

Pathways for urgent action towards climate resilient development

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There is a closing window of opportunity to ensure a sustainable future for all, with deep and rapid action needed this decade. Inclusive and just climate resilient development advances sustainable development and keeps open pathways to a liveable planet but requires urgent and fundamental shifts in prevailing development politics and practice.

Development pathways have failed to deliver the rapid, deep and just climate action necessary for enduring human well-being and planetary health¹. The interconnected nature of climate impacts and geopolitical instability, pervasive injustices, biodiversity loss and other socio-environmental challenges underlines the urgent need to shift to new development pathways.

Climate action is currently woefully inadequate to meet scientifically informed and politically agreed targets to halt global warming, reduce vulnerability and adapt. Slow progress is attributed to systemic failures in the structure of the political economy, development framings, technological and institutional challenges, lack of political will, and insufficient access to and levels of finance, among many other constraints^{1,2}. Political commitment has stalled and competes with multiple crises from COVID-19 to conflicts in Ukraine, Sudan and the Middle East. These crises compound climate-related, humanitarian and sustainability challenges. Pressing development needs, such as education, health and peace building, make it difficult to prioritize climate action and priority is given to gross domestic product growth at the expense of human well-being and the environment.

A major advance in the IPCC sixth assessment cycle that charts pathways to overcome these challenges was the articulation of climate resilient development (CRD) as closely intertwined with ecosystem stewardship, social justice and sustainable development. This Comment explains how CRD – the integration of adaptation and mitigation action to advance sustainable development for all – frames the kind of development actions urgently needed this decade to limit global warming for a liveable planet, support adaptation, address inequities and make progress towards the Sustainable Development Goals (SDGs)^{1,3}.

Closing window of opportunity

The costs for not acting urgently on effective climate policies and actions are substantial. Climate change has negatively affected socio-environmental systems around the world, including freshwater,

health, food, land and oceans ecosystems, cities, infrastructure and energy systems, making it difficult to realize sustainable development outcomes³. The annual economic damages from climate change are rising. Global income is expected to be US\$38 trillion less by 2049 than in a world without climate change⁴. These costs outweigh the mitigation costs required to limit global warming to 2 °C by sixfold⁴. Climate change is a risk multiplier, precluding sustainable development and increasing costs of future climate impacts and adaptation with each increment of global warming^{1,3}.

Current development trajectories and delaying climate action close down opportunities for sustainable development¹ (Fig. 1). Increased warming, adaptation limits and inequitable and unsustainable development cause path dependencies that constrain future adaptation, mitigation and development options, and hence future prospects for human and ecosystem well-being¹. Adaptation cannot therefore be delinked from mitigation and the development choices driving climate change. At and beyond 1.5 °C warming above pre-industrial levels, many adaptation and mitigation options become less effective and more costly, while some ecosystem- and water-based solutions no longer work, with some people and systems unable to adapt¹. The longer emissions reductions are delayed – with extreme events, risks and impacts escalating – the effectiveness of available adaptation options declines, especially for the most vulnerable¹. Urgent and transformative action is required to shift from current unjust and unsustainable development pathways onto CRD pathways in this decade.

Actionable knowledge for systemic change

Prevailing development approaches are typically isolated from climate action; and mitigation and adaptation are separated by both policy and funding structures. This compartmentalization leads to fragmented and contradictory efforts and disengagement, and can compound response risk when key development and climate change interactions are not accounted for³. To overcome these challenges, CRD advances opportunities for sustainable development by unlocking context-relevant synergies that rapidly scale up greenhouse gas emissions reductions and climate change adaptation.

Evidence shows that coordinated mitigation and adaptation actions can co-deliver on development priorities. In urban areas, for example, carefully implemented blue–green infrastructure can reduce energy demand, enhance thermal comfort and improve well-being – integrating societal, environmental, mitigation and adaptation objectives⁵. Other potential synergies include water and wastewater infrastructure, transportation and sustainable urban food systems⁶. Such action is complicated in practice because urban planning and

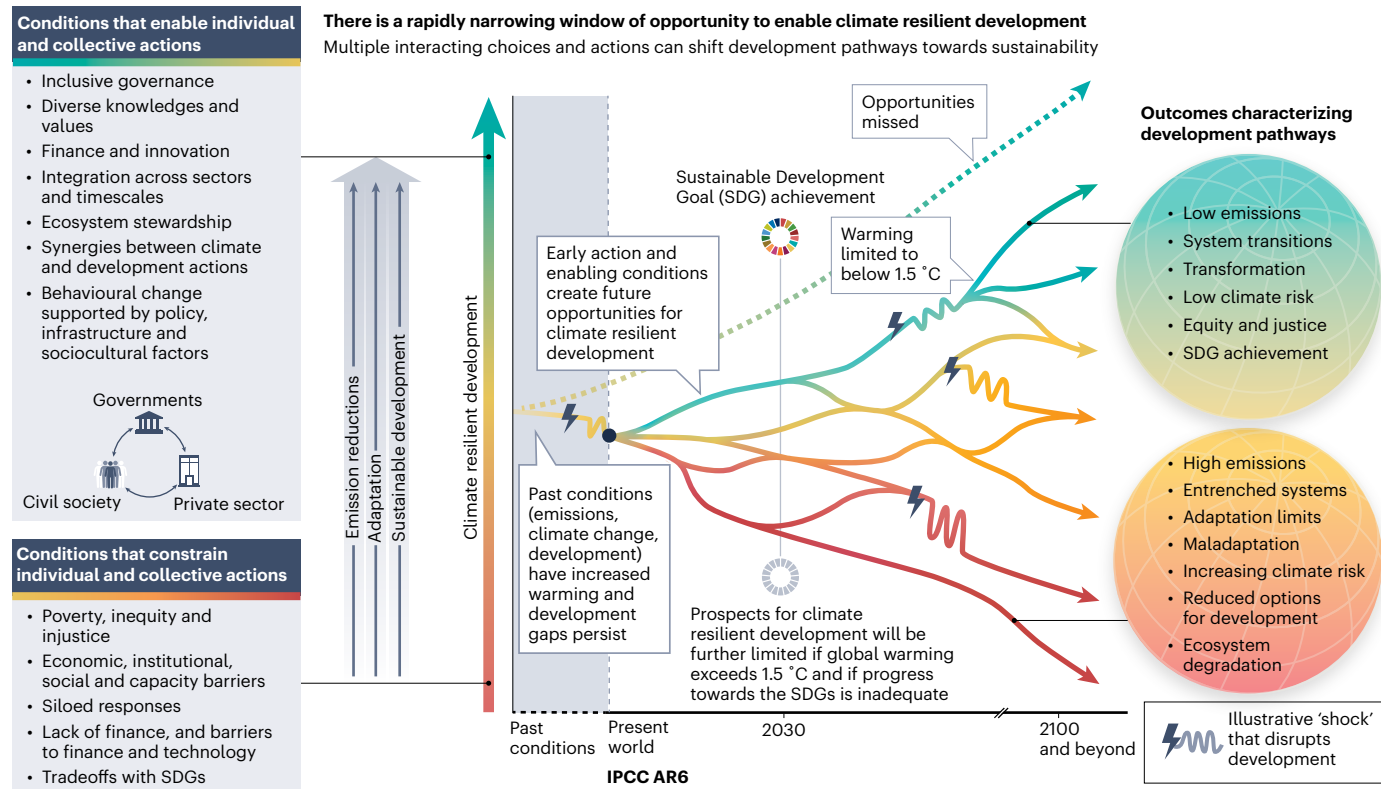


Fig. 1 | The IPCC synthesis of CRD illustrated for policymakers. The illustrative development pathways (red to green) and associated outcomes (right panel) show that there is a rapidly narrowing window of opportunity to secure a liveable and sustainable future for all. CRD is the process of implementing greenhouse gas mitigation and adaptation measures to support sustainable development. Diverging pathways illustrate that interacting choices and actions made by diverse government, private sector and civil society actors can advance CRD, shift pathways towards sustainability and enable lower emissions and adaptation. Diverse knowledge and values include cultural values, Indigenous knowledge, local knowledge and scientific knowledge. Climatic and non-climatic events, such as droughts, floods or pandemics, pose more severe shocks to pathways with lower CRD (red to yellow) than to pathways with higher CRD

(green). There are limits to adaptation and adaptive capacity for some human and natural systems at global warming of 1.5 °C; and with every increment of warming, losses and damages will increase. The development pathways taken by countries at all stages of economic development impact greenhouse gas emissions and mitigation challenges and opportunities, which vary across countries and regions. Pathways and opportunities for action are shaped by previous actions (or inactions) and opportunities missed; dashed pathway) and enabling and constraining conditions (left panel), and take place in the context of climate risks, adaptation limits and development gaps. The longer emissions reductions are delayed, the fewer effective adaptation options. Figure modified with permission (Figure SPM.6) from the IPCC *Summary for Policymakers* in ref. 1.

infrastructure investments are often spread across and siloed within city departments and tend to focus on solutions that are less integrated and effective⁷. Yet, including approaches that integrate mitigation and adaptation can foster more equitable service delivery, even under disruptive climate impacts and in resource-constrained contexts⁸ (as outlined in Box 1).

Transformative CRD action hinges on several key considerations and conditions (Fig. 1). Enabling rapid and integrated CRD entails transformation of systems, governance and the values and ethics that underlie decision-making structures and processes. CRD confronts prevailing development paradigms and assumptions and addresses unsustainable and inequitable patterns of resource use and consumption. Such societal transformation underpins system transitions, where joined-up mitigation, adaptation and sustainable development actions reconfigure social, institutional and technological interactions across systems, including land and ocean ecosystems, food, urban and infrastructure, industry and energy systems^{1,3}. 'All of society' approaches activate agency among diverse

governance actors for just and effective action across sectors, levels and timeframes^{1,3}.

Development pathways are the emergent outcomes of ad hoc incremental development and climate actions, as well as cumulative intentional choices and actions by diverse societal actors. Together, these decisions and actions determine the extent to which development shifts away from current unsustainable trajectories and carbon lock-in (Fig. 1).

Societal transformation in the context of CRD therefore concerns both the outcomes and processes of development choices and actions. CRD relies on actionable knowledge that guides governance actors and decision-makers away from prevailing path dependencies and towards pathways based on portfolios of already available innovations that enhance effective climate action⁵. To be actionable, CRD knowledge is deepened and extended through inclusive, just and equitable opportunities for diverse actors across society to build shared understanding about what policy options and development interventions have worked or could work and to mobilize collective action^{5,9}.

BOX 1

Accelerating CRD pathways in Cape Town, South Africa

The City of Cape Town's 2022–2027 Integrated Development Plan (IDP) exemplifies many of the challenges and opportunities in charting CRD pathways¹¹. Apartheid shaped the city's development conditions, pathways and prospects. The 1994 advent of democracy, along with development efforts over the past three decades, have transformed the livelihoods of the city's residents. However, the city remains deeply divided, with extreme unemployment and inequality and growing informal settlements juxtaposed against affluent suburbs.

In South Africa, an IDP is the central strategy of a city and forms the primary basis on which the public keep local governments accountable. The 2022–2027 IDP is a step change in mainstreaming climate change into integrated development planning. Despite deep historical divisions, trenchant poverty and inequity spatially distributed around the city, the IDP exemplifies the transformational potential of integrated development planning that engages city managers, residents, civil society and the private sector in inclusive deliberations to secure a better future for all Capetonians. This stands in sharp contrast to the Apartheid philosophy of 'separate development'. Fifteen of the 49 IDP programmes are identified as being 'Climate Priority Programmes', which aim to enable Cape Town's adaptation capacity and greenhouse gas mitigation actions¹¹. Charting new pathways, Cape Town's IDP engages with the four foundational CRD conditions and outcomes through:

- Equity and justice: the IDP prioritizes the needs of vulnerable groups, notably through programmes on disaster risk reduction and response; upgrading informal settlements; and

mainstreaming basic service delivery to informal settlements and backyard dwellings. Access to adequate housing, reliable energy, and water and sanitation remains a key driver of differentiated vulnerability and is central to the IDP's provisions to advance equity and justice for CRD.

- Inclusion: the IDP seeks to redress the spatial dislocation of many vulnerable groups from socioeconomic opportunities in the city. This has been an ongoing challenge since 1994 and continues to drive planning efforts to chart pathways towards a more spatially integrated, resilient and inclusive city.
- Knowledge diversity: the IDP seeks to better integrate climate risk information into infrastructure planning and development processes in the city, drawing on diverse sources of knowledge and evidence to improve decision-making.
- Ecosystem stewardship: the IDP promotes healthy ecosystems as foundational for human well-being and includes focused attention on maintaining healthy urban waterways for a host of benefits, including climate-related flood and drought risk reduction.

CRD is the cumulative and emergent outcome of development decisions and actions — or pathways — across scales, actors, sectors and timeframes. Cape Town exemplifies the urgency of tackling inequity and exclusion and engaging across sectors and actors as part of action to accelerate CRD pathways locally and globally. This IDP is a necessary but insufficient foundation for advancing CRD pathways and outcomes in Cape Town. Its full implementation requires political commitment, dedicated financial resources and adequate capacity, including real-time monitoring¹¹.

Societal transformations involve changes in values, worldviews, ideologies, structures and sociopolitical relationships that underlie choices and actions. A reframing of climate action requires policy and practice to engage explicitly with the ethics that can provide a compass for shifting the course of development towards reduced emissions, effective adaptation, enhanced equity and strengthened sustainability³. CRD thus confronts prevailing development paradigms and assumptions, including the inequitable and unsustainable patterns of consumption and resource extraction that drive current development pathways⁵. Instead, CRD centres on human rights, justice and ecosystem stewardship^{1,5}. Ecosystem stewardship, as a value guiding development decisions, draws on diverse knowledges, including Indigenous worldviews of nature—people togetherness, to recognize the foundational role of nature in CRD.

Effective deployment of green infrastructure as a nature-based solution in a given city depends on authentic inclusion of diverse actors and their perspectives in planning and decision-making. Furthermore, diverse and healthy ecosystems provide a stronger foundation for new green infrastructure and are more likely to be successful when accompanied by behavioural changes enabled by aligned policies, practices and local support¹⁰. Siloed and business-as-usual development can be counteracted through measures that increase the agency of those marginalized in decision-making (including those in vulnerable situations

due to poverty and inequitable relations of gender, ethnicity, disability, age and so on), such as through rights-based approaches and locally led adaptation^{1,11}. For example, recognition of the inherent rights of Indigenous peoples is integral to effective adaptation and mitigation across forests, oceans and other ecosystems, and is important for justice, avoiding maladaptation, meeting local and global conservation goals, and improving disaster risk reduction outcomes⁵. Some cities have embarked on CRD-framed planning initiatives to chart new development pathways, as illustrated by Cape Town's Integrated Development Plan process (Box 1).

A new politics of climate resilient development

Amidst the need for urgent climate action, opportunities for deep engagement are diminishing instead of expanding. Emerging poly-crises hamper CRD opportunities, constrain spaces for deliberative decision-making and delay urgently needed system transitions.

A new politics of CRD requires social-justice-centred action that spans from local scales to strengthened global cooperation. CRD opportunities are unequally distributed². Hence, climate change can only be effectively addressed by simultaneously tackling global and local injustices. Climate change amplifies long-standing inequities that shape current vulnerability and development pathways. Climate coloniality underscores that just solutions to climate change require

moving beyond existing framings, as well as neoliberal and populist development approaches that entrench climate mitigation and adaptation inaction^{12,13}, contributing to (rather than addressing) exploitation, segregation, dehumanization and othering¹⁴. Shifting development away from predominant economic growth models towards sustainability demands greater attention to the differences, needs and priorities between and within different socioenvironmental settings, and transforming the power relations and structures and processes that institutionalize them^{14,15}.

Emerging examples show how development planning founded on inclusive and deliberative arenas of engagement helps reimagine climate action as equitable and sustainable development^{2,11} (Box 1). Transformative action can be enabled by creating 'safe spaces' for contestation and resistance to move beyond entrenched institutions and practices that privilege some and marginalize others. Including diverse epistemic communities, governance actors, stakeholders and sectors creates more equitable, just and sustainable development conditions, processes and outcomes⁵.

Shifting development pathways towards CRD cannot be achieved without urgent and deliberative collective action. Therefore, climate action needs to be reframed by expanding opportunities for ethical and political engagement in reconfiguring the conditions, pathways and outcomes of development.

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Competing interests

The authors declare no competing interests.