: none"> • Protected migration routes • Climate refuge identification • Habitat bridges 	Yellowstone’s pathways helping elk move to cooler areas	Prevents species extinction
Health System Adaptation	<ul style="list-style-type: none"> • Heatstroke protocols • Disease outbreak forecasting • Mobile clinics 	Arizona hospitals deploying cooling tents during extreme heat	Addresses climate’s direct health impacts
Indigenous Knowledge Integration	<ul style="list-style-type: none"> • Ice/melt tracking • Traditional weather prediction • Native crop varieties 	Inuit guiding Arctic research with ancestral ice knowledge	Combines millennia of wisdom with modern science.

CONCLUSION

The evidence surrounds us in ways we can no longer ignore. Fields that once produced abundant harvests now bake under unrelenting sun. Coastal roads that carried generations to market now disappear beneath rising tides. Forests where families gathered firewood and medicinal plants stand as blackened skeletons



after wildfires. These are not abstract warnings - they are today's realities in communities from the Sahel to the Solomon Islands. While no one escapes climate change's reach, its cruellest blows land on those least responsible - subsistence farmers watching crops fail, slum dwellers knee-deep in floodwaters, island nations preparing to become climate refugees. We've identified the culprits fuelling this crisis with scientific certainty. Our stubborn reliance on coal, oil and gas continues to pump heat-trapping gases into our shared atmosphere. Industrial agriculture strips soil of its vitality while livestock operations and synthetic fertilizers release potent greenhouse gases. The relentless destruction of forests - our planet's natural air filters - continues unabated in too many places. Yet even as we diagnose these problems, hope emerges from grassroots action worldwide. In Niger, women farmers are reviving traditional agroforestry techniques, regreening the desert one tree at a time. Vietnamese fishing communities are restoring mangrove buffers that protect against typhoons while nurturing marine life. Engineers are developing affordable carbon capture methods that could help heavy industries transition. Most inspiring, young people globally are holding leaders accountable through protests, lawsuits and innovative startups. Addressing this dual crisis requires parallel solutions - radical emission cuts to prevent worse outcomes and smart adaptation to cope with unavoidable changes. The energy transformation is already underway, with solar panels bringing power to remote villages while massive offshore wind farms replace coal plants. Regenerative farming practices are restoring degraded soils and sequestering carbon across millions of acres. Urban planners are redesigning cities around people rather than cars, with electric buses, bike lanes and vertical gardens making concrete jungles more livable. Perhaps most importantly, indigenous communities are finally getting seats at decision-making tables, sharing ancestral knowledge about living in balance with nature. But technical solutions alone won't suffice - this is fundamentally a crisis of justice and moral responsibility. It's about ensuring a single mother in Detroit can afford to heat her home without choosing between electricity and groceries. About guaranteeing a child in Delhi can play outside without choking on smog. About honoring our sacred obligation to leave our grandchildren a world as bountiful as the one we inherited. The blueprints for this better future already exist in communities leading by example. You'll find them in Iowa fields where wind turbines spin beside rows of drought-resistant crops, in Kenyan schools where students tend climate-smart gardens, in Pacific villages combining weather satellites with traditional navigation knowledge to predict storms. The question history will ask about our generation is simple: When the facts became clear, did we act? Did we rise above short-term thinking to safeguard the web of life? Did we have the courage to transform crisis into opportunity? The science is settled, the solutions tested, the costs of inaction calculated. What remains is summoning the collective will to act - not tomorrow, not eventually, but now. Our children's



memories, the very contours of their world, depend on the choices we make in this pivotal moment. The time for half-measures and empty promises has passed; only bold, immediate action across all sectors of society can steer us toward the future we all deserve.

References

- Aldy, J. E., & Pizer, W. A. (2014). *Comparability of effort in international climate policy architecture* (Discussion Paper 2014-62). Harvard Project on Climate Agreements. <https://www.hks.harvard.edu/centers/mrcbg/programs/hpca>
- Alley, R. B., Marotzke, J., Nordhaus, W. D., Overpeck, J. T., Peteet, D. M., Pielke, R. A., Pierrehumbert, R. T., Rhines, P. B., Stocker, T. F., Talley, L. D., & Wallace, J. M. (2003). Abrupt climate change. *Science*, 299(5615), 2005-2010. <https://doi.org/10.1126/science.1081056>
- Bodansky, D. (2010). *The international climate change regime: The road from Copenhagen* [Policy brief]. Harvard Project on Climate Agreements. <https://www.belfercenter.org/publication/international-climate-change-regime>
- Bucchini, M., & Tuley, A. (2022). *Planning for climate mitigation and adaptation* (PAS Report 601). American Planning Association.
- Cadez, S., & Czerny, A. (2016). Climate change mitigation strategies in carbon-intensive firms. *Journal of Cleaner Production*, 112, 4132-4143. <https://doi.org/10.1016/j.jclepro.2015.07.099>
- Clarke, L., Jiang, K., Akimoto, K., Babiker, M., Blanford, G., Fisher-Vanden, K., Hourcade, J.-C., Krey, V., Kriegler, E., Loschel, A., McCollum, D., Paltsev, S., Rose, S., Shukla, P. R., Tavoni, M., van der Zwaan, B., & van Vuuren, D. P. (2014). Assessing transformation pathways. In O. Edenhofer et al. (Eds.), *Climate change 2014: Mitigation of climate change* (pp. 413-510). Cambridge University Press.
- Descheemaeker, K., Oosting, S. J., Tui, S. H.-K., Masikati, P., Falconnier, G. N., & Giller, K. E. (2016). Climate change adaptation and mitigation in smallholder crop-livestock systems in sub-Saharan Africa. *Agricultural Systems*, 143, 71-82. <https://doi.org/10.1016/j.agsy.2015.12.009>
- Ericksen, P., Thornton, P., Notenbaert, A., Cramer, L., Jones, P., & Herrero, M. (2019). *Climate impacts on agricultural and natural resource sustainability in Africa*. Springer. <https://doi.org/10.1007/978-3-030-61136-7>



- Harrison, M. T., Cullen, B. R., Mayberry, D. E., Cowie, A. L., Bilotto, F., Badgery, W. B., Liu, K., Davison, T., Christie, K. M., Muleke, A., & Eckard, R. J. (2024). Triple-bottom-line assessment of climate-smart livestock systems in developing countries. *Nature Sustainability*, 7(2), 145-156. <https://doi.org/10.1038/s41893-023-01253-w>
- Intergovernmental Panel on Climate Change. (2018). *Global warming of 1.5°C*. <https://www.ipcc.ch/sr15/>
- Mapiye, O., Makombe, G., Molotsi, A., Dzama, K., & Mapiye, C. (2020). Climate change and livestock production in Southern Africa: Impacts and adaptation options. *African Journal of Range & Forage Science*, 37(3), 159-174. <https://doi.org/10.2989/10220119.2020.1794212>
- Nhemachena, C., Nhamo, L., Matchaya, G., Nhemachena, C. R., Muchara, B., Karuaihe, S. T., & Mpandeli, S. (2020). Climate change impacts on water and agriculture sectors in Southern Africa. *Water Policy*, 22(S1), 120-137. <https://doi.org/10.2166/wp.2020.032>
- Rao, P., & Thamizhvanan, A. (2020). Determinants of corporate climate change mitigation and adaptation strategies. *Business Strategy and the Environment*, 29(3), 1287-1304. <https://doi.org/10.1002/bse.2432>
- 14.Thornton, P. K., van de Steeg, J., Notenbaert, A., & Herrero, M. (2009). The impacts of climate change on livestock and livestock systems in developing countries. *Livestock Science*, 130(1-3), 113-121. <https://doi.org/10.1016/j.livsci.2009.01.006>
- 15.West, J., & Brereton, D. (2013). *Climate change adaptation in industry and business*. CSIRO Publishing. <https://doi.org/10.1071/9781486304671>
- 16.Intergovernmental Panel on Climate Change. (2018). *Global warming of 1.5°C: An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [V. Masson-Delmotte, P. Zhai, H.-O. Portner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, & T. Waterfield (Eds.)]. <https://www.ipcc.ch/sr15/>