# NAVIGATING A JUST AND PEACEFUL TRANSITION

Environment of Peace
Part 3

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# About the Environment of Peace research report

This research report is a product of the Environment of Peace initiative launched by SIPRI in May 2020. It sets out the evidence base that provided the foundation for *Environment of Peace: Security in a New Era of Risk*, a policy report published in May 2022. The report is published in four parts—Elements of a Planetary Emergency (part 1); Security Risks of Environmental Crises (part 2); Navigating a Just and Peaceful Transition (part 3); and Enabling an Environment of Peace (part 4)—as outlined below.

## Elements of a Planetary Emergency

Part 1 lays out the conceptual and evidential landscape for Environment of Peace, bringing together data on a wide range of indicators, showing that both security and environmental stresses are increasing.

## Security Risks of Environmental Crises

Part 2 shows how combinations of environmental and security phenomena are generating complex risks and discusses options for responding to them.

## Navigating a Just and Peaceful Transition

This part, part 3, focuses on needed transitions towards sustainability and climate resilience. Geoffrey D. Dabelko, Professor at Ohio University, and his colleagues argue these transitions must happen quickly and will inevitably meet opposition. Policymakers must prioritize both just and peaceful approaches to achieve sustained success. The authors analyse evidence from the major climate mitigation, adaptation and conservation approaches to illustrate the downsides of ill-considered interventions. They explore the potential for climate adaptation to help build and sustain peace, while documenting the main pitfalls of maladaptation. Finally, they look at the need to manage the risks of transition in petrostates.

## Enabling an Environment of Peace

Part 4 examines the legal and institutional landscape within which the twin crises—and humanity's responses to them—play out.

## Other related materials

Separate annexes assemble a number of in-depth case studies and other input papers that were commissioned to inform the research and analysis of the report. An annex corresponding to each part can be downloaded from the SIPRI website. A comprehensive overview of the report's four parts and the Environment of Peace initiative is also available at the SIPRI website.

# 3. NAVIGATING A JUST AND PEACEFUL TRANSITION

## 3.1. Necessary transitions

Navigating the Anthropocene (see part 1) will involve massive and rapid transitions, requiring responses that are diverse, numerous and at scale.[1] Countries, cities, corporations and communities will make choices that create winners and losers, with the interests of long-established economic and political actors forced to evolve or suffer. Resistance to these dramatic shifts—many still in their infancy—is already manifest at all levels. It would be naive not to expect pushback, injustice and a variety of conflicts.[2]

In fact, much-needed zero-carbon, green economy and meaningful ecosystem protection offer opportunities to contribute to peace, but only if the conflict risks of transitions are understood and managed with a view to minimizing unintended negative impacts. These necessary transitions can be conducted in ways that proactively advance justice and minimize conflict. This requires integrating the necessary considerations at the outset of responses to climate change and the biodiversity crisis rather than waiting until efforts have already contributed to injustice and conflict. Through such up-front anticipatory action, the conditions for more just and peaceful transitions can be created.

### 3.1.1. Charting a course with eyes open

The task for policymakers is beset with challenges given the scale and speed of the needed transition. Parts 1 and 2 of the Environment of Peace research report have detailed the motivations driving intervention, setting the context for the crucial decisions required to minimize conflict and maximize opportunities for peace and human development. Building on this, part 3 charts a course for policymakers navigating the challenges of conserving and protecting ecosystem services, climate mitigation and adaptation, and the fossil fuels phase-down.

Historically, research and practice in the area of environment, climate and security have centred on potential environment and climate contributions to armed conflict.[3] While necessary, this focus is insufficient for dealing with the range of conflict-related possibilities attached to climate change and ecosystem loss. Thus, a broader human and ecological security lens (see part 1) is required to make any transition as just and peaceful as possible, with part 3 casting a decidedly wider net than organized violent conflict. In this context, conflict ranges across a continuum of social friction, from targeted assassinations of environmental defenders to violence by state and non-state actors. This inclusive approach to conflict is nested within a wider human security focus, thereby enabling practitioners to fully engage with the interconnected challenges posed by the Anthropocene.[4]

Charting a course to minimize conflict and maximize peace requires the systematic analysis of responses to date. Given that efforts to decarbonize and address biodiversity loss remain in their early stages, however, it is incumbent that justice and conflict considerations be built into all planned interventions. Inevitably, these steps will dramatically scale up both the challenges and opportunities arising, prompting the following hard questions about the steps that will need to be taken:

- As the international community commits to reduce greenhouse gases (GHGs) and adapt to climate impacts, can those efforts avoid inadvertently exacerbating existing conflicts—or creating new ones?
- As countries act on promises to reduce deforestation and increase protected areas, can these monumental land-use changes avoid the injustice and conflict pitfalls seen in previous efforts?
- As demand spikes for the critical minerals essential for scaling up green energy technology, can public and private actors ensure access for all while minimizing the toxic and conflictual legacies of extraction and processing?
- As the world transitions away from fossil fuels, can petrostates and workers in the old energy economy make a just and peaceful shift?

### 3.1.2. Recognizing risks in responses

Systematically analysing the conflict potential of climate and conservation responses is a neglected, challenging, yet essential priority for decision makers. Moreover—given that efforts to transition away from carbon, adapt to climate impacts and conserve critical ecosystems are still in their infancy—the evidence base is by definition limited. Despite the rapid growth of renewable energy technologies, the transformations called for in part 1 have only just begun.

The current and planned scale of the problems and responses require a risk-based precautionary approach to anticipating potential conflictual dynamics. Previous and analogous experiences also provide valuable lessons and cautionary tales.[5] Such an approach must begin with an understanding that all interventions have the potential to exacerbate existing tensions or create new ones, with a first step being to try and minimize these risks.[6] Failure to do so may lead to an unintentional increase in negative outcomes. In addition, the pushback already developing to some climate and conservation proposals suggests downplaying these risks could undercut necessary responses to climate change and ecosystem loss.

Although some may interpret highlighting these conflict challenges as making already challenging transitions even harder, this accounting is intended to help guide practitioners through the difficulties of decarbonization, ecosystem protection and necessary adaptation responses. As seen in parts 1 and 2, these practices often create winners and losers along existing fault lines in society, thereby perpetuating historical power structures and inequalities. A systematic analysis will also empower actors to pursue just transitions.[7] Institutional, cultural, sectoral and disciplinary distinctions have too often kept the worlds of equity and justice apart from the worlds of conflict, peace and security.[8]

Pre-emptively identifying the conflict dimensions of responses while suggesting ways to minimize this potential empowers policymakers to chart a more informed course forward. Such assessments must start with the fundamental threats facing ecosystems—these are explored in the following section. Deforestation and destructive land-use practices are driving biodiversity loss and undercutting invaluable ecosystem services. Moreover, connections with zoonotic diseases, including the Covid-19 pandemic, have placed renewed attention on them. As the United Nations Decade on Ecosystem Restoration kicks off, fauna and flora extinction and climate change are increasingly being framed as inextricably linked.[9] Other projects, such as the Bonn Challenge,[10] 30x30[11] and the Trillion Trees Initiative[12], aim to make progress in restoring and protecting marine and terrestrial ecosystems. While these efforts—many of which are reflected in the latest Convention on Biological Diversity negotiations—offer the potential for enormous benefits, they also raise social, economic and political considerations that have historically had justice and conflict implications for affected communities. Previous experiences with ‘coercing conservation’ and ‘parks versus people’ offer instructive lessons that must be heeded, regardless of the severity of the conservation and climate crises.[13]

The report next explores the various mitigation strategies aimed at reducing GHG emissions. Here too, these essential steps carry the potential for conflict. Implementation of the largest and most rapid energy transition in human history will need to be carefully managed, including consultations with local communities often excluded from decision making.

Mitigation steps include a mix of renewable energy options: wind, solar, hydropower and biofuels. Dynamics around competing land uses, people being displaced, generating energy at the cost of food security, and mining critical mineral inputs are all expected to grow more contested and contentious as these mitigation efforts scale up.

In some instances, payment for ecosystem services has proven to be a valuable tool in mitigating climate change and conserving ecosystems.[14] Reduced Emissions from Deforestation and Forest Degradation (REDD+) schemes, which put a competing value on forests serving as carbon sinks, are a key mitigation strategy. Given their impacts on resource access, land tenure and income generation, however, such efforts hold the potential for triggering disputes if executed poorly.

Nuclear power, which provided 9.84 per cent of the world's electricity generation in 2021,[15] is also promoted by some as a low-carbon energy source.[16] Others, though, point to lingering concerns over cost, safety, dual-use proliferation and the long-term environmental and human health impacts of waste storage and accidents.

A doubling, tripling, or even five-fold increase some envision in the critical minerals and metals needed to power renewable energy technologies (and nuclear power) will mean a steep increase in the challenges of extraction and processing as deployment of these technologies ramps up. The location and processing of critical minerals and metals presents new geopolitical challenges given their centrality across economic and security sectors, accompanied by familiar yet historically neglected ecological, social and conflict costs at the points of extraction and processing.

Geoengineering, a catch-all term for dramatic technological interventions aimed at managing solar radiation or removing carbon dioxide from the atmosphere, is gaining more attention as efforts to reduce GHG emissions lag. High levels of uncertainty around efficacy, impacts and costs, amid limited governance norms, make geoengineering a contentious and uncertain wild card.

Building resilience and adapting to climate change can similarly pose challenges if not done in equitable and transparent ways. The risk of maladaptation, or adaptation that increases vulnerability and conflict risk for some affected populations, must therefore be met head-on. The implementation of technical solutions, even as part of proactive climate feedbacks, runs the risk of exacerbating or creating conflicts. By contrast, decentralizing adaptation and resilience building to communities can generate local support while reducing the vulnerability and conflict risk of the affected parties.

The final section of part 3 examines the transition from fossil fuels, which presents potential conflict dynamics at both country and community levels. Indeed, the loss of geopolitical power, government revenue, employment opportunities and incomes arising from the decline of non-renewables threatens the socio-political architecture of entire countries. These petrostates and the fossil fuel companies operating in them are the vanguard of old vested interests, with many actively resisting needed transitions.

Taken together, the following sections present a daunting picture for policymakers. The scale and speed of the required transformations necessitate responses at all levels. In navigating those transformations, policymakers must account for any potential conflict catalysts or threats to human security generated by well-intentioned efforts, as well as the pushback such efforts are likely to face. According to the Intergovernmental Panel on Climate Change (IPCC)'s Working Group II Sixth Assessment Report, those who are already vulnerable or least resilient are likely to suffer the most from climate change, regardless of intensity.[17] Interventions addressing the climate and conservation crises need to avoid compounding these risks.

## 3.2. Biodiversity, ecological security and conservation

Conserving and restoring healthy ecological systems is crucial to peace, justice and security.[18] As part 1 described, humanity is dependent on biodiversity, functioning ecosystems and the services they provide. Thus, widespread impacts on the biosphere constitute significant risks in the context of a more inclusive human security agenda.[19] The UN General Assembly has designated 2021–2030 as the Decade on Ecosystem Restoration, providing a political framework for acknowledging and acting on this priority.[20] Moreover, the UN Secretary-General has forcefully argued that biodiversity and healthy ecosystems are crucial to future peace and security, stating that 'COP15 [of the Convention on Biodiversity] is our chance to call a ceasefire [with nature and]. Together with COP26 on climate, it should lay the foundations for a permanent peace agreement'.[21] As with other challenges examined in the *Environment of Peace* report, transparent and inclusive implementation at local levels is a cornerstone of successful and peaceful approaches to conserve ecosystem diversity.

This political priority is based on comprehensive scientific assessments that have established both the massive scale of change needed to conserve and restore ecosystems and the myriad costs of continued failure to do so.[22] Some of the most concerning statistics released by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystems Services (IPBES) reveal that there has been a 47 per cent decline in indicators of ecosystem extent and condition compared to their estimated natural baselines; 75 per cent of land has been 'significantly altered' by human activity, and 66 per cent of the marine environment is suffering 'increasing cumulative impacts'; 87 per cent of wetlands present in 1700 were lost by 2000; around 1 million species are facing extinction in the coming decades; and 50 per cent of live coral cover on coral reefs has been lost since the 1870s.[23]

The conservation of nature and restoration of fauna and flora cannot be considered as merely an environmental imperative. Instead, ecological considerations must be tackled in conjunction with efforts to ensure secure livelihoods, avoid conflicts and build peace. Environmental and security-related research and practice have historically treated biodiversity issues as a separate domain, with environment-related security concerns as secondary


**Figure 3.1.** Summary of nature's contributions to human survival and well-being with directional trends over the past 50 years

Source: Díaz, S. et al., *The Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services: Summary for Policymakers* (IPBES: Bonn, 2019), figure SPM.1.

to 'hard' security concerns. Such marginalization is, fortunately, beginning to wane, with scholars and practitioners detailing multiple connections in this arena.[24]

Meanwhile, institutions are increasingly pushing biodiversity and ecosystem services to the forefront of wider international policy and (transnational) economic dialogues. IPBES and the UN Framework Convention on Climate Change (UNFCCC) have both developed frameworks (such as the November 2021 Glasgow Declaration on Forests and Land Use), funding methods, and reporting and monitoring tools that national governments can implement domestically.[25] Socio-economic development, human rights and ecosystem-wide functions must be considered in tandem, as failing to do so could—on top of the economic and ecological losses typically identified—limit peacebuilding opportunities and contribute to conflict.

This section first unpacks how ecosystem services and biodiversity protection efforts are interconnected with peace and security, before turning to the potential conflict drivers that can emerge if a conflict-sensitive approach to conservation is neglected. A number of hard lessons on conservation's conflict potential can be drawn from past experience.[26] They highlight that conservation and security connections should be seen as bidirectional. On the one hand, pressures on nature often intensify during and after conflict, mainly due to natural resource exploitation, mineral extraction, wildlife crime or land grabbing and conversion.[27] During armed conflicts, combatants may deliberately damage natural resources or infrastructure, while explosives and conventional weapons can generate significant debris and leave toxic contaminants that degrade the environment.[28] On the other hand, protecting nature through forcible exclusion (often referred to as 'coercive conservation'[29] or 'fortress conservation'[30]) presents dangers that can generate what some call 'green violence' through militarized conservation.[31]

### 3.2.1. Ecosystem and biodiversity services

Ecosystems render indispensable services to human safety: sustaining food security; providing medicines; cleansing and retention of water and air; providing natural storm, flood, pest and disease control; and providing spaces for recreation, creativity and spirituality.[32] They also provide the foundations for culture and identity.[33] IPBES has identified 18 ecosystem services and their relationship to human security and wellbeing (figure 3.1), while the World Health Organization has also recognized the importance of ecosystem services, not only with reference to such health risks as zoonoses (diseases that jump from non-human animal species to humans; see section 1), but also linking them to 'livelihoods, income, local migration, and on occasion, political conflict'.[34] Such interlinkages are the essence of the UN's 2030 Agenda, connecting and transecting more than half the 17 Sustainable Development Goals (SDGs).[35]

Despite the acknowledged importance of ecosystem services, many human activities undermine them, with industrialized and unsustainable agricultural practices such as deforestation posing the greatest threat to biodiversity.[36] Food systems and security depend on nature for pollination,[37] soil quality[38] and biocontrol of pests,[39] while biodiverse ecosystems are vital for water quality and nutrient cycles,[40] as well as preventing the run-off of excess nutrients into oceans, which degrade coastal ecosystems that support fisheries.[41] Medicines such as penicillin (microbial), morphine, aspirin, chemotherapeutics and antimalarials all have their origins in biodiverse ecosystems.[42] Crucially, biodiversity enables both 'multi-functionality', an ecosystem's ability to provide multiple services, and resilience, an ecosystem's ability to adapt to environmental disruptions.[43]

### 3.2.2. Key international frameworks

The international community has vastly expanded its response to environmental concerns over the past 30 years. Importantly, the 1992 UN Convention on Biological Diversity (CBD) marked a major advancement in securing an international framework for protecting ecosystems.[44] The convention has three primary goals: (*a*) conserving biological diversity; (*b*) the sustainable use of nature; and (*c*) a fair and equitable sharing of benefits arising from genetic science.[45] The Aichi Biodiversity Targets, agreed at the Tenth CBD Conference of the Parties (CBD-COP) in 2010, established measurable objectives for ecosystem conservation, with one commitment being to protect 17 per cent of land and inland waters areas and 10 per cent of coastal and marine environments by 2020.[46] In 2021 the UN Environment Programme (UNEP) reported that this goal had been narrowly missed by 0.3 per cent.[47] Whereas all the other Aichi Targets were missed by a significant amount.[48]

This failure highlights the discrepancy between the ambitions of UN frameworks and implementation by signatory states. Concern is growing that the next CBD framework will also fail, given that after the first round of the CBD-COP talks in 2021, funding commitments by countries did not achieve the $80 billion goal. These resources are vital for supporting efforts by developing countries, local communities and Indigenous peoples to safeguard nature.[49]

Academics and environmentalist organizations have proposed a Global Deal for Nature, which would protect 50 per cent of global land and water areas by 2050[50] and represent a consolidated effort to meet the Paris Agreement (2015) and SDG commitments.[51] It builds on the growing momentum behind the 30x30 Initiative[52] proposed by the non-governmental conservation community, which aims to protect and conserve 30 per cent of the global land and water area by 2030. Furthermore, during the 26th Conference of the Parties to the UNFCCC (COP26) in Glasgow in 2021, more than 100 world leaders pledged to end and reverse deforestation by 2030, promising nearly $20 billion from public and private sources.[53] The 30x30 goal also provides an anchor point in the 'Nature-Positive Global Goal for Nature', a solution proposed by leading conservationist academics and non-governmental organizations (NGOs) suggesting 'three measurable temporal objectives: Zero Net Loss of Nature from 2020, Net Positive by 2030, and Full Recovery by 2050'.[54]

While this newfound political momentum around deforestation and biodiversity is a welcome turning point, emerging efforts must learn from past conservation experiences. Conservation actions need to move beyond exclusionary approaches, which are too often reliant on restricting or removing local inhabitants from protected areas, and in doing so work with and for locally affected communities rather than against them. The risks of undercutting local human security in the name of larger biodiversity and climate-focused goals are significant. Ecosystem protection and restoration must make efforts to better integrate social and environmental justice concerns, including within the international governance institutions that set targets and make pledges.[55]

### 3.2.3. Land rights and commodification of nature versus Indigenous land management

Land rights (ownership of, access to and use of specific areas)[56] represent a major underlying conflict point in conservation.[57] Considered land administration is critical for conservation projects, as payment for ecosystem services efforts—particularly in top-down project arrangements—requires formal land recognition and management mechanisms to be implemented.[58]

There is a long history of land ownership and use changes becoming contentious. The establishment of land ownership and use rights without regard for ecosystem considerations,[59] or accompanied by the failure of government to recognize customary land rights, has contributed to many conflicts in different parts of the world.[60] Moreover, inhabited lands managed by Indigenous peoples (around 20–25 per cent of the world's land area) host approximately 80 per cent of global biodiversity.[61] Despite formal land ownership being an unused concept for many Indigenous or traditional societies, they are often compelled to formalize their customary and ancestral claims into legal ownership.[62]

In 2019 IPBES highlighted the breadth of knowledge and services that Indigenous peoples provide and their importance to global conservation (box 3.1), arguing that national and legal recognition of land rights for Indigenous peoples and local communities (IPLCs) is crucial. Many efforts have neglected to integrate traditional knowledge and voices, which, coupled with notions of ecosystem protection as de facto prioritizing 'nature over people', has given rise to 'public' nature parks that are fenced off and cleared of IPLCs unable to present state-accepted land ownership.[63] Amid widespread enthusiasm for dramatically scaling up land under protection, Indigenous groups and NGOs advocating on behalf of forest-dwelling communities have sounded the alarm on the potential for injustice and conflict.[64] As such, it is incumbent that steps be taken to tackle the biodiversity and ecosystem crisis in ways that ally with Indigenous and marginalized people, rather than perpetuating a tradition of exclusion.

If the expertise and knowledge of Indigenous peoples and traditional communities is integrated into governance frameworks, then these groups will be able to benefit from the 30x30 target and conservation efforts more broadly.[65] However, protecting intact ecosystems—so often the homes of

## BOX 3.1. THE ROLE OF INDIGENOUS PEOPLES IN CONSERVATION

Given the swathes of land Indigenous peoples actively manage and the robust conservation outcomes often achieved, their contributions are critical to a broader understanding of biodiverse ecosystems. IPBES highlights five broad areas in which Indigenous peoples actively contribute to such ecosystems:[a]

*Domestication.* Domesticating and maintaining crops and animals breeds that have proven essential in developing modern agricultural systems.

*Creating new ecosystems.* Creating and managing heterogeneous habitats; identifying useful products emerging from this biodiversity.

*Protection.* Preventing ecosystem resource overexploitation—for example through restricting access in order to prevent legal and illegal logging, overfishing or poaching, or granting sacred status to areas through intracommunal declarations.

*Sustainable use, management and monitoring.* Ensuring forests provide utility to humans through using their products and guaranteeing their long-term ability to continue producing these products; overseeing species diversity and habitat resilience; actively restoring damaged ecosystems.

*Cultural connections.* Demonstrating an intangible spiritual and cultural connection to ecosystems and emphasizing the importance of human–nature relationships.

UNEP and UNOHCHR argue that, as critical implementors of conservation, 'no action with potential impact on Indigenous peoples' rights is taken without consultation and obtaining the free, prior and informed consent of legitimate representatives of Indigenous peoples and should support Indigenous peoples' and other affected communities' participation in the management and ownership of efforts to combat biodiversity loss'.[b]

[a] Díaz, S. et al., *The Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services: Summary for Policymakers* (IPBES: Bonn, 2019), figure SPM5.

[b] United Nations Environment Programme (UNEP) and United Nations Office of the High Commissioner for Human Rights (UNOHCHR), *Human Rights and Biodiversity* (UNEP/UNOHCHR: Nairobi, 2021), p. 3.

Indigenous peoples and local communities—through, for example, REDD+ projects, does not present a silver bullet when it comes to conservation or to mitigation strategies aimed at addressing the climate crisis (see section 3.3.2).[66] Any implementation that does not include these wider considerations runs the risk of creating conflict between competing environment agendas and spurring injustice and conflict through conservation and climate-related interventions.

### 3.2.4. The conflict challenges of conservation

The roots of modern conservation approaches can be traced back to the industrial revolution.[67] The rapid agricultural expansion that accompanied population growth and urbanization demanded increasing resources, with conservation viewed as a means of managing the use of these resources. This perspective legitimized and thus reinforced the continued expansion of unsustainable agricultural practices, leading to many of today's ecological challenges. Significant loss of forests and biodiversity, land and soil degradation, and increasing GHG emissions have resulted in a shift in understanding as to what conservation is and how it should be approached. With market mechanisms now applied to conservation and protection efforts, forest plots have become a new commodity to invest in and accumulate capital.[68]

Another shift in focus is reflected in the 2030 Agenda, which acknowledges the protection of the global ecosystem and its services, as well as biodiversity, as a cornerstone of human existence and development. In acknowledging the interconnections between SDG achievement and ecological services, conservation is accepted as a means of reducing inequality, combatting climate change and strengthening global partnerships.[69]

Heeding the lessons of previous conservation efforts illustrates some of the flaws of past models and the future challenges to overcome in conflict-affected settings. The establishment of 'peace parks'—co-managed conservation areas straddling the boundaries of two or more states—offer a case in point. Despite being held up as potentially useful instruments to promote biodiversity, regional cooperation, poverty reduction and even peacebuilding,[70] peace parks have created new tensions in seeking to bring together former enemies (particularly in their early manifestations after Apartheid in southern Africa). Although political tension among former conflict parties at the national political level may have been reduced, local communities have often been excluded from the political and economic cooperation involved in opening the parks with both conservation and peacebuilding goals. Instead, the conservation and associated tourism opportunities can create economic development opportunities for elites while bypassing emerging participatory governance structures. The parks have therefore been criticized for having increased governmental influence over valuable resources under the guise of conservation concerns.[71]

Forced displacement of local communities, restrictions on access to natural resources in new conservation areas, and disregard for the human rights of those found acting against the rules run contrary to the Peace Parks' fundamental aim of promoting peace and security.[72] While valuable lessons have been learnt from earlier efforts, the case illustrates how the management of protected areas can undermine customary and formal land rights, thereby undercutting already strained local livelihoods.

The existing laws and practices for biodiversity conservation in Myanmar, which are primarily state-driven and highly centralized, provide another instructive example. During the reform era, several laws and policies provided a foundation for conservation efforts: the Myanmar Environmental Conservation Law (2012), the National Biodiversity Strategic Action Plan (2012), and the Environmental Impact Assessment Procedures (2016).[73] These policies were, however, formulated without extensive public participation and consultation, which has diminished their effectiveness and led to conflict with local communities.[74]

State-driven conservation efforts can be particularly problematic in the context of conflict, with post-conflict conservation leading to the forced eviction and resettlement of conflict-displaced people, or the dispossession of their customary land. In Myanmar, when rebel groups signed a ceasefire agreement with the government, it allowed the state to enter previously inaccessible areas.[75] Enhanced stability also created opportunities for transnational conservation actors and relevant government departments.[76]

Such tensions are illustrated by the case of Lenya National Park in southern Myanmar. Drawing the boundary for the national park has been highly contentious, with a long history of conflict and repeated displacement.[77] After the 2011 ceasefire agreement between the Karen National Union and the army, many displaced Karen people gradually migrated back to areas proposed for inclusion in the national park.[78] Ethnic Karen people not only rely on forests for food, livelihoods and traditional medicine but also consider them an integral part of their cultural identity.[79] The Karen National Union also resisted the establishment of the national park, insisting on postponing the zoning until a comprehensive peace agreement was in place.[80] Before the 2021 military coup brought a halt to most international collaborations, the involvement of transnational conservation and international development actors had proven controversial, with external actors primarily focused on promoting their conservation goals. As such, they sided with the state, ignoring concerns raised by the local population and Karen civil society.[81]

### 3.2.5. Militarization of conservation

With conservation and ecosystem protection ramping up through a variety of programmes at the global and national level, it is critical that the antiquated approach of nature protection based on human-free conservation areas is avoided. In the past, such assumptions have led to multiple conflict and justice concerns, including the possibility of 'violent environments in the context of reserve and protected forest areas'.[82] The use of force in this context constitutes a form of militarization, with armed police, military forces or private militias utilized to enforce conservation zones.[83]

An example of the militarization of conservation can be seen in India, where the Ecological Task Force (ETF) has been established within the Indian army. Putting nature protection on a 'war footing' was seen as an effective way of enforcing the protection and restoration of degraded areas.[84] The ETF is mostly composed of former soldiers and is supposed to work in cooperation with the Forestry Department. However, differing authority structures have at times prevented the ETF from fostering relations with local communities. As a result, its presence is often seen as threatening.[85]

Militarized conservation practices have particularly negative impacts on local communities that have traditionally relied on resources found in newly conserved areas, especially in conflict and post-conflict contexts. For example, the Gulf of Mannar Marine National Park in India is a protected area established in a region of ongoing ethnic and military conflict.[86] Under the pretext of conservation, the Sri Lankan government banned the harvest of sea cucumbers and other marine species of commercial value historically traded between the Indian state of Tamil Nadu and Sri Lanka, in order to disrupt the trafficking of arms, ammunition and other contraband along the same routes after civil war broke out in 1983. State and international conservation and security actors actively criminalized artisanal fishing communities, allowing the Sri Lankan government to pursue its security goals.[87]

Another concern arises from the outsourcing of conservation capacity to private owners. In South Africa, for example, state incentive structures have led private owners to hire former military personnel to protect wildlife, contributing to the militarization of conservation. This practice has triggered an 'arms race between poachers, soldiers, and rangers, with each group using more and more sophisticated weaponry'.[88] In response, many environmental NGOs have incorporated a human rights framework into their practice, with the aim of restricting the use of force in conservation practice.[89]

Despite the devastating consequences of military interventions, sometimes unintentional conservation benefits can accrue.[90] Limited human activity in the no-go demilitarized zones in Cyprus and between North and South Korea have led to thriving ecosystems,[91] with some Asian crane species having been saved from extinction in the latter case.[92] Military bases can also ironically experience higher levels of biodiversity.[93] While the ecological benefits of limited human access in militarized areas are recognized, it is incumbent that plans are made to maintain these resource protections in peacetime rather than relying on conflict to protect ecosystems.

Peace can come with environmental costs as well. The signing of the 2016 Peace Accords in Colombia saw not only the (formal) end of conflict but also the end of de facto environmental protection provided in the areas formerly under armed group control, where people were largely excluded. Peace has allowed various actors to access formerly dangerous regions for logging, mining and grazing purposes. Deforestation has increased dramatically, thereby reigniting conflict over natural resources in the country.[94]

### 3.2.6. Conclusions

While the growing momentum to protect and restore ecosystems is a positive development, practitioners must ensure they adopt approaches that avoid the conflict and injustices seen in a multitude of previous cases across the world. The key challenges relate mostly to land tenure, ownership rights, and competing claims to the use of these areas and their resources. There is an urgent need to cast aside antiquated notions of intact nature as human-free habitats, which in the past—and even today—can be seen as a desirable condition. Approaches to protecting and supporting ecosystems that put humans at the centre of holistic, inclusive and effective ecosystem stewardship are needed. To achieve this, the empowerment and active participation of those inhabiting biodiversity-rich habitats is essential.

Integrating nature protection and human development forms the basis of 'wise conservation' and environmental peacebuilding (see part 4).

Relegating conflict and justice considerations to second-tier concerns threatens to make opponents out of allies in such efforts. Shared environmental resources need cooperative management if they are to remain a sustainable basis for sustainable development, transcending arbitrary political divides. Most ambitiously, these efforts can contribute to inter-community trust building, thereby helping prevent future conflict or build peace in the wake of conflict.

# 3.3. Mitigation

## 3.3.1. Navigating the conflict dimensions of the mitigation imperative

Mitigation, defined by the IPCC as 'a human intervention to reduce the sources or enhance the sinks of greenhouse gases', has been the centrepiece of public and private responses to climate change.[95] Myriad mitigation activities aim to reduce the release of heat-trapping emissions or increase the means of sequestering carbon. In terms of the former objective, transitioning from fossil fuels to a range of low or zero-carbon renewable energy sources dominates, while a mix of natural and technological steps are being deployed in pursuit of the latter.

As illustrated in figure 3.2, the speed at which we reduce emissions is crucial due to the cumulative and lagged effects of $CO_2$. While modelling suggests that most of the heating from GHG emissions occurs within 10 years, the peak may not occur until centuries later.[96]

Mitigation has historically been the primary focus of collective international responses through the 1992 UN Framework Convention on Climate Change (UNFCCC) and its 27 subsequent Conference of Parties (COP) negotiations. While the results of these negotiations remain hotly debated, the prospect of emission mitigation strategies requires close scrutiny in terms of the potential justice, peace and security implications. As such, this section examines the key mitigation interventions and suggests how practitioners can proactively act to minimize conflict and maximize justice.

## 3.3.2. REDD+

Payment for ecosystem services is an established tool for making explicit the economic value of natural systems in providing necessary services. This tool is at the heart of REDD+ (reducing emissions from deforestation and forest degradation) approaches to mitigation through conservation. These initiatives were formalized under the UNFCCC's Warsaw Framework (COP19, 2013)[97] in order to maximize the carbon sink function of forests while generating income for development through means other than timber and agricultural

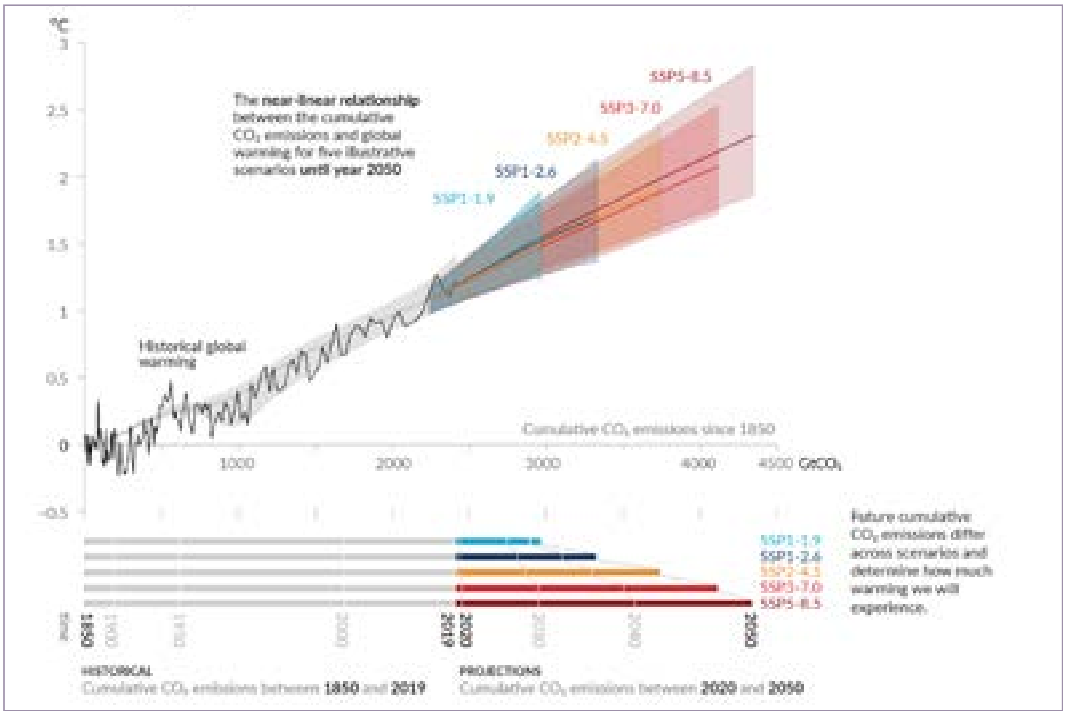


**Figure 3.2.** Near-linear relationship between cumulative $CO_2$ emissions and the increase in global surface temperatures

Source: IPCC, 'IPCC, 2021: Summary for policymakers', eds V. Masson-Delmotte et al., *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press: Cambridge, 2021), fig. SPM.10.

activities requiring deforestation. REDD+ channels finances from the Global North to countries in the Global South, potentially allowing the latter to protect their forests and gain income for these sequestration services. It has been described as a 'triple-win' programme, providing: (*a*) the sequestering of carbon; (*b*) reduced deforestation of the critical ecosystems necessary for the provision of ecosystem services, including to forest-dependent communities; and (*c*) alternative means of generating funds that do not require harvesting natural resources.[98]

The carbon emission reductions and possible biodiversity gains from REDD+ projects are, however, limited, especially if projects are not implemented alongside transformations in the related land-use practices driving deforestation.[99] Initial takeaways from REDD+ projects highlight a number of implementation techniques to avoid and lessons that need to be applied in other mitigation and conservation contexts.[100] While REDD+ is relatively new and the outcomes have yet to fully materialize, early evaluations find 'the rhetoric is stronger than the evidence of practices on the ground; that short-term, administrative interests overshadow long-term environmental ones; that REDD+ rules adversely interact with state and customary institutions; and that REDD+ lacks local legitimacy by excluding non-elites'.[101]

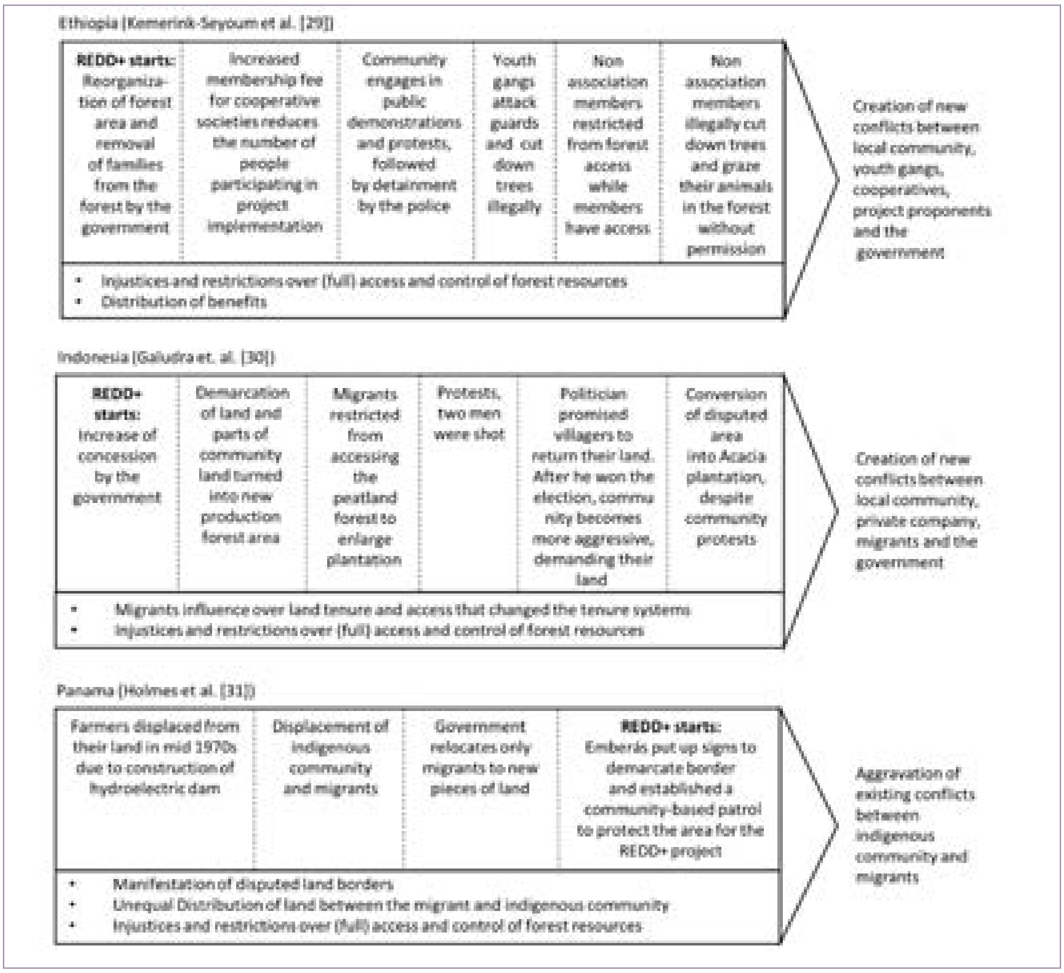


**Figure 3.3.** Three case study conflict pathways

REDD+ = Reducing Emissions from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries

Source: Alusiola, R. A., Schilling, J. and Klär, P., 'REDD+ conflict: Understanding the pathways between forest projects and social conflict', *Forests*, vol. 12, no. 6 (June 2021), figure 5.

### 3.3.2.1. Potential conflict pathways

While payment for ecosystem services can potentially deliver multiple ecological, economic and social benefits, REDD+ projects also present a number of conflict and justice risks. Given that UNFCCC COP decisions mean that countries manage their projects in different ways,[102] making a generalized assessment of the conflict potential of international REDD+ initiatives is difficult. However, an analysis of eight projects suggests six potential ways in which conflict could arise:[103]

1. Injustices and restrictions over (full) access to and control of forest resources;
2. Creation of new forest governance structures that change relationships between stakeholders and the forest;
3. Exclusion of community members from comprehensive project participation;

4. High project expectations created by implementing governments not being met or not being experienced by affected local communities;
5. Changes in land tenure policy due to migrants; and
6. Aggravation of historic land tenure conflicts.

These potential drivers of conflict are illustrated in figure 3.3, which maps three REDD+ case studies and highlights how conflict emerged in each instance.

### *3.3.2.2. How cases could lead to conflict*

The change of governance structures occurring in REDD+ forests and the potential for conflict that this brings warrants close attention. REDD+ projects often take place on Indigenous lands, inhabited by people who have managed the forests for centuries or in some cases millennia. Some REDD+ projects have criminalized the traditional practices these groups have pursued in their forest homes.

A study of 71 REDD+ projects found that external actors were the cause of insecurity at a rate of five-to-one compared to internal factors (i.e. not intra-community conflict), with local communities only granting permission for the project to proceed in 38 per cent of cases.[104] Moreover, 55 per cent of cases were found to involve land tenure insecurity.[105] Land tenure issues often arise due to historical land grabs away from Indigenous peoples, who have customary law claims over the land. Competing claims over forest land also exist between different government departments, private companies and local communities.[106] Difficulties in identifying the legitimate rights holder of the land then has downstream impacts on who receives compensation for giving up access and use rights to the now protected forest.

A detailed study of the forests of Central Kalimantan, Indonesia, showcases 'slippery violence'[107] surrounding REDD+ projects: those without formal land titles are excluded from access to forests; projects often reinforce patriarchal structures; the licensed use of forest land favours the conservation of local orangutang populations over people; and the extent of labour required in balancing biodiversity, conservation and livelihoods is underestimated.[108] Thus, local populations get labelled as uncaring for failing to successfully implement these conservation and mitigation schemes. Ultimately, this 'slippery violence exacerbates exclusion of the already marginalized as many countered their exclusion with violence with at times an emancipatory effect and at times with environmentally destructive outcomes'.[109]

### *3.3.2.3. Safeguards*

In response to the emerging conflict issues seen in early REDD+ projects, implementers have developed safeguards to further protect the mostly Indigenous custodians of the forests. UNFCCC safeguards articulate the need for 'transparency, participation of stakeholders, protection of biodiversity and ecosystem services, respect for the right of Indigenous Peoples and Local Communities'.[110] Another set of safeguards developed by the Climate, Community and Biodiversity Alliance,[111] the REDD+ Social and Environmental Standards (REDD+ SES), sets out 28 criteria over seven principles, including land rights, benefit sharing, good governance, biodiversity, participation and the rule of law.[112]

Despite such safeguards, REDD+ continues to be a potential driver of conflict risk, especially in a context where forests are viewed primarily as carbon sinks rather than complex ecosystems.[113] This threat persists because projects consist of multiple actors—including affected communities, private investors, civil society, and local, regional, national and international governance—each of which has a different interpretation of the rules.[114] Most fundamentally, REDD+ commoditizes the Global South's forests as a means of offsetting the Global North's failure to dramatically reduce GHG emissions.[115] The safeguards, while well intentioned, remain broad and have no international enforcement mechanism.[116]

The top-down approach of REDD+ management has disadvantaged local communities, which inherently have less power and understanding of how national and international institutions operate. Neutral-appearing policies, such as open consultative processes, can serve to exacerbate existing capital, labour and credit inequalities.[117] Rather than simply assuming that an 'open' process achieves representative participation, specific power decentralizing policies are required to ensure power is not concentrated away from the affected communities, thereby exacerbating pre-existing marginalization.[118]

The hoped-for outcome of REDD+ is a triple-win of carbon sequestration, forest and biodiversity protection, and alternative development pathways for forest communities. While payment for ecosystem services offers powerful incentives for protecting carbon sinks, REDD+ approaches must be go beyond viewing forests as simply carbon accounting tools. Instead, such approaches should be part of integrated lines of action that treat forests as dynamic ecosystems critical for ecological and human security both locally and globally. Thus, in order to reduce conflict risk and opposition, projects must ensure local communities and beneficiaries are meaningfully involved in their design and implementation. The urgency of carbon sequestration, particularly when viewed as a cheaper alternative to making mitigation changes in the Global North, should not come at the cost of the human rights and livelihood strategies of REDD+-affected communities.

### 3.3.3. Bioenergy

Biofuels are a growing dimension of efforts to transition away from fossil fuel-dependent transportation and electricity generation. Despite a temporary decline due to the Covid-19 pandemic, global biofuels production is expected to surpass 2019's record global production of 153.5 billion litres,[119] with the International Energy Agency (IEA) projecting a 28 per cent increase in biofuel production by 2026.[120] Like all mitigation strategies, however, biofuels must be evaluated in terms of the conflict and injustice potential as well.

First-generation biofuels come from oil seeds such as oil palm and jatropha, which are converted into biodiesel or sugarcane, and corn, which is turned into ethanol. Such biofuels are sometimes referred to as agrofuels due to their close association with high-yield agricultural plantations. Second-generation biofuels, meanwhile, utilize non-food biomass, such as switchgrass and wood pellets.[121]

Currently, Brazil, China and the United States are the largest producers of ethanol, while the European Union, Indonesia and the USA are the largest producers of biodiesel.[122] More than half the world's potential biofuels production is in sub-Saharan Africa and Latin America,[123] where countries and communities bear much less historical responsibility for generating GHG emissions compared to the Global North. There are increasing concerns that the global political economy of biofuel has reinforced inequalities across economies and within vulnerable areas.[124] Given this worry, biofuels need to be evaluated in a broader context than just GHG reductions.

Like other biomass-focused mitigation approaches, such as REDD+, biofuel mitigation strategies aspire to deliver 'triple-win' outcomes. In this case, the outcomes relate to energy sovereignty, with the fuels providing benefits in terms of domestic usage, improving food security and enabling sustainable development within a scalable project framework. Despite this, biofuel deployment has been slowed by intense debates around actual net emissions reductions, food price increases, biodiversity loss, water usage and rural economic effects.[125] Large-scale biofuel cultivation may even—through generating food insecurity, socio-economic decline and land evictions—contribute to new conflicts or exacerbate existing ones in vulnerable areas.[126] Overuse of monoculture agriculture, commonly used in biofuel production, degrades habitats, reduces potential yields and undercuts the conservation priorities detailed in part 3.2.

Prioritizing regulations that take into account the complex interactions between land purchases, food prices and local political organizations is a key step in reducing the inequalities and local dynamics that can 'fuel resistance'.[127] While in many cases the conflict risks may not be about the biofuels themselves, they can become an 'ignition point', adding new layers of complexity to existing conflicts.[128] Mitigation efforts therefore need to address these inequities and design conflict-sensitive biofuel projects with local co-benefits.[129]

#### *3.3.3.1. Food versus fuel*

Early debates around the scale-up of biofuel production centred around competition for agricultural land-use designation. In developed countries, diverting biomass feedstock from corn, soy and sugarcane did not immediately impact food availability. However, rising demand for biofuels boosted demand for feedstocks (corn in the USA, oilseeds in the EU), raising the prices of these crops.[130] Because these commodities are traded on global markets, the higher prices fed through to consumers around the world, including those in developing countries. As the EU and US policies ramped up biofuel demand in the early 2000s, price fluctuations and land conflicts began to emerge in Africa, Asia and Central and South America.[131]

Biofuel deployment can lead to explicit food versus energy security trade-offs in developing nations.[132] EU and US subsidies for non-domestic biofuel cultivation in developing countries typically reduce land availability for local populations and increase the prospects of food insecurity. In these and similar instances, increased deforestation coupled with monoculture land practices may contribute to negative human security outcomes. For example, the 2009 EU 'Renewables in Transportation' directive led to external land investments in Liberia. These actions in turn drove up land costs for local Liberian subsistence farmers, undercutting food security and generating climate injustice claims.[133]

#### *3.3.3.2. Land tenure and conflict*

Land-use requirements for biofuels can be a key factor behind conflict and social protest,[134] with a Food and Agricultural Organization High-Level Panel report on food security and biofuels stressing that the recent rise of investment in land for biofuels—which some term 'land-grabbing'—can explicitly threaten food security.[135] Indigenous and non-formal landholders are often ignored or intimidated during the land acquisition and project development stages, while project negotiations between developers and state governments frequently exclude local stakeholders and spur conflict.

In Brazil conflict emerged between the Guarani-Kaiowá and industrial sugarcane developments due to fundamental differences in land tenure understanding.[136] Internal displacement and water pollution from sugarcane cultivation had an outsized impact on these communities, with grievances escalating into violent altercations. Large landowners in Mato Grosso do Sul have better access to local and international governance levers, creating a legal environment where the Guarani-Kaiowá cannot adequately defend their land claims.[137] In 2012 Raizen, a joint venture between Shell and Brazilian Ethanol COSAN, agreed to stop sourcing sugarcane from Indigenous lands in Brazil.[138] Despite these concessions, violence against the Guarani-Kaiowá has continued.

Environmental defenders representing agrarian concerns have been repeatedly targeted in countries such as Honduras (see part 2 for more discussion of environmental defenders), where oil palm for biodiesel production has introduced a new dimension to long-standing conflicts over agrarian land rights. Land reforms encouraging the sale of cooperatively held lands to private entities received pushback from peasant farmers, leading to farmer-led occupations of land sold for oil palm cultivation and violence directed at climate-focused clean development mechanism projects in North Honduras's Bajo Aguán region.[139]

Biofuel development can also exacerbate ethnic tensions in ecologically sensitive areas with high levels of biodiversity and agricultural value (e.g. deltas, forests). In the case of the sugarcane and jatropha plantations in Kenya's Tana Delta, divisions in local attitudes towards biofuel development reflected existing ethnic divisions and a long history of colonial and state policies. More specifically, the corporate entity, Bedford Biofuels, and state proponents of the project aggravated tensions between pastoralist Orma and agriculturist Pokomo ethnic groups over local land tenure practices.[140] In August 2012 violent clashes broke out between Orma and Pokomo, leading to Bedford ceasing operations in the Tana Delta and declaring bankruptcy the following year. This case highlights the complexity of biofuel projects in regions afflicted by long-standing conflicts over land and agricultural rights.[141]

Biofuel production presents additional risks beyond the project development and implementation stages. Case studies from Ghana point to a need to focus on the post-closure and abandonment of existing large-scale biofuel projects. If projects are abandoned without a plan for ecosystem restoration, then land degradation or conversion to other large-scale agricultural use is likely to occur. In some instances, rural areas that were targeted based on weak land tenure have been left without viable restoration pathways, harming the ability of local people to subsist on agriculture and ecosystem services.[142] These situations can result in societal conflict and socio-economic decline. While in some instances local community distrust of national government has made working with private entities appear a better bet, the withdrawal of corporate stakeholders due to market prices shifts and reduced project profitability can leave an 'institutional vacuum'.[143]

While there have been efforts to address some of these shortfalls through market-based guarantees of sustainable certification efforts, they have fallen short of the intended impact. In the 2010s the EU implemented a hybrid approach to biofuel governance, setting minimum sustainability targets for the industry (e.g. addressing GHG emissions, biodiversity and carbon stocks) in expectation of the industry developing a 'race to the top' system and better mechanisms. A subsequent study found this did not occur, and instead the industry maintained a fairly 'lax' standards framework. The study therefore recommended the EU reformulate its policies to be more stringent.[144]

#### *3.3.3.3. Water and land resources*

High-intensity biofuel cultivation often can result in increased strain on water resources, with early iterations of such large-scale cultivation providing incentives to divert water resources away from key environmental areas.[145] Innovative irrigation and agroforestry still hold the potential to compound conflict arising from food insecurity and water shortages. A 2021 study found that global water withdrawals for the irrigation of biomass plantations are estimated to be of the same magnitude as other industrial uses.[146] Thus, scaling up water demand for biofuel cultivation presents a stark trade-off between agricultural security, ecological stability and climate mitigation goals.[147]

### *3.3.3.4. Biofuels and globalization*

Biofuels are also a story of growing globalization and commodity relations between the Global North and South, as well as South–South relations.[148] Notably, policies instituted in major economies such as the EU and USA have impacted food and oil prices in developing countries that adapted farmland in order to benefit economically from Global North biofuel policies.[149] Additionally, in response to volatility in oil-producing countries, the EU has increased its research and development in biofuels with the aim of bolstering energy security,[150] a dynamic that may be accelerated by efforts to diversify away from Russian fossil fuels in the wake of the war in Ukraine.

The rise of biofuels has been dubbed the 'biofuels complex', whereby the Global North has commodified traditional local energy sources and multinational corporations have consolidated power. Here, government policies have generated a new area of profitability in the name of energy security and lessening reliance on traditional fossil fuels.[151] Relatedly, the militaries of some NATO members are ramping up their research in biofuels in order to diversify their sources of fuel.[152] As this example suggests, the benefits of biofuels as a climate mitigation strategy are often secondary to larger geopolitical and economic motives.

The commodification of biofuels is environmentally concerning, as corporate profit motives (for investors in the Global North) trump concern for environmental damage caused in the Global South.[153] This relationship is not limited to North–South relations—as the BRICSAM[154] economies grow and further integrate into the global economy, they will drive such investments in other developing countries.[155]

As more countries seek to share in the profitability of biofuels, large-scale projects may be green-lighted without the proper consultative processes or life-cycle analyses.

### *3.3.3.5. Biofuels and bioenergy carbon capture and storage*

Biofuels and bioenergy carbon capture and storage (BECCS) is 'the production of bioenergy using biomass, coupled with the harvesting and subsequent storage of carbon dioxide'.[156] The storage occurs underground, in oceans or in forests.[157] BECCS also pose trade-offs between food, water, energy, biodiversity and social systems.[158] Despite lingering debates, BECCS projects are scaling up. The IPCC has produced four model pathways to achieving the 1.5°C target that include significant roles for BECCS, ranging from 0 Gt $CO_2$ BECCS to a cumulative total of 1191 Gt $CO_2$ stored through BECCS by 2100.[159]

The P2 model (sustainability and economic convergence but with some BECCS) would require approximately 3 Gt $CO_2$ sequestration per year from 2050 onwards, and nearly 1 $km^2$ of global cropland.[160] The P3 model (following historical patterns, focusing on energy supply technologies) would require

3 million $km^2$ of cropland (roughly the size of India).[161] The scale and nature of such land-use strategies, however unlikely they may be, raise a range of concerns, including adverse effects on biodiversity, water supplies, livelihoods and competing uses for such large areas of land.[162]

Current projects have been shown to cause acidification, eutrophication,[163] water overexploitation and biodiversity loss.[164] Moreover, this new demand for land would come on top of existing land-related competition and conflict, suggesting that explosive growth in BECCS would be incompatible with projected land requirements for urbanization, food production and maintaining global biodiversity.[165] Future BECCS projects can draw on many of the lessons learned from biofuel projects over the past two decades—notably, the unforeseen consequences on food and oil prices due to the incentivization of biofuels projects. Best governance practice requires engaging with affected communities to ensure projects are viable in the long term and that disruptions and conflict potential are minimized.

BECCS is often raised as a solution that aligns with the underlying assumptions of Integrated Assessment Models that rely on outdated data about alternate mitigation strategies, double-count the benefits of BECCS (as both an energy source and carbon capture tool), lack transparency (especially in terms of sequestration technologies) and draw on other external models without properly assessing them.[166] Failure to update these models is likely to result in faulty conclusions and poorly derived policy.

The potential for land evictions and socio-economic decline increases the likelihood of conflict arising from BECCS and large-scale biofuel operations.[167] Thus, BECCS life-cycle assessments must fully incorporate the conflict potential of water usage and agricultural runoff, while governments should focus on data-collection efforts for local and regional reviews in order to fully understand the nature of BECCS trade-offs.

#### *3.3.3.6. Bioenergy, conflict and (in)justice*

Ultimately, the success of BECCS in minimizing conflict needs to come through an active engagement process with potential host communities. Careful consideration of stakeholder needs is required to ensure the environmental and social impacts of large-scale biofuels do not create or inflame tensions. Biofuel demand faced serious reconsideration after a World Bank report identified a link between policies promoting the biofuel production and food price increases between 2006–2008.[168]

Carbon180 Fellow Meron Tesfaye identifies four key principles for reducing the risks of BECCS as a climate mitigation response. First, BECCS (and other bioenergy projects) should be evaluated on a local and regional basis. Second, the full life-cycle of emissions and impacts needs to be accounted for transparently. Third, the protection of vulnerable communities and ecosystems must be ensured. And finally, engagement and trust have to be built among all stakeholders, especially in fragile/post-conflict settings.[169]

Biofuel-related conflicts tend to occur when, in response to surges in market demand, weak and underdeveloped governance systems favour fast-tracking projects at the expense of rigorous stakeholder engagement.[170] A shift away from this practice requires the host and sponsor governments to drive foreign direct investment into projects aimed at creating and enforcing project development guidelines. While certification can lead to better foreign investment practices, it should nevertheless be bound to multi-level governance norms that follow the 'do no harm' principle. Biofuel projects need to consider local governance and prove positive impact before implementation. At a minimum, such action will require increased investment by existing developers and transparent profit-sharing mechanisms for at-risk communities. Before initiation, future projects must have a high level of conflict sensitivity and stakeholder engagement. Steps to ensure local environments are sufficiently protected and systems for monitoring and evaluation should be put in place. Multilateral efforts are necessary to define clear standards for sustainable biofuel feedstock while considering potential backdraft effects. Above all, all actors must recognize that bioenergy mitigation efforts can exacerbate or alleviate tensions in their respective implementation zones.[171]

### 3.3.4. Geoengineering—'governing the sun'[172]

Large-scale technological intervention aimed at affecting the Earth's climate system, often referred to as geoengineering, is increasingly debated as a tool to address climate change.[173] Though the array of such technologies is vast, current geoengineering efforts tend to fall into two broad categories: solar radiation management and carbon dioxide removal.[174] While the former looks to alter regional or global heat absorption through reflective technologies such as marine cloud brightening and stratospheric aerosol injection, the latter seeks to reduce atmospheric levels of $CO_2$ through such means as ocean fertilization or carbon capture technologies.

Despite some arguing that the imprecise umbrella term 'geoengineering' should be cast aside in favour of more precise technological options, political use of the term persists. These approaches, at times sounding like the stuff of science fiction, remain resonant in part due to scepticism that governments, companies and communities will be able to reduce fossil fuel use fast enough to avoid catastrophic warming. Thus, a growing (but limited) number of public and private entities are advocating for research, development and/or deployment of these technologies for climate change mitigation.[175]

Geoengineering raises a number of conflict and human security concerns.[176] Some interventions could generate large unintended impacts, for example on precipitation patterns or food security.[177] The history of security institutions deploying analogous weather modification techniques in competition or conflict with other states has generated fears of the militarization of such approaches. Conversely, some who fear the low barriers to entry when it comes to conducting geoengineering are looking to security institutions to interdict such efforts.[178] More generally, the high degree of uncertainty surrounding the global and localized impacts of these interventions has prompted grave concerns around justice and human security possibilities. As such, it has been difficult to arrive at any form of consensus on whether geoengineering should be implemented, who should implement it and how it should be governed.

#### *3.3.4.1. Solar radiation management*

Scientific research purports to lay out both the dangers of solar radiation management (SRM) and its potential for substantial climate hazard reduction.[179] Changes to the carbon cycle and the response of ocean ecosystems to solar geoengineering remain major uncertainties in the deployment of such technology,[180] with further modelling of diverse climate processes in simulations the only means of substantially testing the consequences of SRM proposals. However, even extensive modelling can only reduce, not eliminate, uncertainties.[181]

#### *3.3.4.2. Stratospheric aerosol injection*

Stratospheric aerosol injection (SAI) involves releasing large volumes of reflective particles such as sulphur dioxide into the upper stratosphere to reflect sunlight outward, thus cooling the planet.[182] Naturally occurring SAI has resulted in the short-term cooling of global atmospheric temperatures, laying precedence for the development of SAI technologies. Large-scale volcanic eruptions have reduced global average temperatures significantly,[183] as showcased by the 1991 eruption of Mount Pinatubo in the Philippines. In the year following the eruption, the Earth's global average temperature fell nearly 0.3°C due to the release of 20 million tonnes of sulphur dioxide into the atmosphere creating a cooling effect.[184]

Of the wide range of geoengineering technologies, SAI stands out as more technologically feasible and comparatively lower cost.[185] However, concern remains over the types of aerosols used and the possible interactions they may have with the ozone layer, unwanted heating at lower atmospheric layers, and consequential cascading impacts.[186] The approach requires constant deployment to generate the cooling effect as the injected particles ultimately fall back to Earth. Deployment would thus need to be maintained for many decades with persistent uncertainty around local impacts. Ultimately, SAI addresses the symptoms rather than causes of climate change.

#### *3.3.4.3. Marine cloud brightening*

Marine cloud brightening (MCB) technologies are similarly designed to alleviate global warming impacts by cooling the Earth. MCB techniques aim at increasing stratocumulus cloud sunlight reflectivity and longevity through the injection of micro seawater particles into low-lying clouds.[187] Like SAI, uncertainties surround the potential adverse effects of MCB: changing cloud properties could impact precipitation patterns; water quality, content and thickness; water evaporation cycles; and agricultural outputs.[188] These potential indirect effects are poorly understood, making it difficult to assess the impact MCB aerosols may have.[189]

### *3.3.4.4. Carbon capture utilization and storage*

Carbon capture utilization and storage (CCUS) has long been discussed as a technique to mitigate future climate crises. Carbon dioxide removal techniques can be categorized into three main strategies: (*a*) *biological methods*, which seek to utilize agriculture systems, marine environments and forests to capture and store carbon; (*b*) *geologic methods*, which involve storing carbon underground or encased in rock formations; and (*c*) *carbon-utilization methods*, which seek to incorporate captured carbon into the production of long-lived products such as cement or plastics.[190] Given the potential trade-offs and conflict and human security concerns involved, scale and context are critical for evaluating biological or nature-based CCUS methods (previously discussed in section 3.3.3.5).

Geologic- and utilization-based CCUS methods involve using built solutions to either capture carbon as it is created or remove it from the air. The carbon is then utilized in other industrial processes or geologically sequestered. Due to the pilot-scale of CCUS projects, no substantial research focuses on potential conflict impacts. With that in mind, the conflict potential would likely be focused around local- or industry-level infrastructure aspects,[191] in particular socio-political conflict among activists, corporations implementing CCUS projects, and governments approving or subsidizing them.[192] Moreover, technologies such as direct air capture and storage are very energy-intensive, making them only effective as a mitigation strategy if powered by renewables.[193]

Currently, CCUS methods are at varying stages of development and use. In order to meaningfully reduce the atmospheric concentration of carbon, their deployment would need to be significantly increased.[194] Time and funding are the main barriers to the successful operationalization of such goals, as scaling up will likely take decades.[195] Despite the growth in support for CCUS technology within some scientific and policy communities, further exploration into the potential adverse effects of large-scale deployment is needed.[196] Meanwhile, other groups of scientists have called for proactive non-use governance agreements.[197] Despite the perception that carbon removal techniques will be needed to sustain a liveable climate, critics suggest a more precautionary approach that recognizes carbon removal technologies can have highly negative impacts if deployed poorly.[198]

### *3.3.4.5. Needed governance safeguards*

Geoengineering as a climate mitigation strategy has the potential to catalyse a range of ecosystem, economic, social and even security risks. If geoengineering initiatives are implemented without a thorough understanding of possible adverse effects, such projects could exacerbate rather than redress climate-related crises.[199] Increasing the levels of international research, deliberation, and collaboration among public and private actors must be an immediate priority when it comes to developing international norms and agreements, thereby ensuring the climate-related mitigation outcomes of such projects outweigh the myriad risks.[200] Particular attention should be paid to forming inclusive and participatory processes that incorporate not only those with the capacity to deploy but also those who could be affected. For some leading academics, the ethical and equitable governance of solar geoengineering is ultimately impossible to achieve due to the uncertainty of how different regions will be affected.[201]

Concerns about equity of distribution also arise, particularly as some states increasingly possess the capacity to geoengineer independently,[202] while others do not possess the resources to meaningfully monitor, evaluate or participate in decision making about geoengineering.[203] This dynamic creates a troubling scenario in which a state could unilaterally carry out geoengineering operations with regional, transnational and global implications.[204] Despite some in the scientific community maintaining that geoengineering is to some extent technologically feasible,[205] the international political community remains in need of mechanisms that can safely ensure geoengineering does not spur further political and environmental security crises and inequalities.[206]

### 3.3.5. Hydropower

Hydropower is the largest source of low-carbon electricity in the world today.[207] If global temperature increases are to be kept below 1.5°C, IEA modelling suggests a further 1300 GW of capacity will be needed by mid-century.[208] In 2020, total hydropower installed capacity was measured at 1330 GW (see figure 3.4).[209] Thus, to achieve the IEA target, a tripling of existing capacity would need to take place in the coming decades. When evaluating hydropower's future role in meeting the growing need for renewable energy, decision makers must include the conflict and justice potentials of this low-carbon energy source.

Hydropower, like all energy choices, can have negative and at times unintended consequences for societies and ecosystems. Many dams are multipurpose and not only contribute to mitigation (hydropower) but also adaptation. Dams can help cope with floods and droughts and in turn benefit irrigation, food security, household drinking water availability and navigation.[210] These benefits, however, should be balanced against the negative impacts on natural ecosystem services and riparian communities. Hydropower commonly means dams, which can upend the livelihoods of riparian communities, displace entire communities, impact the timing and amount of water flow to different users, submerge lands, disrupt natural fish migrations and sediment transports, and engender social protests.[211]

Large dams can also spark transboundary water tensions among states. While wars have not historically been instigated over water, 'basins at risk'

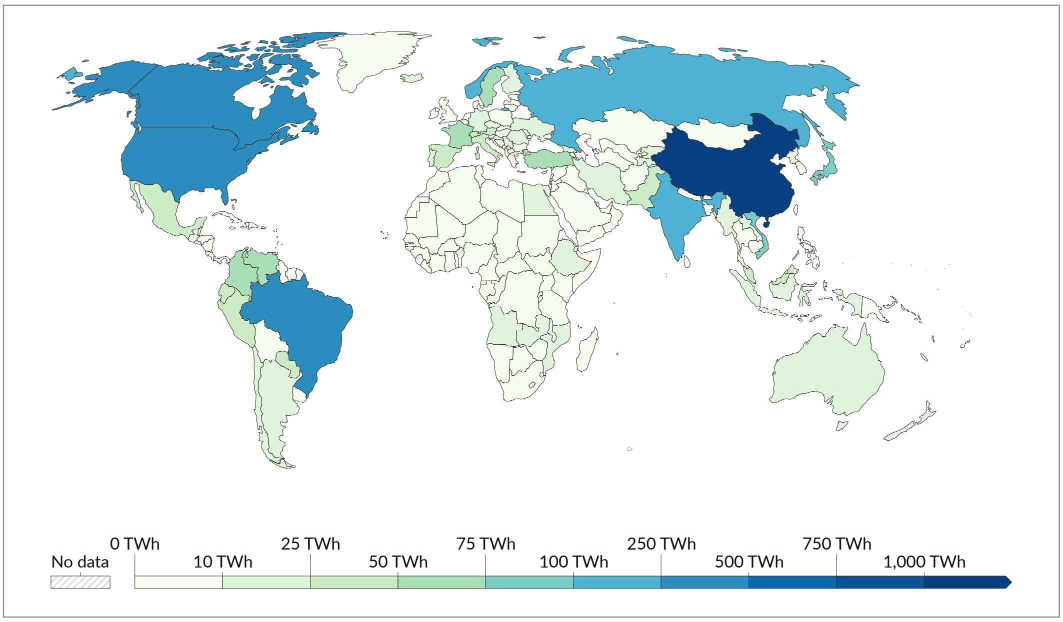


**Figure 3.4.** Global hydropower generation in 2021

Source: Our World in Data, 'Hydropower generation, 2021', 2022.

persist in a warmer, less predictable world where past hydrological records do not necessarily provide a reliable vision of the future.[212] This dynamic is especially alarming in regions such as Central Asia, where the lack of joint water systems, limited experience governing transboundary water and unequal distribution of freshwater resources have aggravated riparian relations.[213]

Dams within conflict zones can also be strategic weapons for armed groups.[214] In 2014 Islamic State of Iraq and Syria captured critical dams along the Tigris and Euphrates rivers, leveraging water access to pressure populations and strengthen political control.[215] Russian forces have targeted water infrastructure during their 2022 invasion of Ukraine.

Globally, almost half of available hydropower potential remains untapped, with 60 per cent of it located in the Global South.[216] In the coming decades, hydropower projects will increase as countries likely develop this potential and the world decarbonizes. If hydropower's conflict and injustice impacts are not proactively mitigated now, their effects will continue and perhaps worsen as renewable energy scales up. Moreover, failure to tackle these challenging dimensions of decarbonization may create further hurdles to making necessary transitions.

### *3.3.5.1. Hydropower boom*

Hydropower projects initially boomed in North America and Europe between the 1920s and 1970s. New dam building declined after the best construction sites were taken and maintenance costs and environmental/social risks made large-scale water infrastructure less attractive for countries.[217] In the 1990s, following protests over the social and environmental impacts of dams in the West, financial investments by institutions such as the World Bank receded. In 2000 the World Commission on Dams warned against the unethical effects of dams,[218] with its influential report highlighting environmental impacts and population displacement. The report also emphasized the importance of conducting strategic impact assessments and compensating community members who had lost their livelihoods and lands due to dams.[219]

Although hydropower construction has declined in many areas, it has continued to ramp up in the Global South. Today, hydropower is the backbone of electricity and economic growth in many developing countries.[220] Africa holds a tremendous amount of hydropower potential, with its 38 GW of currently installed hydropower capacity constituting only 11 per cent of its total potential.[221] In such contexts, large dams help to store water, sustain agricultural-based economies and meet the demands of growing populations.[222]

Most hydropower dams are planned and supported by international donors, primarily India and China,[223] with the latter financing up to 70 per cent of hydropower projects in Africa and 50 per cent in Latin America and Asia.[224]

#### *3.3.5.2. The importance of balancing the benefits and costs of hydropower*

Although hydropower dams can provide benefits, they often come at the expense of local communities and environments.[225] Large dams, as well as a cascade of smaller ones, constructed in biodiverse river basins such as the Mekong, Amazon and Congo may produce negative externalities that outweigh those previously felt in North America and Europe.[226] Without proper mitigation of these risks, hydropower becomes an unjust, conflictual and problematic energy form. The pushback from local communities is especially challenging when affected residents are not receiving greater access to the electricity generated.

The negative or unsustainable impacts of hydropower can broadly be categorized into three areas of risk: (*a*) social/equity; (*b*) environmental and ecological; and (*c*) economic. These risks are further distinguished by the type of hydropower dam constructed—reservoir, pumped storage or run-of-river[227]—and the size: large (10–30 MW), small (1–10 MW), mini (100 KW–1 MW) or micro (1–100 KW).[228]

##### *Social and equity sustainability*

Hydropower dams can cause livelihood deterioration and social inequalities.[229] While estimates vary widely, one recent analysis suggests 80 million people have been displaced worldwide due to hydropower dams.[230] These forced displacements and the increase in resource use shared between arriving and settled communities can create conflict potential. In Burkina Faso, following the 1994 construction of a large hydroelectric dam in the Nakambe river basin, pastoral populations were relocated to[231] new pastoral areas in the Doubégué pastoral zone of Boulgou Province to avert potential demographic conflicts and the degradation of local vegetation.[232] The resettlement of populations living in reservoir areas can also lead to a collapse in social cohesion.[233] In return for moving, communities are often paid undervalued prices for their properties or not compensated at all.[234] In some cases communities are also excluded from the benefits of locally produced hydropower. The Kariba Dam in Zambia, constructed in 1959, displaced Indigenous people from the Zambezi Valley who were promised electricity they never received.[235]

In Brazil hydropower supplies almost 66 per cent of the country's electricity.[236] It has also flooded approximately 3.4 million hectares of land and displaced more than a million people.[237] The Belo Monte dam, the third-largest dam in the world, funded mainly by the Brazilian Development Bank, blocks a section of the Xingu river tributary and has flooded large parts of the rainforest.[238] Many traditional river dwellers, or 'ribeirinhos', lost their lands, with almost 20 000 forced to give up their fishing livelihoods and relocate, often moving internally to areas where they did not speak the language and lacked government recognition.[239]

The communities and ecosystems living downstream of hydropower dams are also often dramatically impacted.[240] A lack of management, communication or action from authorities and entrepreneurs may also mean downstream populations face daily insecurity during rainy seasons.[241] Although downstream communities may benefit from the flood protection and irrigation control provided by dams, this is frequently outweighed by negative externalities.[242]

### *Environmental and ecological sustainability*

Despite producing renewable energy, hydropower dams are not without environmental and ecological trade-offs. They can emit GHG emissions, impact the natural lifecycles and production systems of riverine ecosystems, and deteriorate natural environments through the cumulative effects of a cascade of small and micro dams.

The concrete material used to construct dams is a major carbon dioxide-emitting substance.[243] Globally, concrete production contributes to 4–8 per cent of global $CO_2$ emissions[244]—if the cement industry were a country, it would be the third-largest carbon dioxide emitter in the world, after the USA and China.[245] Reservoir dams have also been found to emit GHGs in a number of ways.[246] First, when a reservoir dam is created, it floods terrestrial organic matter and soil that can cause microbial decomposition and release carbon, methane gas and nitrous oxide emissions.[247] Second, reservoirs experience greater fluctuations in water levels than natural water systems and lakes, which can create drops in hydrostatic pressure and release additional GHGs.[248] Finally, the high catchment-area-to-surface-area ratios and amount of human activities that occur near reservoirs can increase organic matter and nutrients deposited from land to water and create additional decomposition processes.[249] Run-of-river dams mostly avoid these problems, as they generate hydropower from the natural flow of a river rather than storing water through a reservoir.

When a dam disrupts fish migrations and fisheries, it can impact local ecosystems and food security. Changes in river flows can negatively alter the natural production systems of fisheries in downstream areas especially.[250] The Tucuruí Dam in the Brazilian Amazon, for example, caused fish catch to decline by 60 per cent, impacting almost 100 000 downstream inhabitants who relied on the fisheries and agricultural lands for their livelihoods.[251]

In the Mekong River Basin, one of the largest inland fisheries in the world, the construction of 78 dams on its tributaries has disrupted critical fish migrations.[252] Given that the Mekong Basin is home to 65 million people, two-thirds of whom depend on subsistence fisheries for their diet, changes to local fisheries have a considerable impact on local food supplies and larger human security conditions.[253]

### *3.3.5.3. Social mobilization against dams and conflict*

Hydropower has a long history of generating protests and social conflict.[254] A study conducted in 2020 found that, among low-carbon energy sources, hydropower produces the highest amounts of social conflict over social and environmental damages.[255] Repression and violence against protesters is also particularly high in cases involving hydropower,[256] and even building smaller dams can pose significant environmental, economic and conflict risks.[257]

In the Balkans a shift towards renewable energy increased the development of hydropower, especially micro dams. The 2015 European Union Connectivity Project and the Green for Growth Fund incentivized countries to invest in hydropower in preparation for future EU accession.[258] Currently, more than 3000 small dams are planned or have been built in the Balkans, a third of which are in natural parks or protected areas, generating significant protest from local communities.[259] These protests have also been spurred by perceived corruption, electricity delivered across borders to neighbouring countries, and construction contracts going to both companies and workers from outside the region.

#### *Social mobilization*

More generally, environmental activists around the world have since the 1950s mobilized against the unsustainable effects of hydropower dams,[260] with most protests targeting loss of livelihood, forced displacement, lack of compensation and incomplete impact assessments.[261]

In the early 2000s the Indian government's desire to transform the northeast region of Arunachal Pradesh into 'India's Future Powerhouse' provoked protests over the negative repercussions for local ecosystems and cultural heritage.[262] Similarly, the Sardar Sarovar Dam in India prompted peaceful protests by the Narmada Bachao Andolan after the dam submerged large areas of land, leading to people living in the Narmada Basin being displaced without adequate compensation.[263]

In Brazil, protests spurred by local churches and communities in the 1970s grew into international anti-dam movements.[264] Following a decision in 1979 by the government's regional energy company to construct 22 dams in the Uruguai Basin, church activists, university professors and students demanded compensation for displaced populations and a complete halt to dam building.[265] By 1987 the movement expanded into a global network connecting activists worldwide.

Targeted use of violence against protest leaders has been a particularly insidious response to the pushback on hydro power.[266] One of the most notorious examples is the case of environmental defender Berta Cáceres in Honduras, who was assassinated in 2016 after leading a protest against the impacts of the DESA Agua Zarca dam on the Gualcarque River.[267]

#### *Hydropower in conflict and post-conflict settings*

Developing sustainable hydropower poses additional challenges in civil war and post-conflict societies such as, among others, the Rio Grande in Guatemala, the Chittagong Hill Tracts in Bangladesh, and Nepal.[268] Myanmar, a country affected by decades of insurgencies under enduring military dictatorship, offers perhaps the clearest illustration of contested hydropower governance in conflict-affected settings.

Most untapped hydropower potential in Myanmar—almost 100 GW according to the government—is located in border regions populated by diverse ethnic minority groups who have long fought against the expansion of state control.[269] The government plans to harness this vast hydropower potential by installing an additional 5738 MW by 2031 (from 3158 MW in 2016).[270] Human rights advocates have expressed concerns over the negative social and environmental impacts of large hydropower projects on local communities,[271] arguing that under the previous military regime hydropower development led to the eviction of populations at gunpoint.[272] Even during the period of civilian government rule, hydropower development was linked to the escalation of violent clashes over control of dam sites and access roads.[273] While many communities have suffered in silence, others have protested, as in the case of the Myitsone Dam in northern Myanmar.[274] The emergence and suspension of the Myitsone Dam are intricately linked to the ethnonationalist struggle of the Kachin population against the government.

Ethnic communities have also led popular movements against large hydropower dams along the upper stretch of the Irrawaddy River and the Salween River, the last two free-flowing rivers in Asia,[275] with claims focused on human rights abuses, environmental degradation and conflict escalation.[276]

### *3.3.5.4. Hydropower for peace and development*

Though hydropower can generate conflict, inclusive hydro-governance can also promote peace and development. In transboundary waters, dams can bring disputing parties closer together and help them manage their shared waters. Hydropower can also provide affordable and accessible electricity access to remote areas that are unable to connect to larger centralized electric grids.

Despite fears of 'water wars',[277] there is little evidence pointing to a causal link between water and conflict in transboundary settings.[278] Nevertheless, dams constructed on transboundary waters can spark geopolitical tensions and hostile rhetoric among riparians.[279] Even when basin-wide mechanisms exist, dam building and flow management may factor into challenging regional security conditions—as current tensions surrounding the Grand Ethiopian Renaissance Dam (GERD) on the Nile River illustrate.[280]

In most cases, sharing and jointly managing water induces countries and communities to engage more closely, thereby developing cooperative regimes.[281] While these joint management arrangements can reinforce unequal water distribution,[282] it can also, in post-conflict settings, offer a way of rebuilding trust and cooperation between societies.[283]

International water law, applied to both surface and groundwater, provides additional impetus for transboundary water cooperation.[284] The 1997 Convention on the Law of the Non-Navigational Uses of International Watercourses, which entered into force in 2014, and the 1992 Convention on the Protection and Uses of Transboundary Watercourses and International Lakes, launched in 2016, are fundamental steps in the management and protection of shared water resources.[285] In the absence of widespread regional transboundary water treaties, the principles of 'equitable and reasonable use' and 'no significant harm' also govern the use of international waters.[286] Although countries differ over their interpretations of the legal principles, often bending them to justify unilateral water projects, they have provided a normative duty to cooperate.[287]

*Hydropower for development*

Hydropower dams can have positive effects on a country's development, even in post-conflict settings (see part 4 of this report). In Nepal two communities worked together at the end of the civil war in 2006 to construct micro-hydropower plants for shared electricity and socio-economic benefits.[288] The Daram Khola and Girindi Khola micro dams provided both the Rishmi and Kharbang localities with electricity, alleviating the burden for women, who could now use electrical cooking appliances and rice mills to speed up their labour and spend more time in their communities.[289] In Rishmi, the dams created bigger and better irrigation channels, enabling local inhabitants to have up to three harvests of varying grain types per year—previously only one harvest had been possible.[290] Electricity access also enabled the use of refrigerators, which bolstered food security and durability.[291]

### *3.3.5.5. Reconsideration of hydropower as renewable and sustainable energy*

Several policy tools can help minimize conflict and maximize justice around hydropower. To reduce environmental damage, hydropower projects must consider environmental flows (EFlows) to determine the amount of water and sediment needed to sustain a river's freshwater resources, ecosystems and livelihoods.[292] EFlows as a tool can be used to allocate water and build consensus among different watershed users through developing insights into which ecosystem components and services will be impacted under different dam operation alternatives.[293]

System-scale planning can provide an early strategic vision on the basin-wide cumulative effects of hydropower dams,[294] ensuring a more sustainable balance between hydropower development and a watershed's connectivity (flow and exchange of resources and services) and health.[295] Through river basin simulation models and spatial analyses, stakeholders can predict the performance and cumulative impacts of hydropower designs (on river flows, upstream/downstream usages) before constructing them. By prioritizing certain rivers or sections of river as 'healthy' and 'working', system-scale planning can help countries develop their river systems while ensuring critical ecosystem services remain intact.[296]

Joint, inclusive and accountable environmental and social impact assessments of dams also identify the diverse social and biophysical issues surrounding dam developments.[297] These assessments need to be conducted throughout project cycles in order to provide continuous feedback on dam impacts and how best to address them.

In some cases dam removal may be an optimal strategy to balance the various social, economic and environmental interests. The decision to remove four destructive dams in California's Klamath River represents one of the largest river restoration initiatives ever.[298] After decades of protests by Indigenous peoples and environmental groups over the impacts on local salmon species, water quality and traditional communities, the free-flowing Klamath river was restored.[299]

Transboundary river basin organizations can provide forums for exchanging information, reducing uncertainty and enabling greater cooperation.[300] They can help riparians govern and manage joint water infrastructure projects. The Nile Basin Initiative (NBI), established in 1999 as a transitional body until a Cooperative Framework Agreement could be reached,[301] was the first intergovernmental body to bring together all 11 Nile riparians. Countries worked to move from rights to water, to assessing multiple needs to water and ultimately towards how to share benefits across borders. However, political deadlock over water allocations and the GERD in Ethiopia continues to stall negotiations for a transboundary water agreement.[302] The NBI lacks legal clarity over its status and remains a transitional body that coordinates water resource management mainly at technical levels.[303] Despite this limitation, the NBI has enabled transboundary discussions amidst growing tensions among countries in the Nile basin, especially around the controversial GERD and joint technical and trust-building programmes to support political progress. Developing transboundary accords, underpinned by basin-wide institutions, such as the Senegal River Basin Development Organization (Organisation pour la Mise en Valeur du Fleuve Senegal) in West Africa, can enable the collective management of joint infrastructure projects, grounding international cooperation in the realization of mutual development benefits.[304]

## 3.3.6. Critical minerals

### *3.3.6.1. Mineral requirements of the transition*

Critical minerals are vital for wind, solar and battery technologies, and therefore underpin many of the technologies for low or carbon-free energy. They are also necessary for the digital and cyber technologies essential to today's economic and security sectors.[305] The World Bank has estimated that 'over 3 billion tonnes of minerals and metals will be needed to deploy wind, solar and geothermal power, as well as energy storage required for achieving a below 2 °C future'.[306] Some of these minerals are among the 17 minerals referred to as 'rare earth elements'.[307] Figure 3.5 identifies the key mineral inputs for green technologies, while box 3.2 details the scale of minerals needed for batteries and electric vehicles in the energy transition.

### *3.3.6.2. Risks to peace and security*

The extraction of resources leads to a confluence of risks. In highlighting these risks, it should be noted that several of them are deeply intertwined with historical and present injustices arising from colonial legacies, while in some cases the politics of national security have further heightened the stakes. The major risks at play include environmental and health concerns, labour rights violations, conflict at extraction sites, and geopolitical competition over securing mineral supplies. The concerns raised in the following examples are illustrative of a story repeated across extraction sites around the world.

The need for these critical minerals and the 'race' to secure them can have extremely negative environmental and health consequences, especially for local and Indigenous populations.[308] Reports from China, a leading producer of critical minerals, point to some operations having destroyed local environments, with toxic chemicals leaking into drinking water.[309] Other examples include the mining of nickel (essential for solar panels and energy storage), which has been found to deteriorate freshwater and marine ecosystems in various locations,[310] and Bauxite (used for aluminium) mining and processing, which threatens local hydrology, causes dam failures, generates toxic by-products and is emissions intensive.[311] Researchers have noted that stronger environmental legislation and enforcement mechanisms in the Global North have led to some mining being offshored to the Global South, where such protections do not exist or are rarely enforced.[312]

The human rights of workers, including children, are often threatened by the mining practices employed. For example, in 2015 Human Rights Watch found that Ghanaian gold mines had been exploiting child labour.[313] Similar exploitation has also been in evidence in the Democratic Republic of the Congo's (DRC) cobalt mines,[314] with recent reporting revealing that workers earn just $3.50 per day amid conditions akin to slavery.[315] Meanwhile, sexual

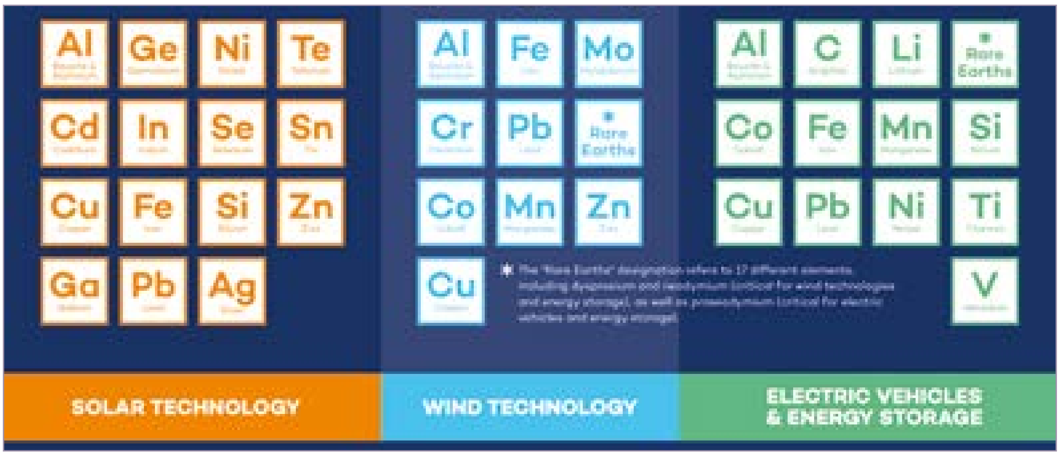


**Figure 3.5.** Minerals required for green energy technologies

Source: Church, C. and Crawford, A., *Green Conflict Minerals: The Fuels of Conflict in the Transition to a Low-Carbon Economy* (International Institute for Sustainable Development: Winnipeg, Aug. 2018), figure 1.

violence has been documented in Guatemala's nickel mines.[316] Although some efforts have been made to minimize the utilization of minerals extracted or produced in countries with troubling human rights records, many of these initiatives are voluntary or insufficiently comprehensive.[317]

Critical mineral extraction—notably of tantalum, tin, tungsten and gold (3TG)[318]—has also been linked to local grievances, tensions and violence,[319] with minerals sometimes used to finance parties to a conflict. 3TG minerals in particular have been targeted by US legislation and EU regulation, as well as the Organisation for Economic Co-operation and Development (OECD)'s best practice guidance, due to the high levels of conflict associated with their extraction and recycling.[320] Some have noted, though, that such interventions by the Global North can create fresh challenges due to the power dynamics that arise at these locations.[321]

Following the independence of many colonial states, international financial institutions (e.g. the World Bank and International Monetary Fund (IMF)) made development finance contingent on market liberalization of the extraction industries, leading to foreign companies establishing operations throughout the Global South.[322] However, these arrangements undermined state power and regulatory capacity, with private companies responsible for their own regulations.[323] Moreover, industrial mines run by foreign companies were prioritized over local artisanal mining, altering on-the-ground livelihoods.[324] Regulation emerging from the Global North therefore remains critical, as many mining companies headquartered there must ensure their international operations comply with legislation.[325]

When natural resources are easily exploitable (such as surface rather than underground mined minerals), they may be more likely to finance conflict.[326] Complex conflict economies emerge where people's livelihoods grow dependent on carrying out illicit economic activities.[327] These dynamics occur mostly in 'fragile and corrupt' countries, which, according to the International Institute for Sustainable Development (IISD), host large reserves of critical

## BOX 3.2. ELECTRIC VEHICLES AND BATTERIES

Energy storage technologies are key to scaling up intermittent renewable sources (wind and solar) and electrifying the transport sector. The World Bank forecasts that by 2050 there will be a five-fold increase in the levels of lithium, cobalt and graphite needed to meet the demand for batteries compared to 2018.[a]

The transport sector makes up just over 16 per cent of global GHG emissions, including 12 per cent from road transport and 2 per cent from aviation.[b] To address these concerns, many countries, as well as the EU, have introduced deadlines for a ban on internal combustion engines, forcing car manufacturers to ramp up production of electric vehicles.[c] Current projections suggest that by 2030, 30–50 per cent of new car sales will be electric vehicles (varies by market).[d] However, government regulations, consumer sentiment and mounting pressure on automotive manufacturers could lead to greater growth in the sector.[e]

Furthermore, countries with large national grids will need to implement grid-scale storage systems to stabilize and enable 24/7 access to electricity, as renewables are intermittent.[f] Some researchers have suggested that electrification of the global vehicle fleet could also operate as grid-scale energy storage, given that many vehicles are not in use much of the time and so could absorb excess energy in the system.[g]

[a] Hund, K. et al., *Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition* (World Bank: Washington, DC, 2020), p. 11.

[b] Ritchie, H., Roser, M and Rosado, P., '$CO_2$ and greenhouse gas emissions', Our World in Data, 11 May 2020.

[c] Morfeldt, J., Kurland, S. D. and Johansson, D. J. A., 'Carbon footprint impacts of banning cars with internal combustion engines', *Transportation Research Part D: Transport and Environment*, vol. 95 (June 2021); and IEA, *Global EV Outlook 2021: Accelerating Ambitions despite the Pandemic* (IEA: Paris, 2021), pp. 25–26.

[d] Walton, B., Hamilton, J. and Alberts, G., 'Electric vehicles: Setting a course for 2030', *Deloitte Insights*, 28 July 2020.

[e] IEA (note c), pp. 5–6.

[f] Kittner, N. et al., 'Grid-scale energy storage', eds M. Junginger and A. Louwen, *Technological Learning in the Transition to a Low-Carbon Energy System* (Elsevier: 2020).

[g] Chandler, S., Gartner, J. and Jones, D., 'Integrating electric vehicles with energy storage and grids: New technology and specific capabilities spur numerous applications', *IEEE Electrification Magazine*, vol. 6, no. 3 (Sep. 2018); and Kempton, W. and Tomić, J., 'Vehicle-to-grid power implementation: From stabilizing the grid to supporting large-scale renewable energy', *Journal of Power Sources*, vol. 144, no. 1 (June 2005).

minerals.[328] The IISD concludes that 'a picture emerges of potential hotspots for increased fragility, conflict and violence from growing resource extraction', especially in South America, sub-Saharan Africa and South East Asia.[329]

Cobalt mining in DRC has received particular attention in recent years. Globally, around 63 per cent of cobalt is supplied by DRC, a country that has experienced significant instability due to postcolonial power struggles, corruption, poor governance and continued violence.[330] Cobalt extraction has been linked to violence[331] and human rights abuses[332] (sometimes perpetrated by companies from the Global North or elsewhere overseas),[333] prompting the UN Security Council to assess the situation in 2019.[334]

A gold rush in the Central Sahel has drawn thousands of artisanal miners to the region. Some extremist groups have seized this opportunity to secure direct control over a handful of mines, while charging 'taxes' to artisanal miners in exchange for security services.[335] The gold mines offer both a place of refuge and a source of income for extremist groups, with the latter used to help fund recruitment and arms purchases.[336] The lack of trust in state security

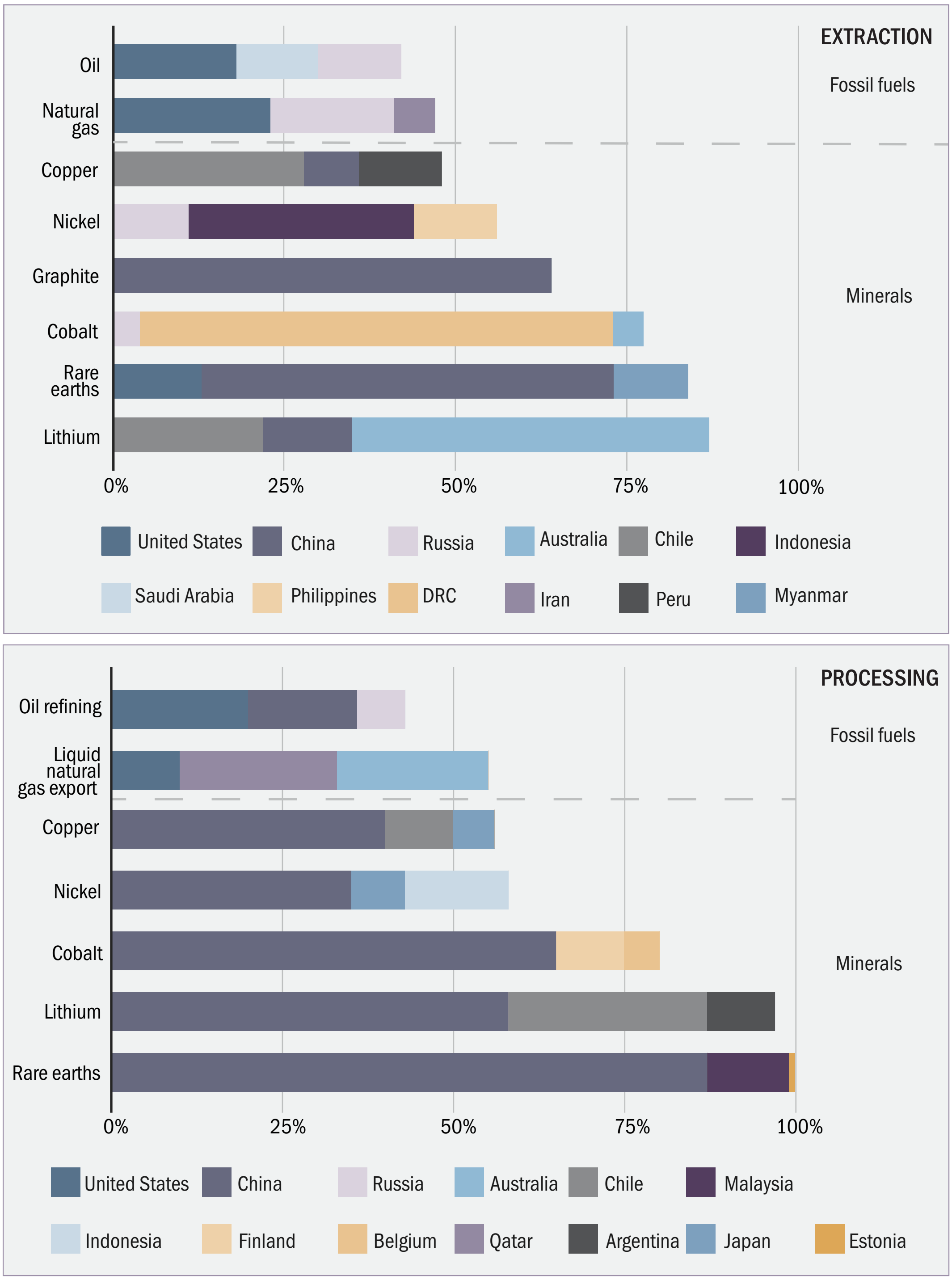


**Figure 3.6.** Concentration of critical minerals

Notes: The extraction (*a*) and processing (*b*) of many energy transition minerals is more geographically concentrated than that of oil or natural gas: (*a*) top three producing countries in the extraction of select minerals and fossil fuels (2019); and (*b*) top three producing countries in the processing of selected minerals and fossil fuels (2019).

Source: IEA, *The Role of Critical Minerals in Clean Energy Transitions* (IEA: Paris, May 2021), p. 13.

forces, combined with their inability to effectively combat non-state militias, also increases conflict dynamics, especially in cases where states passively accept non-state security at artisanal mining sites.[337]

Many extractive activities occur on Indigenous peoples' land. A report by the UN Human Rights Council's Special Rapporteur on the rights of Indigenous peoples found that these communities are often negatively affected by extractive industries.[338] A lack of prior informed consent from Indigenous peoples is a recurring theme around the world. As an illustrative example, the Swedish government's failure to fully engage Indigenous Sámi communities when large projects have been planned on their traditional lands, often limiting their access to formal processes.[339] Procedural shortcomings based on historical power asymmetries can also take more directly lethal forms, including the killing of Indigenous opponents to extraction projects.[340]

The destruction of cultural heritage presents an often neglected injustice and conflict dimension of mining. Often, modern conceptions of development fail to comprehend the spiritual and cultural connections Indigenous peoples have with the land—'Aboriginal people are part of their land because they incarnate spirit that comes from it'.[341] Many Indigenous peoples contend they are indivisible from nature. In a recent example of cultural destruction, a mining company in Australia blew up a 46 000-year-old heritage site, despite consultation with traditional landowners, causing profound emotional distress.[342] A parliamentary enquiry determined that new laws are required to prevent such an event from happening again.[343] Such actions in the face of cultural objections are regularly a source of injustice and social protest.[344]

Finally, the minerals in question not only underpin green technologies but also critical technologies needed for other civilian and military purposes. Their sheer usefulness has already begun to cement their role in global geopolitics. The major concern for policymakers around the world is the quasi-monopolistic position that China holds in the critical mineral supply chain given that it is both a major extractor and processor of the minerals (see figure 3.6).[345]

In 2010 the geopolitical and economic power of China's dominant position became clear when shipments of critical minerals from China to Japan were stopped.[346] Various justifications were provided, from overzealous port officials acting unilaterally[347] to accusations that China was using its exports as a 'political weapon',[348] to claims a domestic crackdown on an environmentally damaging sector replete with illegal activities had slowed down production.[349] Chinese officials denied it was a response to a territorial dispute with Japan.[350] Regardless, the vulnerability of relying on a single source was made clear. This dependency on China and a few other countries for critical minerals became even more of a major geopolitical concern for energy and security actors in the USA, EU and their allies, with the scramble to move more ambitiously into renewables and away from Russian fossil fuels in the wake of the Ukraine invasion.[351]

Over the past 15 years, the Chinese government has emphasized its concerns over 'resource security', making clear the country's further development depends on securing more critical minerals.[352] Here, China's behaviour in seeking to obtain minerals from countries in the Association of


**Figure 3.7.** Some known and suspected sources, routes and destinations of e-waste transit

Notes: Percentages of contributions to global e-waste generation: EU 23%, China 16%, US 14%, Japan 4.8%, Brazil 3.4%, Russia 3.1%, Australia 1.3%, Egypt 1.1%, Mexico 1%, and each other country <1%.

Source: Okeme, J. O. and Arrandale, V. H., 'Electronic waste recycling: Occupational exposures and work-related health effects', *Current Environmental Health Reports*, vol. 6, no. 4 (Dec. 2019).

Southeast Asian Nations, as well as African and Latin American countries, mirrors the behaviour of the USA and EU.[353]

Since the onset of the Covid-19 pandemic and subsequent global supply chain issues, securing critical mineral supplies has again become a prominent policy concern, especially in terms of the major role assigned to them in national security and energy transitions. For example, US President Joe Biden ordered the National Economic Council and National Security Council to conduct a review of the USA's critical mineral supply chains. Their report found that the USA is extremely vulnerable to supply chain disruptions and recommended expanding American capacity domestically, engaging further with allies, and improving the recycling of critical minerals.[354] At the same time, it notes a need to properly engage with US tribal nations in order to gain consent and minimize negative outcomes from extraction and processing.[355]

Elsewhere, a major report by the Polar Research and Policy Initiative has called for the Five Eyes intelligence partners[356] to incorporate critical minerals supply into their sphere of cooperation.[357] The report argues that given Greenland has a substantial amount of critical minerals, its proximity to the USA and Canada, and the engagement of UK, Australian and Canadian mining companies in the Danish territory, there is an opportunity to strategically counteract China's position.[358] The 2021 Greenlandic elections have, however, put this strategy into doubt, with the leading party opposed to allowing this expansion of mining operations on environmental grounds.[359]

The formation of critical mineral alliances via existing security alliances highlights the importance attached to critical minerals in the traditional security field. Statements and policy papers from the Five Eyes nations have also elevated the geostrategic importance of critical minerals.[360] With the USA and its allies beginning to form a cooperative bloc on critical minerals, geopolitical manoeuvres are likely to give rise to other groupings.

The EU is already developing strategic agreements and has signed memorandums of understanding with, for example, Canada and Ukraine.[361] Moreover, as part of its critical mineral strategy, the EU established the European Raw Materials Alliance in 2020. The network includes EU member states and international partners from industry, academia and governments across four key parts of the supply chain: *(a)* primary raw materials; *(b)* advanced materials and intermediate products; *(c)* final products; and *(d)* recycling.[362] Such agreements have garnered increased attention due to changing mineral supply patterns following the Russian invasion of Ukraine in February 2022.

The African continent has once again become a key source of mineral inputs, with governments and industries from the USA, China, Russia, Saudi Arabia, India and others showing a keen interest in securing supplies.[363] Numerous scholars have cautioned that this second 'African scramble' has undertones reminiscent of European colonialism in the 19th and 20th centuries.[364] Similar sentiments apply to increased demand for critical minerals from Latin America and Asia. Some analysts have struck a more optimistic tone of investment funding African development.[365] Meanwhile, pan-African cooperation through the African Union and its development of a similar free market to the EU—the African Continental Free Trade Area—aims to help African countries diversify their economies, thereby lessening the impact of mineral market volatility.[366]

### *3.3.6.3. Mitigating the need to extract*

Several approaches can be utilized to minimize the conflict, health and environmental risks associated with critical minerals, including recycling and reuse of minerals, material substitution, and improving supply chain governance. These steps require significant investments in order to be commercially viable and help meet the growing demand for minerals.

#### *Recycling*

Recycling minerals in old utilities and devices offers one way of reducing demand for extraction.[367] Current estimates suggest only 20 per cent of e-waste is recycled through official programmes, with the remainder sent to low- and middle-income countries[368]—often to be dumped and informally recycled (see figure 3.7).[369] Recycling represents a longer-term approach, with new mining maintained until such time as enough volume can be recycled to meet demand.[370] The EU has claimed the circular use of critical minerals is a key priority.[371] Moreover, improved recycling programmes may be key to strengthening environmental governance and human rights protection in the supply chain of materials needed for solar and wind power,[372] as well as reducing the environmental, health and conflict risks associated with offshoring e-waste.

The renewables industry has made great efforts to reduce the volume of materials needed for renewable energy in order to lower costs. However, attempts at recycling, particularly in the solar photovoltaic (PV) industry—where the strong short-term business case is challenging—must overcome the difficulty of separating all the components if the 'mining' of waste is to be expanded.[373] This new emphasis on recycling e-waste must also reduce the documented harmful effects on both the environment and human rights.[374] Recycling procedures are often unregulated and informal, relying on manual processing by vulnerable people in the Global South, as has been seen in Pakistan and Nigeria.[375]

Estimates suggest 55 million tonnes of waste could be generated by the burgeoning solar industry by 2050.[376] While the long life span of PV panels has meant a lag in addressing end-of-life concerns,[377] feasibility studies suggest an efficient solar recycling supply chain could be established.[378] The EU is currently a world leader in regulations related to recovery, with a mandate that producers 'collect and recycle at least 80–85 per cent of solar PV modules sold'.[379] By contrast, many African and Asian countries do not have formalized e-waste recovery frameworks.[380] It is vital that green energy solutions have integrated recycling and reuse supply chains, thereby reducing their social and environmental impacts.

*Improve governance and supply chains*

Responsible sourcing is needed where demand cannot be met by secondary sources or substitutes. Industries supplying minerals must actively pursue responsible sources, while the mining industry should be required to mitigate negative environmental and social impacts.[381] Clear guidance on responsible and transparent supply chains, engaged communities, companies that take responsibility, and accountable governments are all important components when it comes to ensuring responsible mineral extraction.[382] Achieving these aims requires governments, the private sector and civil society to work together, with special attention paid to historically disadvantaged groups, such as the poor and traditional communities.[383]

Notable examples of strong guidance are available.[384] For example, the OECD's Due Diligence Guidance provides recommendations for businesses on how to protect human rights and avoid contributing to conflict,[385] while the EU Conflict Minerals Regulation, adopted in 2017 and entered into force in 2021, aims to ensure that 3TG minerals imported from conflict-affected and high-risk areas are sourced responsibly.[386] Recent analysis by the US Agency for International Development puts conflict and justice concerns at the centre of mining for scaling up renewables.[387] In addition, there are private sector schemes, such as the Responsible Minerals Initiative, which provides a voluntary framework for improving supply chain governance.[388]

### *3.3.6.4. The future of critical mineral extraction*

It is impossible to ignore the mineral requirements of the energy transition. As such, we must learn from previous mining experiences and minimize the human and environmental costs that perpetuate and exacerbate historical wrongs. Critical minerals could prove to be a potential cooperative win in world politics, with countries using income from minerals to fund development and/or working together to create a global, responsibly sourced supply of minerals. This approach would also involve developing end-of-life recycling to reduce the need for future extraction projects. If these benefits are to be achieved and the negative ecological and social impacts minimized, fundamental changes in extraction and processing processes must occur.

Strong engagement is needed between local communities, national governments, the international community and corporations in order to uphold and respect human rights while ensuring sufficient minerals are supplied to undergird energy production and the manufacture of modern technological goods. Ultimately, cooperating with all parties in the extraction, processing and recycling of critical minerals provides the best chance of minimizing conflict and injustice while eliminating the threat of monopolistic behaviour.

### 3.3.7. Solar and wind power

Solar photovoltaics (PV) and wind power are fast-developing renewable energy technologies, central to all mitigation pathways and currently dominant in terms of new electrical installations.[389] They do not emit $CO_2$ during operation and can bring various co-benefits, such as better access to energy and decentralized solutions for areas excluded from national electricity grids. Some reports suggest that in 2021 wind and solar produced 10 per cent of global electricity.[390]

Investment in wind power is growing swiftly and spreading to new locations around the world—particularly in the Global South—as decreasing prices open new markets.[391] Offshore wind power generation is also expanding quickly, accounting for an increasing proportion of global wind power installations.[392] Meanwhile, solar PV provided 3.6 per cent of global electricity generation in 2019 and continues to expand rapidly, offering the most competitive option for electricity in many locations.[393] Furthermore, there is potential for further growth with the emerging technology of floating solar PV.[394]

#### *3.3.7.1. Conflict and human security dimensions of solar and wind*

Solar and wind technologies contribute to energy and human security in part through contributing to climate change mitigation and increased access to energy.[395] However, they present several social conflict and human security dynamics that must be proactively anticipated and planned for. The type and scale of conflicts relate to the issues surrounding critical minerals discussed in the previous section (3.3.6), with the conflict trends noted becoming more salient as wind and solar installations increase. Beyond the need for mineral inputs, solar and wind power deployment—particularly in large-scale developments—often requires large amounts of land, which may have contested alternative uses.[396]

A US study in 2013 found that between 1.9 and 5.4 hectares of land are required for 1 MW of utility scale solar generation (depending on the technology), with additional land needed for further generation, storage and transmission equipment.[397] Competition over land for renewable energy sources is expected to increase significantly if current uptake trends continue or accelerate. Given the competing uses for land that exist, conflict is expected to increase as well.[398] While offshore wind installations may mitigate some of these tensions over land, they have already received pushback from fisheries and shipping sectors, as well as aesthetic objections in cases where they are visible from land.[399] Other conflict-avoidance strategies include installation of solar panels on existing infrastructure, such as warehouses, parking lots and residential housing.[400]

The current development of wind and solar is dominated by centralized large-scale installations (>MW) owned by large investors and/or utilities.[401] These installations provide energy to distant consumers through transmission lines, meaning the locations where electricity is produced and where it is consumed are generally far apart.[402] The need to move power across multiple political jurisdictions presents an additional venue for social conflict, particularly in terms of people protesting against the installation of large infrastructure (see 'Chile: Exiting Coal and Constitutional Renewal' in the annex). Preliminary research suggests these dynamics do not, however, constitute particularly high-level conflict.[403]

The risk of solar and wind energy causing interstate conflict is low due to the lack of geographical concentration[404]—that is, unlike with fossil fuels, all countries have access to wind and the sun. Instead, through market and grid integration, large-scale renewable systems have been proposed as a means of fostering interstate cooperation, even in contested regions in the Middle East and South Asia.[405]

Locally, however, renewable energy developments can have unintended effects that contribute to conflict and instability. Social disputes related to wind power often involve 'not in my backyard' (NIMBY) responses in which aesthetic or alternative land-use arguments feature prominently.[406] Such social protest is often directed against developers or the relevant government entities, especially when it is perceived that transparent and inclusive processes have not been utilized or were ignored.[407] In other instances, communities oppose transmission infrastructure, particularly when they are not gaining any additional access to electricity.[408] While typically not generating violence, these sources of social conflict can delay, downsize or scuttle solar and wind projects, as well as create new hurdles to green energy transitions.[409]

Large-scale renewable projects can have significant social impacts on surrounding communities,[410] at times contributing to conflicts over land acquisition.[411] Concerns often relate to the natural, cultural or productive areas impacted by projects.[412] Land acquisitions tend to disproportionally affect communities and people with less power and formal land rights.[413] Therefore, renewable energy projects can exacerbate pre-existing fragilities, particularly where there is ongoing armed conflict or where local communities are vulnerable to climate change impacts due to a low capacity to adapt.[414]

On the other hand, local wind and solar projects can give communities access to energy and increase human development. SDG 7 aims to provide access to 'affordable, reliable, sustainable and modern energy', and for those in remote rural areas, decentralized wind and solar (i.e. off grid) offers a readily implementable means of fulfilling this goal.[415] Such an approach may be especially impactful in sub-Saharan Africa, where some estimates suggest as many as two-thirds of the population lack access to electricity.[416] These decentralized systems often have less conflict potential due to the participatory processes required to implement and maintain them.[417] Researchers have found that regardless of the perceived benefits registered by policymakers or development agencies, even local projects must engage with communities and their 'visions of the future', as simply imposing the use of technologies can result in poor outcomes.[418]

While acknowledging the potential of solar and wind, two case studies—one from Lake Turkana in Kenya and the other from Markbygden in Sweden—illustrate potential land-use risks. Both involve wind farm projects and provide glimpses of the land-use challenges that will often accompany renewable energy transitions. There is a long history of energy projects disadvantaging Indigenous peoples. Large-scale renewable projects may threaten a continuation of such practices.[419] Rural land for these projects is often remote from population centres and typically viewed as less productive in gross economic terms. Moreover, the sparse populations inhabiting these lands are less politically powerful. Such characteristics often apply to the areas where Indigenous people live. Climate change mitigation is frequently used as an additional argument in favour of exploiting this type of land, with the large-scale positive climate benefits, coupled with economic opportunities, regarded as more important than potential negative local impacts.

#### *3.3.7.2. The Lake Turkana Wind Power Project, Kenya*

Kenya has an ambitious plan for renewable energy, with over 60 per cent of the country's energy use already sourced from renewables.[420] This energy diversification brings with it a number of important benefits, including reduced air pollution, reduced dependence on imports for energy,[421] and positive climate mitigation contributions. Even so, these renewable energy projects are having concerning impacts on communities at a local level.[422] The Turkana Wind Power Project (LTWP) is part of a wider trend of large-scale infrastructure projects in Kenya, many of which are being built on pastoralist lands.[423] These renewable energy developments are taking place amid an already conflictual context of recurrent clashes between nomadic/semi-nomadic pastoralists and sedentary farming communities.

The LTWP is the largest and one of the most controversial wind developments in Africa, with its estimated 310 MW capacity intended to feed Kenya's national grid. Although the company developing the site is registered in Kenya, it is owned by Dutch, British, Danish and Norwegian companies, as well as Kenyan public development funds.[424]

The project site is located along the ancestral lands of the Borana, Randile and Turkana communities in Marsabit County. The communities are not connected to the national grid and will not receive any of the electricity generated by the wind farm. Communal lands are affected by the project's construction, which is particularly concerning given the historical and cultural significance of pastoralism in the area. One village in Turkana—an important place for traditional ceremonies—was relocated due to its position next to the wind farm.[425] Weak local legislation allowed the project companies to lease the land with minimal local consultation, eventually leading to a court case in which it was alleged the land had been leased on illegal terms.[426] The Turkana project investors managed to avoid the most stringent safeguarding policies by not recognizing the pastoralists as Indigenous people.[427]

In terms of security, the LTWP has had mixed effects on local communities. On the one hand, some have experienced enhanced security due to more policemen being stationed in the area.[428] On the other hand, concerns have been expressed that the project has played into long-standing conflicts over land rights, thereby increasing tensions between communities.[429] Despite the corporate social responsibility programme aimed at providing benefits to local communities, some residents have experienced unmet expectations, leading to a belief that particular communities are being favoured over others.[430]

### *3.3.7.3. Markbygden wind farm, Piteå—Sapmi, northern Sweden*

Markbygden is a large-scale 4000 MW wind farm with over 1000 turbines being constructed on Sámi herding land in Piteå, Sweden. It is expected to produce around 8–12 TW per year, supplying electricity to approximately 400 000 households. The project also includes extensive road infrastructure. The company constructing the wind farm assessed the area as having a 'relatively small degree of conflicting interests'[431] due to the sparse population living there.

The Sámi are Indigenous people recognized and protected under law, although Sweden has not ratified binding conventions that require prior, free, informed consent for the protection of Indigenous peoples, such as the International Labour Organization's Indigenous and Tribal Peoples Convention, 1989 (No. 169).[432] The Sámi are best known for their semi-nomadic reindeer-herding livelihoods, which around 10 per cent (2800 people) of the Sámi population are currently active in. Due to cultural, traditional and environmental reasons, this activity is legally reserved for Sámi people in the Nordic countries. The herders need to move the animals over large distances between suitable grazing lands, but this is proving more difficult as pressures from other economic interests—such as electricity generation and the infrastructure it encompasses—increase.[433]

The herders have expressed concern that the Markbygden windfarm will limit their movement and endanger the reindeer.[434] Research has shown that both the construction and operation phase of wind farms disturb reindeer and alter their habitat selection.[435] The Swedish authorities, however, have stated that the national interest in combatting climate change takes precedence over the possible impact on reindeer herders' livelihoods.[436] The first and second phases of the wind farm have been fully approved and are under construction, while the third is currently in the planning phase.[437] This case illustrates the need to recognize up front current and coming tensions between competing policy goals of climate response and justice through inclusive governance for traditionally marginal groups.

Solar and wind energy are foremost among the renewable technologies being used to reduce fossil fuel reliance, power the energy transition and mitigate climate change. This dominance warrants an in-depth accounting of the ecological and social costs, as well as the benefits. Policymakers, especially those managing nation-scale grids, should be aware of the land-use impacts of utility-scale wind and solar projects, and ensure they actively engage with impacted communities. Wind and solar technologies, like other renewable energy technologies, must work to reduce the ecological damage and social tensions associated with critical mineral and metal inputs if the scaling up of these technologies is to avoid generating conflict.

## 3.3.8. Nuclear power

### *3.3.8.1. Nuclear as a contested energy source*

Nuclear power is a contested mitigation strategy. For some, it represents an operationally carbon-free energy source that has already been deployed, with existing structures in place to address safety and proliferation threats. For others, nuclear power should not be part of a non-carbon-based energy portfolio. Arguments against nuclear power centre on high costs often deferred through expensive public subsidies, and risks arising from accidents, attacks on facilities, ad hoc waste storage, and the weaponizing of fuels or wastes. More recently, reliability has been questioned due to higher summer temperatures affecting cooling water temperature and availability in ways that have reduced operational capacity. Arguments for nuclear power stress the significant capacity already in place, while pointing out all energy technology choices have undesirable dimensions.

Globally, 457 active nuclear reactors provide approximately 10 per cent of the world's electricity.[438] For many countries, nuclear provides a much larger percentage of electricity generation (see figure 3.8), with France, for example, producing over 60 per cent of its electricity this way. Advocates argue that nuclear power plays an important role in producing electricity without GHG emissions,[439] and call for delaying planned closures (especially when doing so increases the use of coal and natural gas or dependence on hostile suppliers)[440] while rapidly constructing new (and more modern) reactors.[441]

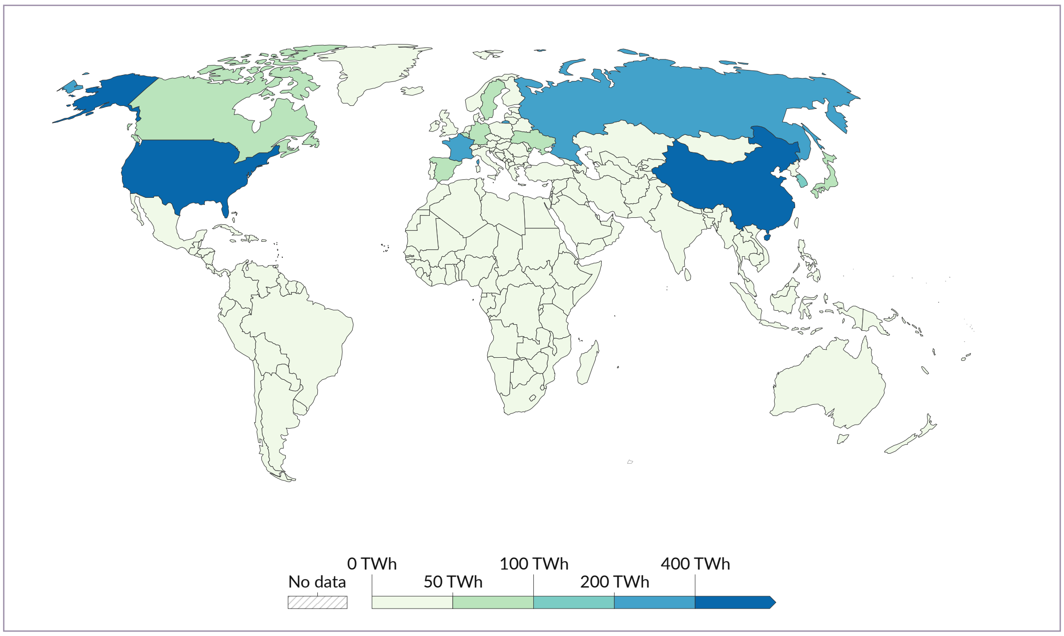


**Figure 3.8.** Share of electricity production from nuclear, 2021

Source: Ritchie, H. and Roser, M., 'Share of electricity production from nuclear, 2021', Our World in Data.

Opponents, meanwhile, point to the ecological costs and social conflict surrounding uranium mining (which are similar to the issues discussed at length in section 3.3.6).[442] In addition, the transport and long-term storage of nuclear waste remains controversial and costly, with the result that it is commonly stored on-site in more dangerous temporary arrangements. To date, Finland is perhaps the only country with a well-established long-term solution for nuclear waste storage.[443] By contrast, the USA spent over $10 billion on the Yucca Mountain repository before closing it in 2010 with none of its 63 500 tonne capacity in use.[444]

Furthermore, fear of possible reactor meltdowns—as well as actual meltdowns at Three Mile Island (1979), Chernobyl (1986) and Fukushima (2011)—have spurred public opposition across continents.[445] The 2022 Russian invasion of Ukraine has added to fears of accidents when nuclear power plants are operating on an active battlefield. Some security experts also worry about nuclear weapon proliferation, 'dirty bombs' and cyber-attack-induced meltdowns. From a practical point of view, nuclear technology has received diminishing amounts of funding since the 1970s, and the regulatory environment to start a new generator requires large financial investment and long lead times before a plant can become operational.[446] This combination of factors has led to the nuclear industry stagnating.

While nuclear power could arguably provide a more readily deployable alternative to fossil fuels if high investment levels were maintained, the reality is that the number of nuclear reactors around the world is decreasing (figure 3.9). This decline is due to many reactors reaching the age of retirement, coupled with few new reactors being planned (mostly in Russia, China and the Middle East). Democratic countries with liberalized energy markets have cancelled new builds, are experiencing construction delays and

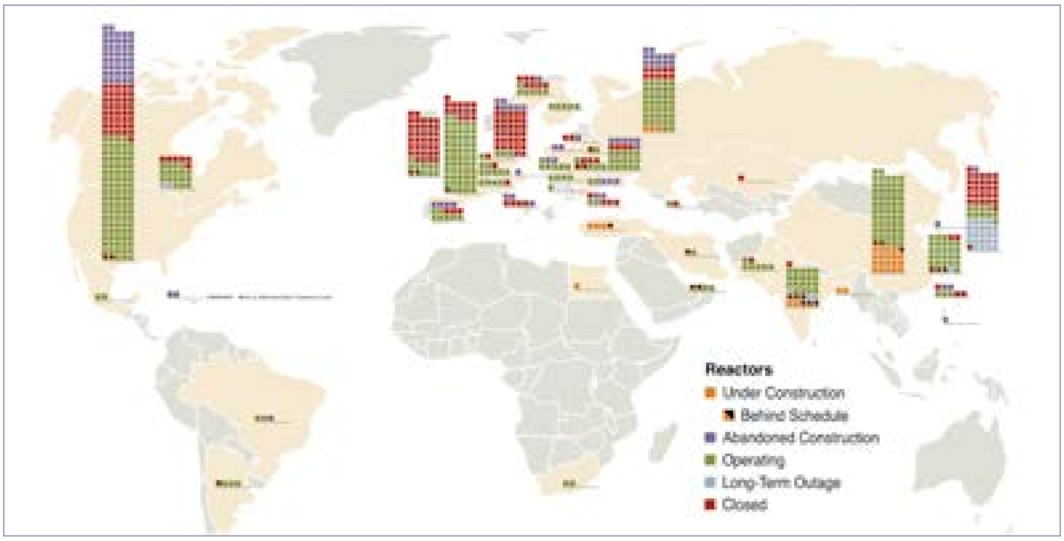


**Figure 3.9.** Status of nuclear reactors around the world

Source: World Nuclear Industry Status Report and Visionscarto, 'World nuclear power reactors 1951–2021—The WNISR interactive dataviz', 22 Apr. 2021.

cost overruns,[447] or are closing them early due to public concerns, particularly in the wake of the Fukushima disaster.[448]

Recently, there has been a revitalization of nuclear efforts due to climate change. This is mostly being driven by GEN-IV reactors that are alleged to be safer, with modular designs that mean they can rapidly be made operational.[449] Many of these are still in the design phase,[450] however, and face years of regulatory approval before coming online—estimates range from 7 to 10 years assuming no major problems arise.[451] The race to diversify from Russian fossil fuels in the wake of its invasion of Ukraine has generated renewed interest in nuclear power options, but many of the fundamental challenges remain.

### *3.3.8.2. Environmental and health concerns*

Similar to critical minerals (section 3.3.6), the environmental damage from mining and processing uranium has provoked great concern among communities and policymakers. Studies have revealed cases of leakage into groundwater,[452] waste heaps emitting above-background levels of radiation,[453] and land degradation.[454] 'Once-through' cooled reactors can also have deleterious effects on aquatic ecosystems. These systems pull water from rivers, lakes or the ocean, pump it through to cool the reactor, then discharge the effluent, which is up to 14 °C hotter.[455] Warmer waterways can also act as a catalyst to other harmful chemicals that may have been discharged.[456]

Additionally, as the climate warms in certain regions, water bodies heat up, leading to once-through cooled reactors facing three potential operational problems. Firstly, the water has a reduced capacity to cool the reactor, resulting in reactor shutdowns, as occurred in Germany and France in 2019 and 2022.[457] Secondly, the water discharge may result in the river becoming warmer than environmental legislation permits, forcing the reactor to shut down to prevent this.[458] Finally, prolonged and worsening droughts and increasing water temperatures may mean there is insufficient (cool) water to run through the cooling system.[459]

### *3.3.8.3. Direct security threats*

There are four direct threats to security that lie at the heart of concerns about nuclear power playing a central role in addressing climate change and transitioning away from fossil fuels: *(a)* nuclear weapon proliferation; *(b)* maintaining physical and operational security in conflict zones; *(c)* cyber-attacks on nuclear facilities; and *(d)* misuse of nuclear fuel and waste.

The uranium enrichment process is the same for energy generation as for producing weapons.[460] This dual-use potential has created opposition to expanding the number of nuclear states regardless of whether energy generation is the stated objective. The Nuclear Non-Proliferation Treaty could, however, be amended to aid new civilian nuclear programmes without undercutting its strong norms against nuclear weapons proliferation.[461] One such amendment would involve altering Articles 1 and 4 to prevent the proliferation of enrichment technology and instead enable the distribution of nuclear fuel, which would limit fears of weapons proliferation.[462]

Pursuing nuclear weapons under the guise of a civilian nuclear programme is rare, and as such the proliferation risk is relatively low.[463] The international governance framework upheld by the International Atomic Energy Agency (IAEA) helps lower this risk, while some have noted that proliferation risks could also be mitigated through modern reactor designs.[464]

Russia's recent invasion of Ukraine has raised the prospect of direct threats from nuclear energy facilities in active conflict zones. Three key concerns have emerged from this conflict: *(a)* physical damage as a result of munitions hitting a reactor; *(b)* the operational functioning and continued supply of electricity (e,g. Zaporizhzhya plant); and *(c)* the monitoring of actively radioactive sites (Chernobyl).[465]

Cyber-warfare is a rising concern vis-à-vis nuclear energy (as well as other energy infrastructure). To date, while cyber-attacks have not caused any meltdowns, the capability to take control of nuclear facilities has been demonstrated. Known attacks include a Russian government attack on European and American reactors (2018),[466] and a North Korean-backed attack on an Indian reactor (2019).[467] In addition, the USA and Israel successfully conducted a cyber-attack against Iran's nuclear centrifuges in 2011, sabotaging their enrichment capabilities.[468] More recently, in 2021, Israel acted unilaterally in cyber-attacking the same facility.[469] National regulators and the IAEA have developed guidelines for reactor operators in order to better protect their facilities against cyber-attacks. Even so, non-nuclear-related but significant cyber attacks in 2020 and 2021 on critical infrastructure (e.g. water supply in Florida,[470] US Colonial Pipeline[471] and SolarWinds[472]) illustrate the importance of securing all elements used in the supply chain.[473]

Finally, the transportation and storage of nuclear fuel and waste carries particular risks, foremost of which is the threat of nuclear material being stolen—most likely by organized crime or terrorist groups—while being transported.[474] A major fear is the creation of a 'dirty bomb' (radiation dispersal device, RDD) from radioactive waste. The radioactive threat of an RDD is, however, highly contested,[475] with some experts arguing that[476] the consequences of a 'dirty bomb' attack would primarily be economic, social and psychological, given that local, state and federal governments would have to undertake a lengthy and expensive clean-up, following which civilians may continue to shun areas they regard as contaminated.

Many experts do not believe that any criminal or terrorist organization possesses the capabilities or infrastructure necessary to produce a nuclear weapon, meaning the theft of a weapon or direct transfer from a nation state is more likely.[477] These high-risk, low or unknown probability scenarios suggest a 'precautionary approach' that leans towards reducing these traditional security risks by drawing back from nuclear power as a climate change response.

### *3.3.8.4. Meltdown*

The ultimate fear surrounding nuclear is the possibility of meltdowns. The meltdown in Chernobyl in Ukraine (then the Soviet Union) resulted in the evacuation of thousands from the immediate region and negatively affected fauna and flora in the surrounding 50 km.[478] Health impacts on humans have been catalogued across the European continent.[479] Similarly, the Fukushima meltdown in Japan prompted an immediate evacuation of the local area.[480] Fortunately, the radiation leak was significantly lower than in Chernobyl, with some experts predicting only a minimal increase in the incidence of cancers or adverse health events.[481] However, there will continue be economic costs arising from the inability to utilize the area or to safely dispose of nuclear materials in the facility as well as incalculable social losses suffered by those who had to flee their homes.

### *3.3.8.5. The uncertain future of nuclear power*

Nuclear power remains a divisive response to mitigating carbon emissions from electricity generation. The catastrophes of Chernobyl and Fukushima have stymied development in the Global North, meaning that globally it is essentially only China and the Middle East that are planning new reactors (although recently some Global North countries, such as the UK, have suggested opening new reactors).[482] While nuclear accidents are rare, the range of scenarios should one occur are nothing short of catastrophic, and despite advocates arguing that modern GEN-IV can deliver cheaper, modular and safer reactors, this approach remains to be realized. Thus, policymakers must ensure active engagement with affected communities and weigh the costs of this energy source against its benefits.

Arguably the greatest roadblock to a nuclear renaissance is its expense (which has increased in the past decade) and long timelines. Given that the science has made clear GHG emissions must be reduced immediately, the

10–15-year lead time for nuclear reactors makes them a less attractive option compared to alternatives.

The pursuit of nuclear power and further research into modern reactors is likely to continue despite the ramping up of wind and solar power sources. Existing reactors, concentrated in a handful of countries, will likely play a role in reducing the demand for fossil fuel generators.

# 3.4. The conflict risk of adapting to climate change

## 3.4.1. Climate adaptation and the risk of maladaptation

### *3.4.1.1. Transforming social vulnerability to climate impacts*

Climate change adaptation (hereafter adaptation) is one of the two principal policy responses to climate change (the other being mitigation, see section 3.3). Given the significant changes to the Earth's climate, adaptation has become imperative to addressing compounding climate-related risks.

Adaptation can be defined as the adjustment of human systems, individuals and societies for the purposes of reducing their vulnerability to the adverse effects of climate change.[483] Although historically mitigation has received more policy attention and resources than adaptation, the two must go hand-in-hand 'to ensure that human societies can progress despite climate change'.[484] The aim of adaptation should not be about protecting or preserving the status quo—rather, it should involve a process of social change that fundamentally transforms the attributes of social systems and structures.[485]

Despite the urgent need for adaptation in managing a range of climate-related risks,[486] its outcomes are not always positive. The adverse effects of adaptation, largely discussed as 'maladaptation', risk generating greater vulnerability for some populations even in cases where other segments benefit from interventions. Moreover, poorly implemented adaptation efforts can aggravate conflict dynamics as well as negatively impact conflict resolution and peacebuilding efforts. These impacts can occur at the local or national level and may even spill across national boundaries.

While awareness of maladaptation risks is growing among the organizations funding, designing and implementing interventions, the conflict risk dimension of maladaptation remains largely overlooked. Understanding how adaptation interventions interact with conflict dynamics is essential to implementing interventions that carry fewer (preferably no) risks and contribute to an 'environment of peace'.

### *3.4.1.2. The need for adaptation*

People, and the institutions and organizations they form, need to adapt because they are vulnerable to the impacts of climate change—without adaptation, these vulnerabilities will further expose them to compounding risks as climate change worsens.

Social context is critical to understanding how different populations experience physical exposure to drought, rainfall, extreme temperatures, sea-level rise and other expressions of climate change.[487] Vulnerability to climate change impacts is not equal for all those living in a particular area, but rather, through a range of inequalities, it clusters around already disadvantaged populations.[488]

Vulnerability assessments must therefore move away from only evaluating physical exposure to a climate hazard (e.g. temperature impact on crop yield) and take into account the socio-economic factors and power relations (e.g. why are people growing this particular crop, why in this location, what other options do they have, why are their options limited?) crucial to understanding the drivers of vulnerability. Pre-existing factors such as gender inequality or political, social, economic or cultural marginalization can co-create climate-related insecurities, and so have a crucial role to play in informing adaptation responses.[489]

#### *3.4.1.3. Adaptation in practice*

Adaptation incorporates an array of practices and policies that may or may not be applicable to a particular context.[490] Moreover, adaptation is embedded within a complex network of socio-environmental interactions across location and scale, and so will look very different depending on whether the observer is an individual, family, social group, region, state or multinational organization. Adaptation can range from technical/infrastructural interventions (e.g. construction of sea walls, dams, levee banks, dikes or flood channels; changes in farm-level irrigation) to institutional or managerial adjustments (e.g. alternations in natural resource management, governance and legal frameworks; changed building standards; climate risk insurance), to behavioural change (e.g. in values or attitudes).[491] Research increasingly suggests that social, economic and political reforms need greater attention rather than the physical or infrastructural solutions that have been the focus of many adaptation efforts to date.[492]

Adaptation was intentionally downplayed in early efforts to address climate change, as advocates for emission reductions were concerned it might weaken the political will for tackling GHG emissions through mitigation. Some worried that adapting to climate impacts was essentially ‘giving up’ on curbing climate change.[493] Since the early 2000s, however, policymakers and practitioners have increasingly recognized the need for immediate responses to observed impacts, with adaptation guiding a variety of policy initiatives aimed at ensuring sustainable development, reducing vulnerability and minimizing risks to humans from climate change.[494]

Over the past 15 years governments around the world have been developing adaptation policies, plans and programmes.[495] Aid organizations, meanwhile, have been funding and carrying out adaptation interventions

**Table 3.1.** Total bilateral and multilateral development finance targeting adaptation spent in 13 selected fragile and conflict-affected states in 2013–2018 (in order of amount received)

| Country | Amount | Top five donors (largest to smallest) |
|---|---|---|
| Iraq | $288 million | International Bank for Reconstruction and Development, IFAD, AF, Germany, Italy |
| Afghanistan | $178 million | USA, UK, Japan, Netherlands, EU institutions (excl. EIB) |
| Mali | $176 million | Germany, USA, Sweden, Norway, Netherlands |
| DRC | $151 million | USA, Japan, CIF, EU institutions, GEF |
| Myanmar | $121 million | Poland, Japan, Germany, EU institutions, AF |
| South Sudan | $103 million | UK, USA, Germany, Norway, Switzerland |
| Somalia | $81.2 million | EU institutions, Denmark, Germany, Australia, Sweden |
| Niger | $80.4 million | France, CIF, Germany, Norway, Spain |
| Chad | $51.2 million | Switzerland, EU institutions, France, Germany, GEF |
| Sudan | $27.2 million | UK, Canada, Sweden, Ireland, GEF |
| Yemen | $10.5 million | US, GEF, Japan, Germany, EU institutions |
| CAR | $1.77 million | GEF, EU institutions (excl. EIB), France, n/a |
| Libya | $636 519 | No data |

AF = Adaptation Fund; CAR= Central African Republic; CIF = Climate Investment Funds; DRC = Democratic Republic of the Congo; EIB = European Investment Bank; EU = European Union; GEF = Global Environmental Facility; IFAD = International Fund for Agricultural Development.

Source: Compiled from Stockholm Environment Institute, 'Aid Atlas', search settings 'All donors to [country] for climate adaptation disbursed during 2013–2018'. Figures relate to overseas development aid commitments that have adaptation objectives (they can also relate to other objectives, such as biodiversity conservation or gender equality).

through bilateral and multilateral funding streams, including in fragile and conflict-affected states (see table 3.1). Despite important progress, however, adaptation planning, finance and implementation are still in their infancy, and the scope of current initiatives remains limited.[496] The annual costs of adaptation in developing countries alone is estimated to increase to $140–300 billion by 2030 and $280–500 billion by 2050.[497] Between 2014 and 2018 total development finance targeting adaptation reported to the OECD's Development Assistance Committee (OECD DAC) was $15.3 billion, compared to $38 billion for mitigation.[498] While the Green Climate Fund, established within the framework of the UNFCCC, has committed to splitting its funding equally between adaptation and mitigation projects, so far 62 per cent of funding has been allocated to mitigation projects, against only 38 per cent for adaptation.[499] There are also concerns that the economic fallout from the Covid-19 pandemic will limit further investment in adaptation.[500]

#### *3.4.1.4. Maladaptation and inequitable outcomes*

While adaptation is urgently needed, it is not automatically or universally beneficial. The concept of 'maladaptation'[501] describes a situation where an intervention generates adverse social, political, economic or ecological outcomes, either immediately or sometime in the future.[502] This maladaptation can result in vulnerability to climate impacts increasing for some people. This dynamic was present in a Cambodian adaptation project intended to increase food security, boost livelihoods and promote biodiversity in areas affected by increasing drought.[503] Designed in a top–down fashion at multilateral and national government levels, the project failed to adequately account for local ecological and socio-political context and history. An independent evaluation conducted several years after the project's completion found that rather than making local communities more resilient, the project exacerbated hierarchical and oppressive power relations and land tenure arrangements, thereby increasing communities' dependence on the government. It also intensified pressure on local ecosystems and even prompted migration out of the area. Evaluators concluded that the reinforced dependency of local populations on state institutions could create fertile ground for conflict.[504]

Recent studies suggest that maladaptive outcomes are more common than might be expected.[505] In particular, they interact with vulnerability in three key ways: *(a)* vulnerability may be reinforced; *(b)* vulnerability may be redistributed to other people or groups; and *(c)* vulnerability may be newly created as a result of adaptation interventions.[506]

#### *3.4.1.5. Causes of maladaptation*

Maladaptation is often the outcome of poorly designed or managed interventions (see box 3.3). However, maladaptation can go beyond unintended negative consequences in cases where those in power use interventions to marginalize or reinforce inequities among groups. In Bangladesh, for example, adaptation projects including coastal afforestation, water management and disaster preparedness went hand-in-hand with land-grabbing by rural and urban elites. Social inequalities worsened as a result of increased deforestation, local community disempowerment and the reinforcement of chronic poverty.[507]

Maladaptation and successful adaptation are not mutually exclusive—what may be maladaptive for some people can be adaptive for others, and while some aspects of a particular intervention may fail, others may be successful (see box 3.4).[508] Given an adaptation–maladaptation continuum,[509] the question to ask becomes one of *how* and *to what extent* an intervention is effective/maladaptive in specific times, locales and for specific groups, rather than simply *whether* it is successful.[510]

Often, maladaptive outcomes affect the social groups that are already vulnerable to climate change,[511] with existing power dynamics reproduced through adaptation interventions.[512] In contexts where decision makers benefit from the status quo, there is a serious risk of deliberate or inadvertent elite capture and manipulation.[513] For example, interventions that benefit sedentary farmers or support specific agricultural practices disproportionally benefit those with land, but not nomadic herders.[514] Such interventions frequently fail to consider, let alone alter, the social and political dynamics that produced vulnerability patterns in the first place.[515] These beneficiary gaps

## BOX 3.3. FOUR MECHANISMS THROUGH WHICH MALADAPTATION CAN EMERGE

Four mechanisms that commonly generate maladaptation emerge from a review of adaptation projects:

- *Shallow understanding of what drives vulnerability*. Most vulnerability assessments ahead of an adaptation intervention focus on adjusting to adverse climate impacts rather than considering the wider socio-political factors and marginalization processes that render people vulnerable in the first place. These factors include gender, race, age, (dis)ability and class. Assessments adopt a climate impact focus rather than a social vulnerability focus that assesses the drivers of unequal vulnerability.[a]
- *Inequitable participation of vulnerable and affected populations in adaptation design and implementation*. Most participatory processes, even at a community level, are superficial exercises that fail to ensure the meaningful participation and engagement of marginalized groups.
- *Rebranding adaptation into existing development interventions*. Rather than developing novel adaptation interventions, existing development projects are 'rebranded' as adaptation efforts and adaptation interventions 'retrofitted' into existing development agendas. The resulting interventions fail to address the root causes of vulnerability or related socio-political relations that produce vulnerability.[b]
- *Insufficient engagement with what 'adaptation success' looks like*. Ideas of adaptation success are normative, contextual and socially contingent. They are more often driven by the politics of funding and prevailing development discourses than local participation.

[a] Eriksen, S. et al., 'Adaptation interventions and their effect on vulnerability in developing countries: Help, hindrance or irrelevance?', *World Development,* vol. 141 (1 May 2021), p. 6.

[b] Eriksen (note a).

are particularly problematic in fragile and conflict-affected contexts, where an intervention may unwittingly factor into conflict dynamics.

Sometimes, maladaptation is the result of unintended side effects. It is not possible to avoid unknown consequences and externalities (the 'unknown unknowns'). Yet, in order to minimize maladaptive outcomes, including conflict risks, interventions must be planned with the meaningful engagement of a broad range of stakeholders. These efforts need to include representatives from affected communities and/or those who have intimate knowledge of the local context (to avoid 'blind spots'), who should be engaged transparently, with free and prior informed consent (to avoid 'deliberate obfuscation').[516]

### *3.4.1.6. Conflict risk as a specific type of maladaptation*

Adaptation can create unequal outcomes, new insecurities and additional vulnerabilities.[517] As such, maladaptation can influence the risk of conflict. In Peru, for example, technical adjustments made under the auspices of adaptation to the water supply of a dam led to water shortages and in turn social conflicts where conflict dynamics were already present related to the privatization of water and management failures.[518] As this experience illustrates, adaptation is not usually a direct contributor to conflict but instead may contribute indirectly to an already insecure or fragile situation.

## BOX 3.4. WHO KNOWS ABOUT THE POTENTIAL FOR MALADAPTATION?

Maladaptation can be categorized based on whether the adverse consequences were anticipated and who possesses this information. There are four possible maladaptation outcomes:[a]

- *'Known knowns'* are known to both the intervention planners and more widely (i.e. all parties involved), but the intervention is undertaken regardless.
- *'Blind spots'* are not known to the intervention planners, but they are known to others outside the circle of planners, based on previous experiences, research or traditional knowledge/local experience.
- *'Unknown unknowns'* are not known by any of the people involved.
- *'Deliberate obfuscations'* are known to the intervention planners but not to others

[a] Glover, L. and Granberg, M., 'The politics of maladaptation', *Climate,* vol. 9, no. 5 (May 2021).

Rather than merely creating or entrenching insecurities at the individual level, conflict risk as a type of maladaptation represents an adverse outcome that affects societal stability more broadly.[519] It is important to consider this conflict dimension, as adaptation is not limited to peaceful settings, and may be required in societies that are conflict-affected or fragile.[520]

The conflict risk of maladaptation is not the same everywhere, with a country's conflict history one of the most important predictors of future conflict.[521] Hence, the potential impact of adaptation interventions on conflict dynamics are of greatest concern in settings with a history of conflict—areas where there are existing tensions between communities, where political instability is in evidence or where migrants or refugees have settled stand out as meriting additional attention. In such instances, those planning and implementing adaptation interventions must take particular care in assessing existing conflict dynamics and socio-political tensions.[522] Too often, however, such care in assessment did not occur. In the Lake Chad Basin riparian zones of Cameroon, Chad, Niger and Nigeria, for example, the majority of adaptation approaches related to water and agriculture had failed to take account of existing conflict challenges.[523]

### 3.4.2. How does adaptation interact with insecurity and conflict?

Conflict, insecurity and adaptation can interact in multiple directions, from adaptation to conflict and from conflict to adaptation, in ways that may have negative and/or positive impacts (see table 3.2).

#### *3.4.2.1. Adaptation can impact conflict dynamics*

Adaptation can impact conflict dynamics positively or negatively. When adaptation impacts conflict in negative ways (table 3.2, column 1), interventions can exacerbate existing vulnerabilities, which may increase conflict risks. These risks are particularly relevant to fragile and conflict-affected regions, where adaptation may be perceived as being unjust,

## Table 3.2. Possible interactions between adaptation and conflict

| Adaptation to conflict | | Conflict to adaptation | |
|---|---|---|---|
| Negative impact | Positive impact | Negative impact | Positive impact |
| Maladaptation can exacerbate vulnerabilities, which can increase conflict risks | If done successfully, adaptation can contribute to sustainable peace | Conflict can (*a*) be an underlying driver of vulnerability; (*b*) undermine people's ability to adapt; (*c*) disrupt adaptation efforts; and (*d*) undermine adaptation gains | Conflict can make adaptation more sustainable if it helps overcome structural violence and injustices at the source of vulnerability |

generating further economic hardship for some people.[524] The intersection of land rights, livelihoods and marginalization provides fertile ground for conflict, especially if interventions exacerbate existing grievances.[525] In the Bangladesh example mentioned previously, exclusionary forms of adaptation planning led to rural and urban elites engaging in land capture and encroachment on public goods, creating further inequalities and in turn further insecurity.[526] Adaptation interventions that impact access to land and water use, or public space, also appear to increase the potential for conflict risk. In Ethiopia, for example, agricultural and infrastructural adaptation resulted in contradictory outcomes, including implications for 'water security, temporal aspects of livelihood security, personal and state security, and scales of economic security'.[527]

Adaptation impacts may not only worsen insecurity and conflict, they can also hinder ongoing peacebuilding efforts. This dynamic can be seen in rural hydropower development in Afghanistan. Designed to address both mitigation and adaptation, the climate development project sought to provide electricity for Herat, contribute to the decarbonization of energy production and advance reliable irrigation schemes for local farmers in an arid area.[528] Despite being intended to build resilience, these upstream adaptation efforts created additional obstacles to successful peacebuilding by adversely affecting downstream communities, providing an additional source of conflict.

Conversely, when adaptation impacts conflict in positive ways (table 3.2, column 2), interventions offer a tool for building stability and preventing conflict, for example under the umbrella of 'environmental peacebuilding' (see part 4 of this report).[529] While evidence remains anecdotal, some have suggested that 'peacebuilding and adaptation are effectively the same kind of activity, involving the same kinds of methods of dialogue and social engagement, requiring from governments the same values of inclusivity and transparency'.[530] When well-planned and implemented, adaptation interventions can provide entry points for improving understanding and cooperation, thereby reducing hostilities between communities and helping 'build trust between citizens and their governments'.[531] An agricultural development project in conflict-affected Guatemala, for example, used community-level adaptation interventions within small-scale farming systems to reduce long-running social, economic and political divisions between neighbouring communities and transform resource competition.[532]

### 3.4.2.2. Conflict dynamics can impact adaptation

Flipping the lens, conflict dynamics can also impact adaptation positively or negatively. When conflict impacts adaptation in negative ways (table 3.2, column 3), it can make people more vulnerable to different sources of stress, including the impacts of climate change (thereby increasing the need for adaptation).[533] Populations experiencing or recovering from conflict are often particularly vulnerable, as they have limited means for coping, let alone adapting.[534] In Gaza, for example, conflict-related non-climatic risks largely overwhelm local communities' capacities to respond to forecasted climate risks. Thus, proactive, forward-looking adaptation in Gaza is 'inconceivable in the current context'.[535]

Some propose that vulnerability to climate change and fragility are in fact two sides of the same coin, with the same dimensions that contribute to fragility—violence; lack of access to justice; an absence of accountable and inclusive institutions; lack of economic inclusion and stability; and insufficient capacities to prevent or adapt to shocks and disasters—also hampering the ability of communities to cope and adapt to the effects of climate change.[536]

In addition to undermining individual and community attempts to adapt,[537] conflict diminishes a government's capacity to deliver public services and so undercuts opportunities for adaptation and development.[538] Active conflicts can also prevent adaptation from taking place or disrupt adaptation initiatives, whether directly or indirectly. Anecdotal evidence from Mali suggests that 'conflict put a stop to ongoing and planned adaptation activities being carried out by UNDP' and other organizations.[539]

In terms of the positive impacts of conflict on adaptation (table 3.2, column 4), conflict that addresses underlying inequalities can result in opportunities for adaptation to be more just and sustainable. Conflict itself can have positive ultimate outcomes, especially where struggles address ongoing structural violence against landless, Indigenous peoples or other marginalized groups.[540] Conflict can also be transformative, leading to more just adaptive governance when organized against local elites and an unjust status quo.[541] Being conflict sensitive (see next section) does not automatically imply a need to avoid upsetting dominant groups, as breaking with structural violence and oppression can be a legitimate struggle.[542]

### 3.4.2.3. Conflict-sensitive adaptation

Adaptation can be planned in ways that avoid increasing conflict risks.[543] This prevention approach requires carefully analysing existing conflict dynamics and evaluating how a proposed intervention will affect all parties.[544]

Levels of ambition vary in terms of how adaptation interventions seek to tackle insecurity and conflict dynamics. Following the 'do no harm' principle, interventions may simply aim not to exacerbate existing conflicts or

| | Negative adaptation outcomes/ maladaptation | | Ineffective adaptation | Positive adaptation outcomes/ effective adaptation | |
|---|---|---|---|---|---|
| Interaction with (in)security | Contributing to conflict risk | ← | → | → | Contributing to peace |
| Outcomes | Increased insecurity/ conflict, undermining peacebuilding progress as a result of the intervention. | Target population or others experience higher vulnerability to climate change than before the intervention. | Intervention's positive or negative impact is negligible. | Vulnerability to climate change is addressed and no harm is done (minimum ambition). | Increased security and cooperation as a result of the intervention (maximum ambition). |
| Explanation | In addition to worsening vulnerability, interventions negatively impact existing tensions or create new ones. | Intervention worsens vulnerability to climate change. | Intervention makes no difference. | Intervention reduces vulnerability. | In addition to reducing vulnerability, intervention prevents or minimizes the risk of destabilization and conflict. |
| Evidence | Some documented empirical examples, though few discuss violent conflict or conflict at higher scales. Need for further studies. | Growing evidence that this is a common outcome.[a] | No data. | No data due to lack of independent monitoring and evaluation of adaptation. Need for further studies. | Limited documented empirical examples—mostly anecdotal evidence. Need for further studies. |

**Figure 3.10.** Spectrum of adaptation interventions contributing to conflict risk through to peace

[a] Eriksen, S. et al., 'Adaptation interventions and their effect on vulnerability in developing countries: Help, hindrance or irrelevance?', *World Development*, vol. 141 (1 May 2021), p. 12.

Source: Adopted and expanded from Schipper, E. L. F., 'Maladaptation: When adaptation to climate change goes very wrong', *One Earth*, vol. 3, no. 4 (Oct. 2020), figure 2.

trigger new ones (the minimum ambition). Here, an intervention is explicitly planned in ways that mean its outcomes are unlikely to aggravate known grievances. Alternatively, interventions can attempt to contribute positively to peace by addressing the causes of conflict, preventing further conflict and building a sustainable peace (the maximum ambition).[545] Adaptations that help clarify land rights and tenure at the local level, or include dispute resolution processes, are examples of interventions that can advance peace. Some suggest there may be synergies between, on the one hand, building community resilience and adaptive capacity to the impacts of climate change, and, on the other, strengthening such capabilities in relation to conflict.[546]

#### *3.4.2.4. Capturing adaptation–conflict interactions*

The possible dynamics between adaptation interventions, maladaptation, peace and conflict can be visualized as existing across a spectrum. Summarized in figure 3.10, this spectrum includes *maladaptive* initiatives on the left-hand side (red shading), where the intervention increases vulnerability to climate change and, in the worst case (furthest to the left), contributes to insecurity and conflict. In the centre of the spectrum sit *ineffective adaptation* initiatives (blue shading), where the intervention has negligible positive or negative impacts. On the right-hand side of the spectrum are *effective adaptation* interventions (green shading), ideally (furthest right) contributing to peace and security. This complements table 3.2 by delving further into the interaction between adaptation and conflict (columns 1 and 2).

Just as adaptation practice is still in its infancy,[547] so too is documented evidence on the long-term outcomes of adaptation interventions for peace and security. Despite these limitations, initial experiences suggest a need to focus on the conflict risk of maladaptation when planning adaptation interventions.

### 3.4.3. Implications for policy and planning

Adaptation is urgently needed in the face of current and future climate change impacts. Even so, depicting adaptation in overly optimistic terms without planning for potential connections to conflict obscures potential security risks. Moreover, if communities perceive interventions to be exacerbating rather than addressing existing vulnerabilities and inequalities, this may undercut support for climate adaptation. Few adaptation interventions are truly ‘win–win’, as there are always trade-offs involved. Given this ongoing challenge, adaptation intervention planners must take care to minimize maladaptive outcomes that may turn into conflict risks.

Conflict-sensitive adaptation is particularly important in fragile and conflict-affected areas that already receive significant amounts of development finance. Given the potential of adaptation to contribute to new disputes, however, all interventions should ideally be conflict sensitive. The lack of conflict sensitivity in adaptation planning is particularly problematic in regions that are heavily affected by climate change and variability but not (yet) considered conflict-affected or fragile.[548] In such contexts, those implementing adaptation interventions are often not utilizing conflict-sensitive analysis to consider the social tensions that may arise.[549]

#### *3.4.3.1. What to avoid*

There is no universal way in which adaptation and conflict interact across localities or among populations.[550] Even so, some common themes emerge to suggest certain maladaptive outcomes and types of intervention carry greater conflict risk than others. Interventions that hold the potential for specific maladaptive outcomes should be particularly carefully assessed for security risks. These are interventions that *(a)* are built on unequal

## BOX 3.5. PRECAUTIONS FOR AVOIDING MALADAPTATION AND CONFLICT RISK FROM ADAPTATION INTERVENTIONS

- *Recognize that uneven power relations and social inequalities are often the root cause of vulnerability and incorporate social and political analysis* into vulnerability assessments (e.g. political economy analysis).[a] Any effective intervention must contend with uneven power relations and the drivers of unequal vulnerability.
- *Be aware of existing conflict dynamics and perceptions of grievances.* In fragile or conflict-affected contexts especially, vulnerability assessments should be *supplemented with conflict analysis* in order to identify current conflict factors, social dividers and connectors, and sources of tension.[b] Conflict analysis and social political analysis must be integrated with the assessment of projected climate impacts ahead of an adaptation intervention.
- *Ensure immediately affected populations can meaningfully participate in the design, planning and implementation of interventions*, following the principle of subsidiarity (issues should be addressed at the most immediate or local level consistent with their resolution).[c]
- *Assess potential maladaptive outcomes* in the design phase of an intervention, *paying particular attention to the distributional effects of adaptation opportunities, benefits and costs.*[d] Assess whether an intervention is likely to entrench or redress social inequalities, and what the implications for justice and equity may be.[e] Interventions with the potential to generate further economic hardship for those already politically, socially, economically or culturally disadvantaged should be avoided (the minimum ambition of conflict-sensitive adaptation).[f]
- In fragile and conflict-affected contexts, *make conflict sensitivity a key criterion*—along with effectiveness, feasibility and cost—when assessing the appropriateness of an adaptation intervention.[g] Having a clear picture of how an intervention might affect conflict dynamics is critical.
- *Acknowledge that adaptation interventions involve trade-offs between different groups, values and priorities, and take care that interventions and their outcomes are not regarded as unfair.*[h] Meaningful participation (see point 1 above and box 3.4) will help in avoiding perceptions that an intervention is illegitimate or unjust, with the IPCC suggesting 'place-specific trade-off deliberations' to ensure trade-offs are socially acceptable.[i]
- *Embed consideration of maladaptive conflict risk in the monitoring and evaluation (M&E) of adaptation interventions.* In fragile and conflict-affected areas especially, there is little evidence about adaptation effectiveness and success.[j] M&E should be undertaken during a project to detect early signs of adverse unintended outcomes; shortly after its completion; and later still in order to assess any long-term effects on conflict.

[a] van Schaik, L. et al., *Making Peace with Climate Adaptation* (Global Centre on Adaptation and Clingendael: Rotterdam, 2019), p. 16ff.

[b] Habib, M. A., *Evaluation of Swedish Climate Change Initiative 2009–2012: Adaptation Fund Cambodia Case Study*, EBA Substudy 6 (Expertgruppen för biståndsanalys (EBA): Stockholm, 2020), p. 33; Mason, M., 'Climate insecurity in (post)conflict areas: the biopolitics of United Nations vulnerability assessments', *Geopolitics*, vol. 19, no. 4 (Oct. 2, 2014); and Tänzler, D. and Scherer, N., *Guidelines for Conflict-Sensitive Adaptation to Climate Change* (Umweltbundesamt: Dessau-Roßlau, Sep. 6, 2019).

[c] Sitati, A. et al., 'Climate change adaptation in conflict-affected countries: A systematic assessment of evidence', *Discover Sustainability*, vol. 2, no. 1 (Dec. 2021).

[d] Mohamed-Katerere, J. C., 'Human rights: An opportunity for making adaptation conflict-sensitive', eds. U. Bob and S. Bronkhorst, *Conflict-Sensitive Adaptation to Climate Change in Africa* (Berliner Wissenschafts-Verlag (BWV): Berlin, 2014).

[e] Schlosberg, D., 'Climate Justice and Capabilities: A Framework for Adaptation Policy', *Ethics & International Affairs*, vol. 26, no. 4 (2012); and Shi, L. et al., 'Roadmap towards justice in urban climate adaptation research', *Nature Climate Change*, vol. 6, no. 2 (Feb. 2016).

[f] Sayne, A., *Climate Change Adaptation and Conflict in Nigeria*, Special Report 274 (United States Institute of Peace: Washington, DC, June 2011).

[g] Sayne, A (note f).

[h] van Schaik et al. (note a), p. 13; and Sovacool, B. K., 'Bamboo beating bandits: conflict, inequality, and vulnerability in the political ecology of climate change adaptation in Bangladesh', *World Development*, vol. 102 (Feb. 2018).

[i] IPCC, 'Chapter 5: Sustainable Development, Poverty Eradication and Reducing Inequalities', *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* (Cambridge University Press: Cambridge, 2018), p. 459.

[j] Sitati et al. (note c).

participation, exclusionary processes and/or create unequal benefits and burdens (i.e. winners and losers);[551] *(b)* ignore existing land or other natural resource conflicts;[552] *(c)* impact pre-existing local grievances against the state or other groups;[553] *(d)* worsen political fissures or impact negatively on social cohesion;[554] *(e)* exacerbate exclusion of specific communities or contribute to patterns of social, political and economic marginalization;[555] and/or *(f)* negatively impact livelihoods or change resource access for certain groups.[556]

The *type* of adaptation intervention matters when it comes to the degree of conflict risk. While certain interventions do not *necessarily* lead to insecurity or increased conflict, they carry a higher risk of fuelling existing or generating new grievances. These include interventions that *(a)* impact on land and land use (e.g. altering or privatizing access to forests, water, land or other resources, including food);[557] *(b)* focus on infrastructure projects (specifically dams and irrigation);[558] *(c)* force people to migrate or move;[559] and/or *(d)* prioritize central priorities over local ones (e.g. urban over rural, metropolitan over peripheral, national over local) and externalize benefits (e.g. for tourism and natural resource markets).[560]

### 3.4.3.2. What to strive for?

To avoid maladaptation in general and conflict risks in particular, adaptation should be planned in ways that address not only the impacts of climate change but also the root causes of vulnerability. Sensitivity to the local context and broader political and power dynamics is essential (see box 3.5).[561] There are concrete ways to minimize conflict risk from adaptation. Some types of interventions carry less conflict risk, thereby meeting the minimum ambition of doing no harm, while some may even help prevent potential conflict, thereby contributing to peace. In both instances, initiatives that focus on reducing underlying causes of vulnerability and building adaptive capacity should be the focus. Going beyond addressing physical climate impacts means working to improve access to education, raising awareness about climate change, improving public health care, addressing gender norms, and reducing political, ethnic and economic marginalization.[562] Notably, such interventions overlap with more 'traditional' development approaches (but are explicitly both climate *and* conflict sensitive). Emerging experiences also suggest that ecosystem-based approaches, which include the sustainable management, conservation and restoration of ecosystems as part of an overall adaptation strategy, are promising.[563]

### 3.4.4. Adaptation conclusions

Policy, practice and research on adaptation often unquestioningly asserts that initiatives reduce vulnerability to climate change. Despite this assumed record of success, growing evidence suggests significant potential for maladaptation and unequal outcomes.[564] In some contexts, especially fragile and conflict-affected settings, these dynamics can result in new security challenges, including the risk of conflict.

Adaptation interventions should not be abandoned simply because maladaptation dynamics are common. Indeed, adaptation efforts remain critical to the wellbeing of societies in the long run. The conflict risks of maladaptation are not inevitable. Greater attention to minimizing these risks up front (see box 3.4 and box 3.5) requires a broad approach to vulnerability that encompasses social justice and power dynamics rather than being limited to climate impacts.

## 3.5. Fossil fuel phase-out: Geopolitical and local transitions

### 3.5.1. The energy transition needs to be rapid

Historically, energy system transformations have taken decades, even centuries, to achieve.[565] The implications of such transformations are wide-ranging, shaping how societies function and countries behave. If we are to decarbonize our current energy system by 2050 to head off the worst of climate impacts, it will require one of the quickest transformations in human history.[566] Despite many headwinds impeding transitions, modern supply chains and global integration can enable the transfer of skills and hardware needed to decarbonize the global economy swiftly. Even so, transitions must be carefully managed if international, regional and local peace and security is to be maintained.

Fossil fuels have been the backbone of energy security for most economies since World War II, powering economic development.[567] For some countries, fossil fuel extraction and sales dominate their economies. While the level of pushback displayed by these fossil fuel extracting countries (FFECs, sometimes referred to as petrostates) varies, steps taken against decarbonization must be incorporated into any assessment of the conflict challenges associated with moving to a low-carbon economy.

There are differing definitions of what constitutes a petrostate. Recent efforts to understand petrostate aggression define a petrostate as a country where at least 10 per cent of gross domestic product (GDP) is comprised of fossil fuel rents (FFRs).[568] While this threshold acknowledges the significant role played by FFRs in such economies, it notably excludes a number of large economies—such as the USA (the world's largest producer of oil and natural gas)—that are also key sources of fossil fuel extraction.

FFECs and their sub-national constituencies are often viewed as the stakeholders with the most to lose in the current energy transition. Notably, many FFECs' budgets are reliant on FFRs and close partnerships with domestic and international fossil fuel companies. The impacts of decarbonization will be global, local and diverse, with the largest transformations likely to be in FFECs, a shift to alternative extracted materials (see also section 3.3.6), declining government revenues, and an inability to use FFRs to fund a country's development. A variety of public and private actors will need to manage the complex interaction of these factors in order to keep the needed transition on track, ensure a just transition for those affected by the decline of the fossil fuel industry, and mitigate maladaptive behaviour by those opposed to decarbonization.

Actions aimed at slowing or stopping a low-carbon transition can be termed 'petro pushback'. Petrostates and others with significant public and private FFRs may (and in some cases already do) advocate against aggressive climate action in multilateral forums, or alternatively seek geopolitical advantage during the transition. Some states may go further and engage in 'petro-aggression' when governments use their FFRs to fund 'foreign policy aggressiveness' and expand their military capabilities.[569]

Such behaviours are frequently influenced by large fossil fuel companies, both state and non-state, which influence domestic and foreign policies through lobbying. These lobbying efforts impact the positions taken by states at the international climate negotiations (UNFCCC COPs), with diverse economy FFECs supporting petrostates in order to ensure they have adequate supplies of fossil fuels to power their economies.

Beyond geopolitical pushback from petrostates, the many people dependent on the fossil fuel sector for livelihoods presents concerns over how they will experience a transition away from fossil fuels. Often termed a 'just transition', decarbonization needs to minimize harms both to those directly reliant on the sector (e.g. workers) and everyone else affected by the damage inflicted by fossil fuels (e.g. communities and countries).

At present FFECs are not advancing the decarbonization imperative, with recent figures suggesting they plan to produce more than twice the amount of fossil fuels by 2030 than would be consistent with limiting global heating to the 1.5 °C target.[570] This so-called production gap illustrates the global failure to take the action needed to meet the targets agreed to in the 2015 Paris Agreement. The Russian invasion of Ukraine in February 2022 has also led to spikes in oil and natural gas prices and pressure to increase production.

## 3.5.2. Changing geopolitics

The expansion of oil, gas and coal has been the centrepiece of energy security since the mid-20th century It has reshaped both international and national politics.[571] Given that decarbonization threatens many states' geopolitical power and economic status, anticipating geopolitical responses must be part of advancing these transitions. Mapping the historical and current impacts of FFRs will help policymakers plan for these changing dynamics as fossil fuels are phased out.

### *3.5.2.1. Oil and geopolitics*

*Western powers and petro-alliances*

In their pursuit of oil supplies and control, Western powers such as France, the Netherlands, the UK and the USA, while not strictly petrostates due to their diverse economies, have had significant influence on international geopolitics and petrostate behaviour. Geopolitical rivalry over access to and control of oil supplies and hydrocarbons characterized many international conflicts in the 20th century[572] and has led many Western powers to forge alliances with petrostates in order to ensure steady oil supplies with which to maintain their industrialized economies and high-tech militaries.[573]

These alliances have sometimes enabled petrostates to act more assertively abroad without running the risk of great power retaliation.[574] This dynamic was evident in the case of Iran, which was supported by the USA in the 1960s when oil was in high demand and no longer a surplus commodity.[575] Amid the cold war, the USA secured its relationship with Iran as a means of denying oil access to the Soviet Union, which was already allied with many Gulf states and expanding its influence in the Middle East.[576] Granted US military aid and advanced weapon systems, Iran not only became a critical buffer against the Soviet Union, but it also grew into the strongest military power in the region.[577]

*Petrostates and foreign policy assertiveness*

In addition to alliances with Western powers, FFRs can enable a petrostate to increase its military spending and foreign policy assertiveness.[578] Prior to 1970, petrostates and non-petrostates were equally likely to engage in militarized conflicts. That pattern changed with the Arab oil embargo of 1973—a five-month Organization of the Petroleum Exporting Countries (OPEC) embargo on countries that supported Israel during the Yom Kippur war. Oil prices quadrupled,[579] and more petrostates became involved in international military affairs.[580] Today, petrostates with revolutionary governments engage in militarized interstate disputes at a rate 50 per cent higher than non-petrostates.[581]

There are several reasons why oil revenues encourage petrostate leaders to take greater risks abroad. When oil is controlled by the central government, leaders become more politically autonomous and able to take risky actions without being removed from office.[582] Political elites can use FFRs to consolidate political power and quell domestic opposition.[583] In the case of revolutionary governments, political leaders are inherently more risk-prone—because they seized power by overthrowing their domestic opponents—resulting in more ambitious foreign policies.

Higher oil prices can also embolden states to act aggressively and initiate military conflicts more frequently.[584] When crude oil prices were high, petrostates such as Russia, Venezuela and Iran initiated more aggressive behaviour.[585] In 2008, Russia invaded Georgia in response to the latter's perceived aggression towards South Ossetia, a breakaway province of Georgia with Russian backing; President Chavez in Venezuela expelled the US ambassador for stirring domestic unrest; and Iran provided financial backing to Hamas for its rocket attacks on Beersheba and Gedera in Israel.[586]

Petrostates have engaged in proxy wars and become aggressive abroad, sometimes as a means of capturing greater oil resources or cementing their status as a regional power. In the wake of the 2011 Arab Spring both Saudi Arabia and the United Arab Emirates (UAE) sought to increase their military capabilities and influence in the region. Saudi Arabia's military offensive against Iranian-backed Houthi rebels in Yemen, which began in 2015, subsequently became a long drawn-out effort, with successive years of airstrikes that have destroyed Yemeni infrastructure and caused thousands of civilian casualties.[587] The conflict was part of a larger proxy war with Iran for influence in the region, and resulted in a sharp decline in oil production in Yemen from 2015 to 2016.[588] The UAE's campaign, aimed at combatting extremism in Yemen and curtailing the influence of Iranian-backed Houthis, also began in 2015 as part of the Riyadh military coalition. It was a way for the country to cement its power and trade in the Red Sea and African continent.[589] Yemen's rich oil reserves were another motive for the UAE to become involved, and today the country continues to exert control over Yemen's southern provinces and oil centres through the South Yemen Transitional Council.[590]

It is worthwhile noting that even when oil prices fall, petrostates often increase their domestic debt to sustain military spending rather than diversifying or making cuts in other areas.[591] After the oil crash in 2014, Saudi Arabia maintained its high military expenditures and engaged in armed tensions with Syria, Yemen and Iran.[592] Following a 45 per cent drop in the price of crude oil between 2014 and 2017, Saudi Arabia offset the loss by increasing its debt by 989 per cent,[593] with the expectation that oil prices would increase again in future.[594] The past two years have again seen large swings in oil prices. During 2020, military funding in Saudi Arabia as a percentage of GDP increased slightly, despite decreases in oil prices (though in nominal terms there was a cut in funding).[595] Despite fluctuations in oil prices, petrostates tend to maintain their military expenditures even if it means incurring additional debt.

### 3.5.2.2. Decarbonization and petro pushback

The incentives to instigate conflict will likely be strong among the most fragile petrostates as they struggle to manage the implications of decarbonization.[596] Social and political upheavals will likely increase as petro-leaders cling to their waning power and social contracts.[597] Moreover, decarbonization could lead to social unrest in states where fossil fuels are paramount to the social contract (see 'Gulf Cooperation Council States, Decarbonisation and the Social Contract' in the annex), with FFRs no longer sufficient to fund existing social programmes.[598] Decarbonization will also be difficult to cope with during spikes in oil demand. According to the IEA, a global peak in oil is likely to occur within the next two decades.[599] If strong climate policies are in place, petrostates and OPEC members are predicted to suffer economically.[600]

Petrostates will likely react differently to decarbonization depending on how reliant they are on oil exports, the cost of production, total reserves, and how they choose to adapt to the transition.[601] Petrostates could, for example, choose to cooperate with each other and agree on a production quota that would preserve their FFRs and maintain higher oil prices.[602] Alternatively, they could pursue a more aggressive option and engage in competitive price wars in an attempt to secure as much of the remaining market share and emission space as possible.[603] The World Bank suggests that the most sustainable course would be for petrostates to diversify their economies and prepare for the decline in oil demand.[604] This strategy most closely complements climate mitigation policies. In addition, such an approach would help reduce the 'resource curse' within petrostates.[605] However, while Saudi Arabia, for example, is pursuing diversification, it only has a net-zero goal of 2060 and intends to maximize oil and gas profits for as long as possible to help finance diversification.[606] At the same time, it has lobbied against language it views as critical of fossil fuels in international fora and major reports, such as the IPCC Assessment Reports.[607]

Some countries like Saudi Arabia may actually benefit in the near-term if they follow a volume rather than price-led strategy. Saudi Arabia itself possesses one of the largest and cheapest producing oil reserves in the world. This advantage enables it to raise oil exports while reducing prices, making it one of the better-suited petrostates when it comes to competing with the deflationary market dynamics of renewable energy.[608]

### 3.5.2.3. Talk is cheap from fossil fuel exporters

Even though every major fossil fuel-exporting country has ratified the 2015 Paris Agreement, many continue to undermine decarbonization efforts. This inconsistent strategy was made clear during COP26 in Glasgow where, at the behest of India and China,[609] commitments to 'phase out' the dirtiest fossil fuel—coal—were diluted to 'phase down' in order to reach a final agreement.[610]

Moreover, despite pledged reductions in fossil fuel production, many countries have allowed further exploration of fossil fuel reserves. These contradictory actions are especially concerning in the cases of Australia, Canada, Norway, the UK and the USA, which despite having the financial capability to rapidly shift away from fossil fuels, have committed $150 billion to expanding fossil fuel production since the beginning of the Covid-19 pandemic.[611] Such actions are in part due to intense lobbying by fossil fuel corporations and the political impacts of high fuel prices.[612] The political realities at play mean that disconnects between international commitments and domestic implementation persist. The 2022 scramble for short-term alternatives to Russian natural gas is providing additional impetus for this approach.

In 2021 the IMF concluded that global fossil fuel subsidies totalled $5.9 trillion.[613] The removal of government subsidies for fossil fuels would reduce $CO_2$ emissions by 36 per cent, raise revenues equivalent to 3.8 per cent of global GDP, and prevent nearly 1 million deaths caused by air pollution.[614] Conversely, failure to address the discrepancies between international commitments and actions will lead to failure in keeping global heating below the 1.5–2°C target.

### 3.5.3. Individual and community-level impacts

Beyond country-level impacts, decarbonization will have profound effects on sub-national units, especially communities heavily dependent on extractive industries. The fossil fuel sector is a key source of employment and socio-economic wellbeing for millions of people around the world. For some states, decarbonization will have consequences for the social contract between government and citizens. The Gulf Cooperation Council (GCC) states (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE), for example, have large public sector employment and funding that is almost exclusively reliant on FFR.

#### *3.5.3.1. Decline of extraction industries and approaches to fossil fuel phase-out*

The number of people employed in the fossil fuel industry—both extraction and downstream refining—is not precisely known. The IEA and Enel Foundation are launching a collaboration aimed at determining the figure and so enabling better policy planning.[615] For many, these (often unionized) jobs are well paid and have been vital to ensuring household economic stability. Inevitably, decarbonization will threaten many of these jobs even as efforts to transition into the renewable economy is ongoing in some places. Comparisons between the UK's sudden, unilateral phase-out of coal and the planned, consultative and staged phase-outs seen in Germany and Chile provide instructive examples for planning current and future transitions.

Historically, coal industry closures have had significant negative effects on local communities. One of the most notable examples was the demise of the coal industry in the UK. While closures had already begun in the 1960s as part of the government preferring oil, these initial closures were conducted cooperatively with the unions.[616] However, when Margaret Thatcher became prime minister in 1979, she accelerated mine closures without the guarantees of economic security provided to the previous generation of mine workers.[617]

In response, more than 150 000 miners went on strike in March 1984.[618] The strikes were seen as being about more than just resistance to job losses—they opposed the abandonment of entire communities built around coal and the increasingly anti-union actions of the government's National Coal Board.[619] The government had planned for such a confrontation, building up reserves of coal and organizing non-unionized transport.[620] These preparations allowed the government to wait out the strikes.

Though the reasons behind the forced closures of UK mines in the 1980s were not environmental, the resultant labour strikes are illustrative of what could happen as fossil fuel extraction industries (FFEIs) close. Six people died in the strikes and over 11 000 were arrested, with over 8000 people charged.[621]

Coal shutdowns in, for example, Russia, Romania, Ukraine and the USA have produced similar economic downturns in local communities.[622] Following the closures, the quantity and quality of jobs diminished, despite government investment in retraining and small businesses. Unilateral shutdowns that fail to actively engage affected communities have the potential to become violent and socially disruptive. As such, policymakers should bear in mind that closure without support will likely produce negative outcomes.

Germany is one country attempting to implement a less disruptive phase-out of coal, with the explicit intention of reducing carbon emissions.[623] Workers are being offered retraining and employment in jobs with similar pay and benefits, alongside significant public pay-outs to companies.[624] By considering the downsides of a coal phase-out in advance and dedicating significant resources to address them, it is hoped the societal and individual negatives associated with FFEI closures can be minimized. Planners want to make affected regions 'future-proof, economically strong, attractive and liveable'.[625] This model requires considerable resources, which may render it unfeasible for other fossil fuel exporting countries. A report by the German Federal Ministry of Economic Affairs and Energy noted that the government has provided €21 billion to be spent on an 'orderly and socially responsible' phase out of coal between 2009 and 2019.[626] Estimates that incorporate aspects beyond mining contend that these costs could amount to €69–93 billion,[627] with the German state having committed €40 billion of this.[628] Some analysts have noted that billions of euros have been spent on the corporations in order to stop their lobbying and satisfy shareholders, with such money becoming available on a faster timeline than compensation to workers.[629] The pressure to replace Russian natural gas and decommissioned German nuclear power plants is testing Germany's timetable for phasing out coal.

Germany's strong economy makes the expense associated with phasing out coal in ways that help mitigate disruption possible—such an expensive strategy may not be replicable in other countries, such as South Africa and

India. However, the 2021 COP26 negotiations have shown the international community may have a role in helping fund transition projects.[630]

Elsewhere, Chile undertook an inclusive consultative commission process in 2017 to help manage its transition away from coal. The process, which included affected workers, companies, academics, international partners and policymakers, resulted in many coal plants closing ahead of schedule, with an end date of 2040 planned for the closure of all coal generators.[631]

Assisted by the German Agency for International Cooperation, Chile is experimenting with transforming old coal-fired power plants into new infrastructure, thereby ensuring that sites are not left abandoned and workers can retrain and take on new roles. Among the suggested transformations are adding molten salt storage to capture excess renewable energy,[632] converting plants to hydrogen storage and processing facilities,[633] or turning them into desalination plants.[634] Desalination could also aid Chile in its extraction of lithium, which is a water-intensive process. Regardless of the risk of failure and coal-community scepticism, the transition will require ambitious experiments that can provide models capable of maximizing potential benefits and minimizing potential harms.[635]

These differing approaches to transitioning away from coal set out above highlight the difficulties involved. While no approach will be conflict free, participatory approaches actively supported by citizens, business, unions and government are not only likely to be more successful but also less conflictual.

#### 3.5.3.6. Abandoned infrastructure and stranded assets

The phase-out of fossil fuels is not as simple as no longer trading fossil fuels. Vast networks of infrastructure have been built around the extraction, transport, storage, refinement and sale of fossil fuels. The economic costs are known as stranded assets—assets that no longer produce an economic return.[636] These costs will be borne by corporations and shareholders, as well as states if they have nationalized fossil fuel infrastructure or intervene to compensate private owners (see Timor-Leste case).[637] Some global estimates place the total cost at $1 trillion.[638]

Abandoned infrastructure—including oil and gas wells—can also become potential hotspots for socio-political conflict once owner/operators close their FFE operations. So-called orphaned wells pose environmental and health problems, including contaminated groundwater used for drinking and irrigation.[639] Currently, weak regulation and enforcement, along with legal loopholes, allow companies to avoid securing their old or abandoned infrastructure, and in some cases dodge liability entirely.[640] For example, some companies file for bankruptcy to avoid liability for capping or fixing leaky wells—burdening taxpayers with the cost of environmental clean-up. A recent study in the US state of New Mexico found that despite an estimated clean-up cost of $8.3 billion (within the state alone), only $200 million had been guaranteed.[641] In the UK, estimates for decommissioning oil and gas infrastructure over the next decade exceed GBP 15 billion.[642] Extrapolating from this, the cost of completing these activities around the world will likely run into hundreds of billions of dollars.

While the impact of abandoned infrastructure is better documented in the Global North,[643] it is by no means limited to these areas. Petrostates with weak governance will have greater difficulty holding corporations to account and implementing environmental laws. The oil leaks and orphaned infrastructure in the Niger Delta illustrate the real costs involved.[644] In this case the Niger Delta has a long record of latent conflict between the state's reliance on oil rents and its enforcement of environmental regulations.[645] Citizens are burdened with either clean-up costs or the costs associated with abandonment and lack of enforcement during the infrastructure's operational life.[646] These dynamics have led to ongoing conflict in the region, as local people have limited other means to enforce environmental regulations.[647]

### 3.5.4. Accounting for petro pushback

History shows that energy transitions are hard, and rapid energy transitions are even harder. The complex systems of global trade, geopolitics, human development and environmental impacts make a shift away from fossil fuels politically and economically difficult. In some cases, proactive efforts to maintain the primacy of fossil fuels factor into conflict and geopolitical machinations, with such pushback delaying needed decarbonization transitions. In other cases, the transition will be costly and require the near-total reconstruction of local communities. Policymakers must therefore consider the petro pushback in all efforts to advance the energy transition. While the experiences of previous industrial transitions can provide valuable lessons, fashioning a just transition will inevitably require new approaches.

## 3.6. Accounting for conflict potential to advance critical transitions

The interconnected crises of the Anthropocene demand proactive action on many fronts. Those political, economic and technological steps in the realms of energy, climate, ecosystems and land use are myriad and contested. Smart long-term thinking on climate adaptation and mitigation is critical to fortifying human security in the century ahead, as are efforts to conserve massively threatened ecosystems.

Even successful approaches to tackling these challenges come with conflict potential. Part 3 has analysed the efforts currently being planned or undertaken to make these transitions, highlighting where they may present challenging conflict dimensions. Practitioners at all levels should use this analysis to chart a course that minimizes conflict through transparent, participatory processes.

Developing a roadmap involves facing the conflict potential of responding to these crises. New low or no carbon sources of energy still require mineral inputs that are polluting, associated with social injustices, and at times linked to conflict at the point of extraction and processing. Land-use demands are changing, with innovative mitigation schemes to enhance carbon sinks favouring some uses and interests over others. Conservation protections aimed at stemming biodiversity loss and restoring degraded lands can provoke conflict when implemented in competition rather than cooperation with those who derive livelihoods from such ecosystems.

While clashes in these contexts may take place at the end of a gun, conflict short of organized violence must also be included in a full accounting of the conflict potential of responding to climate and conservation crises. Here, wider social conflict costs may be involved, with violence taking place despite the lack of recorded battle deaths. It is therefore important that broader human security challenges be proactively tackled rather than ignored or minimized. Two key rationales underlie this argument.

First, practitioners at all levels need to minimize conflict and maximize justice, especially when the mitigation, adaptation, conservation or energy transitions they are pursuing are deemed essential. Second, failure to meaningfully address these transition costs will threaten the pace and nature of the transitions themselves. Remaining deaf to the human and environmental costs of pollution, resource access and energy choices will only lead to further opposition, even from those who would and could be allies.

Inclusive, participatory and transparent governance processes are a common denominator across the more successful approaches. Indigenous peoples, with their numerous instances of achieving positive conservation outcomes, should be courted rather than side-lined. Adaptation must be inclusively designed and equitably beneficial, something that has proven elusive in the early systematic attempts to scale up this historically neglected dimension of climate response. Pursuing these interventions while remaining mindful of not reinforcing historical inequities is key to, in the words of the youth advocates demanding action, ‘thriving not surviving’.

Highlighting the observed and potential problems thrown up by these dramatic transitions should not be taken as an attempt to erect obstacles to making necessary changes. Rather, the overriding message is that these vital transitions must be advanced in ways that do not disrupt their progress or provoke additional challenges to peace.

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