PUBLIC
SIMULTANEOUS DISCLOSURE

CLIMATE CHANGE SECTOR FRAMEWORK DOCUMENT

CLIMATE CHANGE DIVISION

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ABBREVIATIONS

CO_2	carbon dioxide
COP	Conference of the Parties to the United Nations Framework Convention on Climate Change
DFNC	debt-for-nature conversion
DRM	disaster risk management
ESG	Environmental, Social, Governance
GHG	greenhouse gas
iGOPP	Index of Governance and Public Policy in Disaster Risk Management
IDB	Inter-American Development Bank
IPCC	Intergovernmental Panel on Climate Change
LAC	Latin America and the Caribbean
LTS	Long-Term [climate] Strategy
MDB	multilateral development bank
MRV	monitoring, reporting, and verification
NBS	nature-based solutions
NDC	Nationally Determined Contribution
ODA	Official Development Assistance
SFD	Sector Framework Document
TCFD	Task Force on Climate-Related Financial Disclosures
UNFCCC	United Nations Framework Convention on Climate Change

EXECUTIVE SUMMARY
CLIMATE CHANGE SECTOR FRAMEWORK DOCUMENT

The Climate Change Sector Framework Document orients the IDB Group's work on climate change in Latin America and the Caribbean (LAC). This Sector Framework Document (SFD) describes four key challenges associated with climate change and summarizes evidence on the effectiveness of policies that address each of them. It considers lessons learned from the IDB's own experience in the region. Finally, it proposes four evidence-based lines of action. Each section of the document is organized around four cross-cutting themes: (1) adaptation and climate resilience, (2) decarbonization, (3) governance, and (4) financial flows.

While climate change affects all sectors of the economy, this document focuses on the four aforementioned themes to highlight the most pressing broad issues and actions. Other SFDs address in detail climate change impacts in specific sectors and options for addressing them.

1. Adaptation and climate resilience

a. **Climate change poses a grave threat to sustainable development in LAC.** The physical effects include increased frequency and intensity of natural disasters, sea-level rise, changes in local weather patterns, and loss of vital ecosystem services. These effects, both ongoing and projected, vary across the region and entail significant uncertainty. The impacts for humans are complex and overlapping, including threats to food and water security, disruption of infrastructure, increased human morbidity and mortality, and lower labor productivity, household income, fiscal balances, and tourism revenues. Climate change disproportionately affects poor and underrepresented people, creating a vicious cycle. It can spur migration, both within and across national boundaries. The vulnerability of urban populations and small island states is of particular concern. The adverse physical impacts and the implications for human well-being will persist for centuries regardless of emissions reductions, making it essential to focus on enhancing climate adaptation and climate resilience.

b. **Actions to build climate resilience are not only consistent with meeting other development needs; they are often essential.** Reducing vulnerability to climate change is necessary for poverty reduction and vice versa. Investing in adaptation and climate resilience is more cost-effective than responding to disasters. Climate change adaptation requires specialized skills and tools that are geographically focused and that take deep uncertainty into account.

2. Decarbonization

a. **To stabilize climate change and contain damages by reaching net-zero emissions by 2050, the world needs to act now.** On a per capita basis, greenhouse gas (GHG) emissions in LAC are similar to the global average, although the sources of emissions differ. Historically, emissions from deforestation and agriculture have been more significant in LAC than in the rest of the world. However, LAC emissions linked to transportation and energy production are growing fast. In the many economic sectors where long infrastructure lifespans mean fewer future replacement opportunities, urgent action is needed to avoid perpetuating fossil-fuel intensive systems that lock-in further carbon emissions.

b. **Technical solutions for decarbonization are now widely available,** centered around (1) generating zero-carbon electricity, (2) replacing fossil fuels in all sectors, (3) expanding, protecting, and restoring high-carbon ecosystems, and (4) advancing sustainable economic practices. Technical challenges remain for a small share of emissions, but they are being resolved.

c. **The cost of decarbonization in LAC is outweighed by economic and social benefits.** Projected benefits include 1% additional economic growth and the creation of 15 million net new jobs by 2030. For instance, wind and solar are now the cheapest and most abundant sources of energy available to mankind, and electric vehicles are competitive in some markets and their cost will continue to fall; while the price of fossil fuels is more volatile and depends on exogenous factors, as demonstrated by the effects of the COVID-19 pandemic and the Russian War on Ukraine on oil and gas prices.

d. **Ramping up renewable energy is the most important option for achieving zero-carbon electricity.** While other options such as natural gas may reduce emissions in the short term, they lock in substantial emissions over the lifetime of the infrastructure. Fortunately, renewable energy is cheaper than energy from fossil fuels. Transitioning to renewable energy has other advantages as well, including enhancing energy security (since sources of renewable energy are abundantly available in LAC), boosting resilience associated with decentralized production, and improving air quality.

e. **Electrification can help displace fossil fuels in nearly all sectors.** Particularly important are transportation, heating, and light industry. In the transportation sector, decarbonization also requires transit-oriented urban development that favors walking, biking, and public transportation over individual cars. All these transformations come with substantial financial savings, reducing the cost of the health impacts of fossil fuels, and improved competitivity.

f. **Expanding, protecting, and restoring high-carbon ecosystems plays a key role in reaching net-zero emissions.** Food production is the main land use that competes with the preservation of high-carbon ecosystems in LAC. By improving yields and adjusting the types of agricultural products that are produced, countries in the region can reduce their GHG emissions while improving nutritional outcomes and preserving food security. Under certain conditions, policies supporting protected areas and community forestry can help preserve ecosystems. Expanding, protecting, and restoring high-carbon ecosystems (terrestrial and marine) is the cheapest and most scalable way to capture carbon back from the atmosphere, and comes with benefits in terms of ecosystem services, including biodiversity protection and tourism revenues. Because there is limited space on earth to reforest and expand high-carbon ecosystems, carbon capture should not be seen as an alternative to urgent and comprehensive emissions cuts in emissions from fossil fuels and other sources, but as a complement or last resort.

g. **Countries can reduce GHG emissions linked to industrial and food production by advancing toward a circular economy, which includes improving waste management and recycling.** Improving water-treatment plants and waste management can reduce methane emissions. Reducing food waste and losses is also important.

h. **Continued innovation can help resolve remaining decarbonization challenges.** The private sector has unique expertise and capacity for innovation and production of new technologies (Meirovich, Gómez and Araujo 2022). Key areas for innovation include energy storage, industrial processes, green hydrogen and bioenergy to cut emissions from heavy industry and heavy and long-distance transportation.

3. Climate governance

a. **The key challenge of climate governance is ensuring that actors in each economic sector have a clear understanding of (1) how to achieve climate resilience and decarbonization goals, (2) the main barriers to meeting these goals, and (3) which interventions can remove these barriers.** Key barriers to meeting climate goals are related to planning, regulation, price signals, information, capacity, and the political economy.

b. **Comprehensive climate strategies can help governments develop roadmaps for attaining climate goals.** Comprehensive climate strategies can guide implementation of climate-resilience and net-zero-emissions actions at the sector and territorial levels and align financial flows to those actions.

c. **At a global level, the foundation for international climate agreements is the United Nations Framework Convention on Climate Change (UNFCCC).** Parties to the Paris Agreement have agreed to periodically submit Nationally Determined Contributions (NDCs) and to strive to formulate and communicate long-term strategies (LTSs). However, many LAC countries' NDCs and LTSs are not yet aligned with the long-term goals of the Paris Agreement and lack a public policy strategy that is consistent with the targets.

d. **Climate action requires the coordinated participation of a range of government and nongovernment interested parties that often have competing priorities and limited information.** These parties include various levels (federal, regional, and local) and segments of governments, the private sector, academia, and civil society. Continued substantive dialogue among these parties is required to ensure that climate strategies are appropriately formulated and broadly accepted. A territorial approach that focuses on specific local characteristics is particularly relevant to designing adaptation plans.

e. **Dozens of government interventions will be needed to lift the barriers that prevent the public and private sectors from investing in net-zero emissions and climate-resilient solutions.** These include building the necessary infrastructure, implementing regulatory reforms or mandates, getting prices right (through subsidy and environmental tax reforms), providing targeted subsidies to climate solutions, aligning trade and climate policy, building capacity, providing information, and managing the political economy. Carbon pricing through taxes or markets can incentivize emission reductions, but prices would need to be higher and cover more sectors than the existing instruments to have substantial impact on the transition to a net-zero economy.

f. **Climate change and climate policies will affect asset values, price volatility, fluctuations in the availability of inputs, and trade patterns.** Globally, government plans project vastly higher levels of fossil fuel extraction than would be consistent with limiting global warming to between 1.5 and 2.0°C, potentially creating several trillion dollars' worth of stranded assets. Large economies are

discussing legislation to tax or limit the importation of high-carbon industrial commodities and agriculture goods linked to deforestation. A long-term view can help countries minimize and compensate for the impacts of stranded assets on trade balances, fiscal revenues, and the financial system.

g. **Interest groups adversely affected by transition policies and some aspects of consumer behavior impede the transition to net-zero emissions.** Policy packages can be designed to be socially beneficial and politically acceptable. Anticipating the effects of decarbonization on labor markets through active labor policies and upskilling and reskilling for the low-carbon jobs of the future is essential for facilitating a just transition—one that maximizes benefits, minimizes, and compensates for costs, and gives a voice to all parties affected by climate policy. Information campaigns and educational interventions can aid effective climate governance.

4. Financial flows

a. **Financial flows from public and private sources need to be redirected and aligned with net-zero emissions and climate-resilient development goals.** Achieving climate resilience and carbon-neutrality in the region, consistent with the long-term goals of the Paris Agreement, will require incorporating climate change objectives into between 7% and 19% of countries' GDPs' worth of spending every year, up to US$1.3 trillion per year by 2030. Most climate action will be financed by redirecting the everyday spending decisions of households, firms, and governments in the region. In addition, a variety of financial tools can improve mobilization and allocation.

b. **Climate-change-related financial risks can have systemic effects, posing a threat to financial market stability.** Financial regulators and supervisors are promoting sustainable finance and integrating climate change risks into their financial-stability mandates. Vulnerability to climate change can also limit a country's access to capital markets.

c. **Governments can raise resources through environmental tax reforms and carbon markets.** Environmental taxes in the region are low, and fossil fuel subsidies remain in place in many countries. Existing mandatory and voluntary carbon markets modestly raise revenue, and scaling the voluntary market could require improving transparency, stringency, and efficacy. Article 6 of the Paris Agreement limits the ability of countries to use carbon offsets to meet their own emissions reduction targets to avoid double counting.

d. **Green bonds, sustainable bonds, and sustainability-linked bonds can contribute to financing climate action.** To use them, governments need to develop clear climate targets and work with the private sector to set up portfolios of sustainable and economically viable investment projects. Accounting for climate risk and expenditures in government budgets can help mobilize resources for the transition to a net-zero-emissions and climate-resilient economy.

e. **A range of financial instruments can help countries manage physical climate risk, depending on the probability and impact of the event,** including reserve funds, contingent credit, and insurance. Contingent loans are arranged ex-ante to provide liquidity immediately after disasters. Climate-resilient debt clauses are gaining momentum. But existing options are insufficient and a key

outcome at COP27 was the agreement to provide loss and damage funding to developing countries that are particularly vulnerable to the adverse effects of climate change.

f. **Multilateral development banks (MDBs) and other public financial institutions play an important role in ensuring vulnerable countries are not shut out of development finance.** MDBs provide climate finance, and, more recently, have committed to aligning their operations with the Paris Agreement. More importantly, MDBs are a key channel of concessional and blended resources, which can help create markets and address market failures when used strategically. MDB funds are instrumental in mobilizing further resources. But MDBs have limited capital and there are calls from the G20 and others for MDBs to extend it further to address climate change. At the same time, it is important to recognize that MDBs' most important support is unlikely to come via direct financing, but rather through technical support for planning and reforms.

I. THE CLIMATE CHANGE SECTOR FRAMEWORK DOCUMENT IN THE CONTEXT OF CURRENT REGULATIONS, THE INSTITUTIONAL STRATEGY, AND INTERNATIONAL AGREEMENTS

1.1 The Climate Change Sector Framework Document orients the IDB Group's work on climate change with countries in Latin America and the Caribbean (LAC) by summarizing available literature to establish a knowledge base. In accordance with the regulatory document, "Strategies, Policies, Sector Frameworks, and Guidelines at the IDB,"[1] this Sector Framework Document (SFD) is not normative. This document replaces the previous Climate Change SFD.[2]

1.2 This SFD is one of 22 SFDs that, together, provide a comprehensive vision of development challenges in LAC. The Climate Change SFD is complemented by the following: (i) the Energy SFD, which promotes net-zero emissions and climate-resilient infrastructure; (ii) the Transportation SFD, concerning reducing travel, shifting to more sustainable modes, and building climate-resilient transportation networks; (iii) the Extractive Industries SFD, addressing stranded assets and the use of minerals and metals in transitioning the energy sector to net-zero emissions; (iv) the Environment and Biodiversity SFD, about protecting high-carbon ecosystems; (v) the Agriculture SFD, concerning food security and lowering greenhouse gas (GHG) emissions from the food system, particularly from livestock farming, which is the principal cause of deforestation in the region; (vi) the Housing and Urban Development SFD, about integrating urban planning with greener mobility and buildings to reduce urban GHG emissions and efforts to reduce the vulnerability of urban residents to serious climate events; (vii) the Tourism SFD, which addresses specific adaptation measures to maintain the attractiveness of destinations and reduce emissions, particularly from air and ground travel and hotel accommodations; (viii) the Skills Development SFD, addressing developing a workforce skilled in green jobs and ensuring a just transition away from brown jobs; (ix) the Fiscal Management SFD, which addresses fiscal revenues from fossil fuels, stranded assets, and carbon pricing; (x) the Long-Term Financing SFD, about redirecting finance toward green investments; and (xi) the Integration and Trade SFD, concerning developing trade and investment instruments that contribute to countries' climate-resilient and net-zero development pathways. As a transversal issue, climate change is relevant across the complete set of SFDs.[3]

1.3 This SFD is consistent with the Second Update to the Institutional Strategy[4] and the IDB Group Corporate Results Framework 2020–2023[5] by guiding one of the strategy's cross-cutting issues (*addressing climate change and environmental sustainability*) and supporting the three development challenges in the region: (i) *reducing social exclusion and inequality*; (ii) *improving productivity and innovation*; and (iii) *enhancing economic integration*. The IDB Group Climate Change Action Plan 2021–2025[6] translates these strategic commitments on climate change into concrete actions and identifies organizational responsibility for delivering them. A separate IDB Group Natural Capital and Biodiversity Action Plan is forthcoming. This SFD is also related to and coherent with the IDB's

[1] Document GN-2670-5.
[2] Document GN-2835-8.
[3] Annex II provides a summary of how climate change is addressed in each SFD.
[4] Document AB-3190-2.
[5] Document GN-2727-12.
[6] Document GN-2848-9.

Environmental and Social Policy Framework (ESPF),[7] particularly with regard to the explicit exclusion of activities inconsistent with the IDB's commitment to addressing climate change and promoting environmental and social sustainability.[8]

1.4 Furthermore, this SFD reflects important international agreements, particularly the Paris Agreement, the 2030 Sustainable Development Agenda, and the Sendai Framework for Disaster Risk Reduction. All 26 of the IDB's borrowing member countries have signed the Paris Agreement and adopted the 17 Sustainable Development Goals, which include an explicit focus on climate action through Goal 13. Countries in the region have also adopted the Sendai Framework for Disaster Risk Reduction 2015–2030.[9]

1.5 The remainder of this document is structured as follows: Section II describes the development challenges associated with climate change. Section III provides evidence on the effectiveness of climate change policies and programs. Section IV summarizes the lessons learned from the IDB Group's previous experiences. Finally, Section V proposes action lines. Annex I presents tables and figures, Annex II summarizes country-level information on climate action, and Annex III lists how climate change is covered in the other SFDs.

1.6 Terms such as mitigation, resilience, and risk have specific meanings in the context of climate change. Specialized terminology is defined in boxes throughout the document (see Box 1 for a definition of climate change).

Box 1. Key definition

Climate Change. "Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use" (IPCC 2018).

II. KEY CLIMATE CHANGE CHALLENGES

2.1 **Climate change is already having acute physical effects in LAC.** LAC is exposed to shifting patterns of precipitation, which increases the variation in the availability of water for irrigation, drinking, and other uses (IPCC 2022, Moreno, et al. 2021). The terrain, ecosystems, and biodiversity—along with the critical services they provide—are being impacted as mountain glaciers retreat, the sea level rises, and species shift poleward or to higher altitudes (IPCC 2022). Extreme-

[7] Document GN-2965-23.

[8] Per the ESPF, the IDB will not knowingly finance, directly or indirectly through financial intermediaries, projects involved in activities that are inconsistent with the IDB's commitments to addressing the challenges of climate change and promoting environmental and social sustainability, such as (1) thermal coal mining or coal-fired power generation and associated facilities; (2) upstream oil-exploration and -development projects; and (3) upstream gas-exploration and -development projects. Under exceptional circumstances and on a case-by-case basis, consideration will be given to financing upstream gas infrastructure where there is a clear benefit in terms of energy access for poor people and where GHG emissions are minimized, projects are consistent with national goals on climate change, and risks of stranded assets are properly analyzed. The ESPF also requires that all IDB projects be submitted to a risk identification process that considers, among others, "GHG emissions, risks, and impacts associated with natural hazards and climate change," and tasks borrowing entities to "identify appropriate disaster and climate change resilience and adaptation measures to be integrated to the project design, construction, and operation."

[9] The Sendai Framework is a 15-year, voluntary, non-binding agreement with four priority action areas: (i) understanding disaster risk; (ii) strengthening disaster risk governance to manage disaster risk; (iii) investing in disaster risk reduction for resilience; and (iv) enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation, and reconstruction.

weather events, including heat waves, droughts, floods, landslides, and tropical storms, are increasing in frequency and intensity (IPCC 2022).[10] These effects are projected to continue or intensify (IPCC 2022).

2.2 **Given its expansive geography and diverse weather, climate change affects LAC subregions differently.** Arid areas are likely to become even dryer and wet areas are likely to receive even more precipitation, exacerbating inter-regional disparities in the availability of water resources. The shift in species ranges poleward and to higher elevations will have impacts in the tropical highlands. For example, in Nicaragua, by 2050, the optimal farming altitude for coffee will increase by 400 meters, to 1,200–1,600 meters above sea level (Laderach 2009). Small islands in the Caribbean are vulnerable to sea-level rise and to more frequent and intense tropical storms (IPCC 2022), increasing the risk of flooding, damage to infrastructure, erosion of low-lying coastal areas, and salinization of fresh groundwater sources (IPCC 2022), damaging agriculture and tourism and pushing people into poverty (S. Hallegatte, A. Vogt-Schilb, et al. 2017).

2.3 **Section II examines four key challenges associated with climate change.** Climate change affects all sectors of the economy, and other SFDs address in detail climate change impacts in specific sectors and options for addressing them. This SFD focuses on four cross-cutting themes. Part A discusses the ways climate change is threatening sustainable development and the consequent need for adaptation and climate resilience. Part B focuses on the challenges of reaching net-zero emissions. Part C considers the difficulties of effective climate governance. Part D discusses the insufficient and misaligned financial resources for addressing climate change. These four challenges overlap and amplify each other. Noting the heterogeneity of climate needs and experience in the region, Annex II presents country-level information.

A. Need for adaptation and climate resilience

2.4 **Climate change poses a grave threat to sustainable development in LAC.** It has a variety of physical and economic impacts, many of which are associated with a great deal of uncertainty. The manifestations of climate change can be analyzed as shocks and stressors. Climate change brings an increased severity of *shocks*, that is events such as heat waves, cyclones, or pandemics, that have an impact limited in time. Climate change also brings *stressors* such as general temperature rise, glacier retreat, sea-level rise, or different meteorological patterns, that tend to have an extended and cumulative impact in time (Box 2 defines key terms used in this part).

[10] As global temperatures increase, more water is evaporated into the atmosphere, becoming fuel for more powerful storms to develop (United States Geological Survey).

Box 2. Key definitions

Adaptation. "In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects" (IPCC 2018).

Adaptive capacity. "The ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences" (IPCC 2018).

Resilience. "The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation" (IPCC 2018).

Physical risk. "The potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain. In the context of the assessment of climate impacts, the term risk is often used to refer to the potential for adverse consequences of a climate- related hazard, or of adaptation or mitigation responses to such a hazard, on lives, livelihoods, health and well-being, ecosystems and species, economic, social, and cultural assets, services (including ecosystem services), and infrastructure. Risk results from the interaction of vulnerability (of the affected system), its exposure over time (to the hazard), as well as the (climate-related) hazard and the likelihood of its occurrence" (IPCC 2018).

Vulnerability. "The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt" (IPCC 2018).

2.5 **Climate change has increased the intensity and affected the frequency of natural disasters, including hurricanes, floods, and heat waves, with devastating socioeconomic and fiscal effects.** During the past 50 years, the number of disasters in LAC has increased more than threefold (WMO 2021) (see Figure 1. The number of disasters globally and in South America has increased dramatically since 1970Figure 1). These disasters have had significant adverse effects on human morbidity and mortality, ecosystems, and economies. Between 2010 and 2019, direct economic losses from disasters in South America averaged US$3 billion per year, double the amount of the previous decade (2000–2009) (WMO 2021). In Caribbean countries, natural hazards destroy an average of 3.6% of GDP every year (Rozenberg, Browne, et al. 2021). Estimates of the cost of natural disasters tend to underestimate the social and economic impact of disasters (S. Hallegatte, A. Vogt-Schilb, et al. 2017). They do not reflect the fact that US$1 lost by a poor household has a higher impact than US$1 lost by a rich one or that the losses suffered by poor households with informal assets are not always reflected in official statistics. These numbers also do not capture the economic costs of long reconstruction times, which can be up to three times higher than the nominal value of the destruction of assets (S. Hallegatte, A. Vogt-Schilb, et al. 2017). Natural disasters also have a significant fiscal impact. The occurrence of at least one extreme event per year is associated with an increase in the fiscal deficit of 0.8% of GDP for lower-middle-income countries and 0.9% of GDP for low-income countries (Alejos 2018). Even disasters that in isolation are relatively less severe can generate significant losses when they recur. For instance, damages from recurring flooding made up 23% of natural disaster losses in the region from 1980 to 2018 (Centre for Research on the Epidemiology of Disasters 2019).

2.6 **Sea-level rise is an existential threat for small-island and low-lying coastal states.** Six to eight percent of LAC's population lives in areas at high or very high risk of being affected by coastal hazards (WMO 2021). Coastal hazards associated

with sea-level rise include the submergence of land, flooding, erosion of land and beaches, salinization (of soils, groundwater, and surface waters), loss of and change in marine and coastal ecosystems, blocked drainage, damage to infrastructure, and impeded logistics (Pery, et al. 2021). These hazards have cascading effects on coastal agriculture, tourism, recreation, fisheries, and aquaculture (Oppenheimer, et al. 2019). Under pessimistic climate change projections, sea-level rise could lead to an average 35-meter shoreline retreat of sandy beaches across the Caribbean by 2050, with the greatest retreats in Suriname (71 meters), Guyana (65 meters), Trinidad and Tobago (53 meters), and Belize (46 meters). Under those projections, average shoreline retreat across the Caribbean is expected to reach 98 meters by 2100 (Rozenberg, Browne, et al. 2021). Reducing GHG emissions drastically to meet the Paris Agreement goals would decrease projected land loss due to sea-level rise by 20% by 2050 and 40% by 2100, but beach loss for hotels would still be significant and projected reductions in tourism revenue are 17% by 2050 and 38% by 2100 (Rozenberg, Browne, et al. 2021). A geospatial analysis finds that, absent adaptation, by 2050, 25%–65% of hotels in Trinidad and Tobago, Antigua and Barbuda, St. Lucia, and the Bahamas will become unable to profit from proximity to a sandy beach (Rozenberg, Browne, et al. 2021).

2.7 **Climate change compromises ecosystem services, with potentially dire economic consequences.** Ecosystems provide valuable services directly to humans and indirectly through natural systems. These services are typically grouped into four categories: (1) provisioning services, which entail the supply of products like food and fuelwood that are directly consumed by humans; (2) regulating services like flood control and water purification, which have to do with the regulation of ecological processes; (3) cultural services, which refer to nonmaterial benefits like spiritual well-being and recreation; and (4) supporting services, which are basic ecological processes like soil formation and nutrient cycling that maintain ecosystems without necessarily benefiting people directly (MEA 2005, Blackman, et al. 2020). Climate change is adversely affecting all these services (IPCC 2022). Some estimates indicate that half of global GDP is moderately or highly dependent on them (WEF and PwC 2020).

2.8 **Climate change threatens water security, particularly in the Caribbean, Mexico, Northern Brazil, and the Central and Southern Andes.** Climate models predict an increase in water scarcity in certain parts of LAC as precipitation patterns change, glaciers retreat, and sea levels rise, and the frequency and severity of droughts and flood increase (IPCC 2022). Glacier retreat is already well advanced in the Andes, for instance in Bolivia and Peru losses of more than two-thirds of glacier extension are common (Johansen, et al. 2020). By the end of the century, in countries like Mexico, Argentina, and Chile, up to 50% of the population could be living in areas under water stress due to climate change (Cavallo, Powell and Serebrisky 2020). For islands, special concerns include lack of land for storing fresh water from the rainy season and saltwater intruding into groundwater due to sea-level rise (Williams and Thomas 2012). Because hydropower supplies almost half the electricity in the region, changing water availability also has implications for energy (OLADE 2022). Expected changes to water availability must be analyzed at a granular local level (see ¶2.15).

2.9 **Climate change reduces agriculture productivity and threatens food security.** As discussed in the Agriculture SFD,[11] increased temperatures, rising sea levels, changing precipitation patterns, and more extensive damage from pests and disease, combined with the occurrence of extreme weather and climate extremes, such as droughts, flooding, storms, and heat waves, are negatively impacting agriculture production by increasing crop losses (IPCC 2022). Between 2005 and 2015, 30% of crop losses globally were caused by droughts (FAO 2017). In addition, changing temperatures and shifting precipitation patterns are impacting land suitability for agriculture and changing the patterns of agricultural pests and diseases (IPCC 2022, IDB 2019). For example, shifts in species ranges will move Nicaragua's production of beans and coffee to higher elevations (IDB 2019). Climate change will also increase the incidence of pests and diseases in primary agricultural products, including coffee, bananas, cacao, and corn (IDB 2019).

2.10 **Climate change destroys infrastructure, generates disruptions, and disturbs transportation and energy provision.** As discussed in the Energy SFD (forthcoming), Transportation SFD, and Trade SFD,[12] low-lying infrastructure, including roads and power generation and distribution, are vulnerable to rising sea levels and increased incidences of flooding (IAEA 2019, ITF 2016). Heat waves and increased temperatures might damage unprotected photovoltaic solar panels and transmission lines and accelerate the deterioration of asphalt, affecting roads, ports, and airports (IAEA 2019, ITF 2016). In the case of hydropower plants, increased precipitation and storms can reduce their life expectancy by accelerating sedimentation (Ubierna and Alarcon Rodriguez 2022). Changes in precipitation, winds, and cloud cover have adverse effects on energy generation potential, transmission, distribution, and demand patterns, threatening energy-provision capacity (IEA 2021). Disruptions in the transportation system can increase travel time and costs, isolate areas during emergencies (Hallegatte, Rentschler and Rozenberg 2019), and interrupt international trade (WTO 2022). Disrupted energy and transportation systems are costly for households, firms, and government operations during emergencies (Hallegatte, Rentschler and Rozenberg 2019). The expected increase in frequency and severity of extreme meteorological events also creates risks for health and education infrastructure. COVID-19 has revealed vulnerabilities in many countries' health systems (WHO 2022).

2.11 **Climate change adversely affects human health.** As discussed in the Health SFD,[13] climate change increases the prevalence of water- and vector-borne tropical diseases, heat stress, malnutrition, and child-growth stunting (Hallegatte, Bangalore, et al. 2016). Due to climate change, between 2030 and 2050, malnutrition, malaria, diarrhea, and heat stress will cause 250,000 additional deaths per year, costing between US$2 billion and US$4 billion by 2030 (WHO 2014, WHO 2021). Increased frequency and intensity of heat waves raise mortality and morbidity due to heat stress, especially among older age groups and the urban poor (IPCC 2022). Land-use change and climate change increase the probability of zoonotic disease transfer from original wildlife hosts to humans and livestock (Carlson, et al. 2022).

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[11] GN-2709-10.
[12] GN-2740-12 and GN-2715-11
[13] GN-2735-12.

2.12 **Climate change reduces labor productivity and affects educational needs and outcomes.** As discussed in the Labor SFD,[14] climate change will disrupt economic activities in the region, leading to job and productivity losses in sectors such as agriculture, tourism, and transportation (UNOCHA 2019, Pecha Garzón 2017). It may also push affected workers into informality (UNOCHA 2019, Pecha Garzón 2017). Nineteen percent of the LAC workforce is in sectors like agriculture and tourism that depend on natural resources, such as water and intact biodiversity, that are being adversely affected by climate change (Saget, Vogt-Schilb and Luu 2020). Excessive heat creates occupational health risks and reduces productivity (ILO 2019). In LAC, such productivity losses could total 2.5 million full-time equivalent jobs by 2030 (Saget, Vogt-Schilb and Luu 2020). As for education worldwide, students are expected to miss more days of instruction as a direct consequence of the increasing incidence of extreme-weather events (UNESCO 2012). Rising temperatures and increasingly inadequate classroom ventilation may be associated with reduced school attendance and lower learning (Gaihre, et al. 2014). Gradual changes due to climate change that affect livelihoods could also lead to reduced household expenditures on schooling and affect children's nutrition (UNESCO 2012, Bangay and Blum 2010).

2.13 **Climate change disproportionately affects poor and underrepresented people, creating a vicious cycle** (Hallegatte, et al. 2020). Vulnerable groups, including women, indigenous people, and the elderly, tend to be more exposed to climate hazards, are more susceptible to damage from climate hazards, and have fewer resources to cope with and recover from climate-induced shocks, resulting in greater subsequent inequality (Islam and Winkel 2017, Hallegatte, Bangalore, et al. 2016). Climate change pushes people into poverty through other channels as well, including decreased agricultural and labor productivity, lack of food security, and poorer health. In worst-case climate change scenarios, an estimated 5.8 million people in LAC will be pushed into extreme poverty, resulting in a staggering 300% increase in poverty. Even under best-case climate change scenarios, an estimated 2.4 million people will be pushed into poverty, resulting in a 126% increase of poverty in LAC (Jafino, et al. 2020).

2.14 **Climate change can spur internal and outward migration in affected countries.** For LAC, the main mechanisms by which climate change results in migration are reduced water availability, reduced agricultural yields in low-latitude areas, increased flooding and droughts, and loss of biodiversity in tropical and semi-arid areas. Climate change can also cause migration via the risk of violent conflict by amplifying drivers of conflict such as poverty and economic shocks (Mach, et al. 2019, ICRC 2020). Between 2000 and 2015, an estimated eight million people in the region were displaced or evacuated due to natural disasters, many across borders (Rodríguez Serna 2015). By 2050, 17 million people in LAC could be displaced by climate change impacts, mostly within their own country (Rigaud, et al. 2018). Migration related to climate change and environmental degradation has already been observed in several countries including Brazil, Colombia, Ecuador, Argentina, and Chile (IOM 2017). On the island territory of Panama's Kuna Indigenous people, rising sea levels have reduced habitable space, forcing many inhabitants to migrate to mainland cities in Panama or Colombia (Altamirano Rua 2014). In the Northern Triangle, migration is often driven by violence and socioeconomic insecurity coupled with drought, especially

[14] GN-2741-12.

in the Dry Corridor, and a high vulnerability to increasingly intense tropical storms and hurricanes (Masters 2019). Climate change can also affect return migration in the Northern Triangle. In Central America and the Caribbean, heat episodes have been linked to migration, including youth migration, particularly to urban centers within the country (Baez, et al. 2017). Ibáñez et al. (2022) recently found that in El Salvador, each week experiencing a temperature shock is associated with a 25% increase of migration of farming households to another country, often due to lower agricultural production. Knowledge gaps remain in terms of the relationship between migration and climate change and its implications for sending and receiving communities, including return migration, in the region.

2.15 **Observed and projected climate change impacts vary across the region.** For example, climate change will have large adverse effects on terrestrial and freshwater ecosystems in the southeast and southwest parts of the region but limited effects on these systems in Central America (see Figure 2 and Table 1). Small-island and low-lying coastal states are particularly vulnerable (Rozenberg et al., 2021).

2.16 **Climate change will have a particularly substantial impact on people living in cities.** As discussed in the Urban Development and Housing SFD,[15] more than 80% of LAC's population is urbanized (United Nations Population Division 2018), so cities are where most of the direct effects of climate change on human health and well-being occur. Climate change creates heat waves that affect the productivity of urban households, increases the risk of flooding, especially in coastal cities, and can increase migration to cities. Rapid and unplanned urbanization increases the exposure and vulnerability of the urban poor to climate change impacts. Informal settlements are frequently established on flood- or landslide-prone sites, and informal dwellings are often built using substandard materials and construction techniques (Williams, et al. 2019).

2.17 **The deep uncertainty surrounding climate impacts introduces knowledge gaps and additional challenges for managing physical climate change risks** (IPCC 2022). Scientific models show the climate will certainly change, but in many cases, the direction, magnitude, and timing of the change is unknown. This uncertainty is compounded by the uncertainty of development scenarios themselves, with technology, science, and economies constantly evolving (¶2.40 considers transition risks).

2.18 **Climate change will continue to worsen.** Temperatures in 2001–2020 were already about 1°C higher than pre-industrial temperatures (IPCC 2021). Climate Action Tracker projects existing policies will result in about 2.7°C warming above pre-industrial levels. If implemented, current Nationally Determined Contributions (NDCs) could limit warming to 2.4°C above pre-industrial levels and binding long-term commitments could limit warming to about 2.1°C (Climate Action Tracker 2021) (see ¶2.28).

2.19 **Adverse climate change impacts will persist for centuries regardless of emissions reductions, making a focus on developing climate resilience essential.** Human action affects climate change with a considerable lag. Even if emissions were to drop to zero tomorrow, GHGs in the atmosphere and the effect they have on the climate system would persist.

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[15] GN-2732-11.

B. Decarbonization to contain dangerous warming

2.20 **To avoid dangerous warming, the world needs to drastically reduce emissions by 2030 and reach net-zero emissions by 2050.** Efforts to decarbonize across sectors are urgent, and they require resolving remaining technical hurdles for decarbonizing while safeguarding provision of basic goods and services, including food and energy (see Box 3 for key terminology used in this part).

Box 3. Key definitions

Committed emissions. Cumulative emissions an asset would emit over its remaining lifetime under normal economic conditions—that is, if it were to be operated at normal utilization (Davis and Socolow 2014).

Greenhouse gas (GHG). "Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation that is emitted by the Earth's surface, by the atmosphere, and by clouds (IPCC 2007). This property causes the greenhouse effect" (IPCC 2018).

Mitigation. "A human intervention to reduce emissions or enhance the sinks of GHGs" (IPCC 2018).

Net-zero emissions. Reaching net- zero carbon emissions, or carbon neutrality, means reducing emissions of GHGs due to human activities, such as fossil fuel combustion, and balancing out remaining emissions—by planting trees at scale, for example. The term **decarbonization** is used here as a synonym for reaching net-zero emissions.

2.21 **Stabilizing climate change requires reaching net-zero emissions of carbon dioxide (CO_2) and drastically reducing all other GHG emissions.** Meeting the 1.5°C target requires GHG emissions to peak as soon as possible, be halved by 2030, and reach net-zero emissions by 2050 (IPCC, 2022). Different GHGs affect climate change differently, depending on their level of concentration in the atmosphere, how long they stay in the atmosphere (ranging from a few years to thousands of years), and the strength of their warming effect (EPA 2022). CO_2 is the primary GHG emitted through human activities, and it has a virtually permanent impact on global warming (EPA 2022). CO_2 comes from the burning of fossil fuels (coal, oil, and natural gas),[16] deforestation and the destruction of other high-carbon ecosystems, and some industrial processes. Methane (CH_4) is also an important GHG. It comes from cattle, rice, and organic waste as well as leaks in coal, oil, and natural gas wells and infrastructure. Its lifetime in the atmosphere is much shorter than CO_2's, but methane traps more radiation than CO_2—each ton of methane emitted in 2030 will have the same impact on global warming by 2050 as 86 tons of CO_2 (EPA 2022). Reducing methane and other so-called short-lived climate pollutants provides an opportunity to influence climate change quickly. Nitrous oxide (N_2O), which comes from fertilizers and manure used in agriculture, is the third main GHG (see Figure 3 for a comprehensive view of global GHG emissions).

2.22 **Although per capita GHG emissions in LAC are similar to the global average, the sources of emissions differ.** Total GHG emissions from LAC, which is home to about 8.4% of the world's population, represent about 8.1% of global GHG emissions, or about 3.9 gigatonnes of CO_2 equivalent ($GtCO_2e$) of 48.9 $GtCO_2e$ in 2019 (WRI 2022). Per capita GHG emissions in LAC average about 6 tons CO_2

[16] Fossil fuels are used to generate power, in transportation, to heat buildings, and as a source of energy (mainly for heat, but also motion) in industry.

per year, close to the global average (WRI 2022). Historically, emissions from deforestation and agriculture have been more important in the region than in the rest of the world (see Figure 4).This could change in the years to come given that LAC is experiencing a faster-than-average growth in sales of private cars (Papaioannou, et al. 2022) and investing heavily in natural gas (González-Mahecha, et al. 2019). The above represent so-called production-based emissions. Consumption-based emissions in the region are higher: while about 20% of production-based emissions correspond to goods that are exported to the rest of the world, this is more than compensated by the carbon footprint of the goods and services the region imports (Dolabella and Mesquita Moreira 2022).

2.23 **In the region, the fastest growing sources of GHGs are transportation and power generation** (Fazekas, Bataille and Vogt-Schilb 2022). Future emissions are uncertain as they depend on uncertain technology trends (e.g., energy used for mining blockchain has recently surged globally), geopolitical factors (e.g., the Russian War on Ukraine has prompted some actors to reduce their exposure to oil and gas markets), consumer preferences (e.g., a surge in veganism or a taste for alternatives to beef is difficult to predict), and, most importantly, government policy, particularly policy designed to control, reduce, or eliminate GHGs.

2.24 **Urgent action is needed to avoid further carbon lock-in in sectors where long infrastructure lifespans mean fewer future replacement opportunities.** Infrastructure can last for more than 30 years (see Figure 5), and urban forms, which shape demand for transportation and relative attractiveness of different transportation modes, may last for centuries. In LAC, committed emissions from existing power plants (see Box 3) are already 10–16% higher than what Intergovernmental Panel on Climate Change (IPCC) scenarios suggest would be consistent with the region reducing emissions fast enough to reach carbon neutrality by around 2050 (González-Mahecha, et al. 2019). Worse, the power plants that are planned or under construction could double committed emissions (González-Mahecha, et al. 2019). These estimates suggest that for LAC to reach net-zero emissions by around 2050, countries in the region would need to cancel a substantial fraction of planned new fossil-fueled power plants and replace them with renewable plants, and they would need to close existing plants before the end of their technical lifetimes. This situation in the region is similar, if less extreme, than in the rest of the world (Tong, Zhang, et al. 2019).

2.25 **Technical solutions remain unknown for a small share of emissions, but they are being resolved.** In addition to the combustion of fossil energy, some heavy industries emit CO_2 as part of the physical process itself (e.g., cement, steel, and fertilizers). Emissions from these processes can be substantial, energy efficiency and fuel shifts cannot fully decarbonize them, and what technology will be used in the future to decarbonize them is unknown (Åhman 2020). Likewise, heavy-duty transportation poses special challenges. As discussed in the Transportation SFD,[17] while electrification is relatively straightforward for smaller vehicles that travel shorter distances carrying lighter loads, it is challenging for long-distance heavy trucking, shipping, and aviation, which we do not yet know how to cost-effectively decarbonize (Gross 2020) (see ¶2.37 for a discussion of the barriers to investment in emerging technologies).

[17] GN-2740-12.

C. Climate governance

2.26 **Climate action requires coordinated participation of a range of government and nongovernment parties.** These interested parties include various levels (federal, regional, and local) and segments of governments, the private sector, academia, and civil society (Fazekas, Bataille and Vogt-Schilb 2022, Delgado, Eguino and Pereira 2021, Saget, Vogt-Schilb and Luu 2020). Ongoing substantive dialogue among these parties is required to ensure that climate strategies are appropriately formulated and broadly accepted. Coordination using a territorial approach is particularly important in designing adaptation plans because the impacts of climate change on economic activity are heterogenous within countries, for instance they can differ at the watershed level (OECD 2021).

2.27 **At a global level, the foundation for international climate agreements is the United Nations Framework Convention on Climate Change (UNFCCC).**[18] The UNFCCC's aim is "preventing dangerous human interference with the climate system." The Paris Agreement is a legally binding international treaty under the UNFCCC (2015). It was adopted by 196 Parties at COP21 in December 2015 and entered into force the following year. It has three objectives: (1) limit the global temperature rise this century to well below 2°C—aiming for 1.5°C—above preindustrial levels; (2) reduce vulnerability and increase climate resilience; and (3) make financial flows consistent with a pathway toward low-GHG emissions and climate-resilient development. Parties to the Paris Agreement have agreed to periodically submit Nationally Determined Contributions (NDCs) and to strive to formulate and communicate long-term strategies (LTSs). In addition, there are biannual biodiversity conferences. At COP15 in Montreal, a landmark biodiversity agreement was reached.[19]

2.28 **LAC countries' commitments to the international climate agreement are still work in progress.** All 26 of the IDB's borrowing member countries have signed the Paris Agreement. However, existing NDCs and LTSs are not yet aligned with the long-term goals of the Paris Agreement. For instance, under the first round of NDCs submitted in the region, the share of renewable power would remain stable at around 53% by 2030, while targets consistent with decarbonization by around 2050 would require 83%–90% zero-carbon sources by 2030 (Binsted, et al. 2019). Since then, countries have updated NDCs, but they remain globally inadequate (UNFCCC 2021). The costs and benefits of updating NDCs in each country are not known precisely. NDCs and LTSs should be aligned with both climate change goals and national development goals in each sector and should be complemented with sector plans and investment plans to make the goals operational (Jaramillo and Saavedra, NDC Invest: Supporting Transformational Climate Policy and Finance 2021). Private companies and financial intermediaries are increasingly interested in preparing climate transition plans for reaching net-zero emissions, but many also face skill gaps for doing so (Delgado, Eguino and Pereira 2021).

2.29 **At the IDB Group, assessing the alignment of operations with the Paris Agreement is focused on avoiding undermining countries' transition to long-term carbon neutrality and climate-resilient development**, in accordance with the Agreement's objective to make all finance flows consistent with climate change

[18] The Convention entered into force in 1994 and today has near universal membership (UNFCCC n.d.).
[19] The IDB was an active participant at COP15, leading efforts to develop tracking methodologies for nature-positive finance.

goals. Assessing the alignment of IDB operations with the Paris Agreement mitigates the risk of the IDB Group providing financing that would hinder—or even run contrary to—countries' or clients' progress toward long-term carbon neutrality and climate-resilient development. The IDB Group's efforts to align its operations is structured on a client-centered approach, acknowledging that ownership by countries and clients is essential for effective climate action. Institutional capacities and national realities, both in the public and private sectors, vary widely throughout the region.

2.30 **The key challenge of climate governance is to ensure that in each economic sector, and at all levels of governments, actors have a clear understanding of the role they can play.** This means understanding (1) how to achieve climate-resilience and decarbonization goals, (2) the main barriers to meeting these goals, and (3) which public investments and policy instruments can be used remove these barriers and establish incentives and enabling environments to scale up climate friendly spending (Fazekas, Bataille and Vogt-Schilb 2022).

2.31 **Interested parties often have competing priorities and knowledge gaps** (Vogt-Schilb and Hallegatte 2017). Ongoing, substantive dialogue among the range of government and nongovernment parties is required to ensure that climate strategies are appropriately formulated and broadly accepted. However, dialogue, collaboration, and action are impeded by a lack of clearly defined responsibilities; weak inter-sectoral collaboration; inadequate knowledge, data, and information; a tendency to focus on short-term instead of long-term planning; overly prescriptive regulation; misaligned price signals; and missing or nonfunctioning enforcement mechanisms (Fazekas, Bataille and Vogt-Schilb 2022). For example, those barriers impede establishing early-warning systems for extreme-weather events and climate-related health hazards (such as heat waves and disease outbreaks), which are underdeveloped in LAC (WMO 2021).

2.32 **The transition to net-zero emissions is impeded both by interest groups adversely affected by transition policies and by some aspects of consumer behavior.** While decarbonization can generate overall net economic benefits, including 1% additional growth by 2030 (Vogt-Schilb 2021), unmanaged adverse impacts on concentrated interest groups can jeopardize emission-reduction policies (Vogt-Schilb and Hallegatte 2017). Changing consumer behavior patterns is also a challenge. Studies have shown that most consumers cannot readily identify the worthwhile behavior changes, from transportation patterns to diets (Thøgersen 2021).

2.33 **Consumers can be negatively affected by carbon pricing and reforms to energy or agriculture subsidies.** In the region, a US$30 per ton CO_2e carbon tax, which is lower than what is deemed consistent with reaching climate change goals,[20] would increase the price of basic goods such as natural gas (by 27%), gasoline (14%), electricity (9%), public transport (4%), and food (3%). If not offset by other policies, these price increases would consume 1.2–4.5% of households' income (Vogt-Schilb, Walsh et al, 2019). In the region, the poorest households are particularly affected , given that they spend a large share of their income in food,

[20] Stern and Stiglitz (2021) suggest that prices around US$100/t$CO_2e$ by 2030 globally would be consistent with reaching the temperature targets in the Paris Agreement.

public transport and electricity.[21] Similarly, removing energy subsidies in the region would cost households between 0.8%–4.8% of their income, depending on the country and income group, and typically aggravate poverty if not complemented with redistributive policies (Feng, et al. 2018). Importantly, from a development and political economy perspective, the relevant question is not whether reforms are regressive or progressive, but which consumers are affected, by how much, and what the government does to compensate them. The goal should be to avoid aggravating poverty and avoid creating homogenous groups of losers that have the political power to veto reforms, for instance by organizing protests or riots (Missbach, Steckel and Vogt-Schilb 2023).

2.34 **Workers and the communities that depend on them can be negatively impacted by the transition to net-zero emissions.** Although the transition to a carbon neutral economy can create 15 million net jobs in the region by 2030, with all countries winning, it would create losers and winners across sectors (Saget et al, 2020). New jobs would be created in plant-based agriculture and renewable energy sectors, and jobs would be lost in fossil fuel and cattle sectors. Regional variation in impacts can be important. For example, in Chile, replacing all coal power plants by renewable energy or natural gas is projected to destroy 4,000 jobs and create 12,000 new ones, for a net positive impact of 8,000 jobs (Vogt-Schilb, Walsh, et al. 2019). However, some municipalities with coal power plants would be particularly affected, losing 6.8% of their jobs in the worst case (Viteri 2019).

2.35 **The transition to net-zero emissions entails risk for owners of carbon-intensive assets and actors that depend on them.** Fossil fuels, including natural gas, will face increasing competition from renewables. Therefore, going forward, investments in fossil fuels risk becoming stranded assets—that is, they risk unanticipated or premature write-downs, devaluations, or conversion to liabilities (Pfeiffer, et al. 2018, González-Mahecha, et al. 2019). For instance, government plans globally project vastly more fossil fuel extraction than would be consistent with climate change goals. Current plans would lead to producing 240% more coal, 57% more oil, and 71% more natural gas in 2030 than would be consistent with limiting global warming to 1.5°C (Coffin, Dalman and Grant 2021). As such, the functionality of natural gas as a transition fuel in an energy system that decarbonizes quickly enough to become carbon-neutral before 2050 has been questioned (Welsby, et al. 2021, González-Mahecha, et al. 2019, Kemfert, et al. 2022). Climate change and climate policies also entail systemic risks for financial stability through effects on asset values, price volatility, fluctuations in the availability of inputs, and increasingly trade restrictions based on the carbon-content of commodities (Caldecott and McDaniels 2014, Caldecott, Harnett, et al. 2016, Jakob, et al. 2022). For instance, the European Union (EU) is discussing legislation to charge imported industrial goods the same charges they would pay if produced in the EU under the emission trading system. The EU is also discussing legislation to limit imports of agricultural commodities linked to deforestation.

[21] Vogt-Schilb et al. analyze the distributional impacts of carbon prices in 16 countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru, Paraguay, and Uruguay. Carbon prices are found to be regressive in all countries except Ecuador and El Salvador. In these two countries, much higher car ownership by richer households in the surveys (and thus higher gasoline use) used to make carbon prices progressive, but even in these countries, carbon prices are now likely to be regressive, as household surveys used in the study are old and the car ownership of poor and medium class household is rising very fast.

2.36 **Decarbonization has important implications for fiscal management policies.** In many LAC countries, fiscal revenue depends on exploitation of oil and natural gas. For example, between 2013 and 2018, fiscal revenues from exploiting fossil fuels amounted to 8.3% in Bolivia, 8.0% in Ecuador, 6.6% in Trinidad and Tobago, 5.4% in Mexico, and 2.5% in Colombia (OECD, ECLAC, IDB 2020). Reducing the global demand for fossil fuels in a way that is consistent with limiting the temperature increase to 1.5°C would mean that 66%–81% of oil and gas reserves in the region would remain unexploited, costing by 2035 between US$1.3 and US$2.6 trillion in forgone oil royalties and between US$42 and US$200 billion in forgone gas royalties (Solano-Rodriguez, et al. 2019, Welsby, et al. 2021). More research is needed to quantify options to replace revenues from fossil fuel revenues and the macroeconomic impact of these options. Some countries in the region will also need to reform fiscal strategies that depend on generating revenues from taxing gasoline and diesel consumption. On average, fuel taxes represented 1.1% of GDP and 5.3% of government revenues in 2018 (Bonzi Teixeira, Benavides, et al. 2022).

D. Misaligned and insufficient financial flows

2.37 **LAC faces a huge gap in both public and private investment needed to address the climate change challenge.** Achieving a climate-resilient and net-zero economy in the region will require redirecting 7%–19% of GDP, the equivalent of US$1.3 trillion every year (Galindo Paliza, Hoffmann and Vogt-Schilb 2022). The region must invest heavily in climate-resilient decarbonized infrastructure. The IDB conducted a novel exercise to quantify the investment gap for achieving the infrastructure-related SDGs for 26 countries in LAC (Brichetti, et al. 2021). The exercise covers the energy, transportation, telecommunications, and water and sanitation sectors and identifies additional needs that will have to be met if the region advances a climate agenda based on net-zero emissions. The result of this exercise shows that the region must invest a minimum of US$2.2 trillion in the next decade to achieve the SDGs by 2030. In annual terms, the gap amounts to 3% of GDP, compared with the 1.8% the region invested annually between 2008 and 2019. This estimate not only includes the investment required for new infrastructure but also to properly maintain existing infrastructure.

2.38 **A variety of risks and barriers impede investment.** Climate projects have a strong social return but are nonetheless unpalatable to public or private investors because of hurdles related to regulations, infrastructure (e.g., to enable biking, walking, and efficient public transport), or lack of knowledge or capacity to act on it (Fazekas, Bataille and Vogt-Schilb 2022). Under normal market conditions, new technologies cannot always compete with established, lower priced gray options (especially in capital-intensive sectors). The private sector alone will not take the technical, financial, and intangible asset risks absent public sector intervention. At the same time, policymakers are cautious to use public resources to support technologies for business models that are not well known. A key role for government is to identify and remove such barriers.

2.39 **Mobilizing private climate finance in developing countries entails particular challenges.** Private investors may be hesitant to invest in developing countries due to (real and perceived) risks, including (1) weak investment climate (particularly policy uncertainty for energy investments); (2) exchange rate risks; (3) lack of familiarity with emerging markets (leading to higher perceived risks);

(4) lack of a high-quality pipeline of investable projects; (5) insufficient scale of investable projects; (6) little reliable data to assess risk; (7) gaps in risk mitigation instruments; and (8) MDB incentive structures that risk 'crowding out' private capital (Songwe, Stern and Bhattacharya 2022). Higher upfront capital costs favor investments in technologies with proven effectiveness. But these technologies often entail higher GHG emissions. The uncertainty surrounding mitigation and adaptation measures (e.g., new markets and technologies) and short-term vision are also significant barriers (Fay, et al. 2015, Höhne, et al. 2015, N. Stern 2006). When policymakers, project developers, and financiers do not fully understand the technologies and processes involved, they may overestimate risk and take inappropriate or unnecessary corrective actions (Amin, Dimsdale and Jaramillo 2014). Possible future changes to policies and regulations, including international financing mechanisms, also contribute to investment risks (UNDP 2011).

2.40 **Essential financial resources can be diverted from the transition if physical and transition risks are mismanaged.** The allocation of financial resources to high-carbon sectors can lead to stranded assets that divert critical financial resources (see Box 2 for a definition of physical climate risk and Box 4 for a definition of transition risk). As discussed in the Extractive Industries SFD[22] and the Fiscal Management SFD, investing in fossil fuel extraction infrastructure can lead to stranded assets if global demand for fossil fuel declines (see ¶2.35). An emerging issue in the agriculture sector is that investments in food items associated with deforestation can, similarly, become stranded assets. For example, in 2017, more than 900 $MtCO_2eq$ emitted in Brazil was associated with soybean, cattle, and maize produced for export, 20% of which was exported to the European Union (Hong, et al. 2022). However, the European Union is now considering banning commodities linked to deforestation (Searchinger, James and Dumas 2022). If such proposals become law, countries like Brazil could see their exportation opportunities decrease. More research is needed on this issue. In addition, investments are left vulnerable to physical damage from natural disasters and others if physical climate risks are not considered, (Hallegatte, Rentschler and Rozenberg 2019). Finally, when climate risks are not well understood by markets, these risks are not appropriately priced, leading to underinvestment in green opportunities (Frisari, Gallardo, et al. 2019).

Box 4. Key definition

Transition risk. "Transition risks typically refer to risks associated with transition to a low carbon economy. Transitioning to a lower-carbon economy can entail extensive policy, legal, technology and market changes to address mitigation and adaptation requirements related to climate change. Depending on the nature, speed, and focus of these changes, transition risks may pose varying levels of financial and reputational risk to organizations. The nature and magnitude of risks will depend upon how rapidly organizations develop resilience attributes (awareness, objectiveness, diversity, and flexibility). Transition risks could include Policy; Legal; Technology; Market; Liability risk; and Reputational. Transition risks, if realized, can result in stranded assets, loss of markets, reduced returns on investment and financial penalties. A key issue is the stranding of assets that may not provide the expected financial returns and may end up as large financial liabilities" (Reisinger, et al. 2020).

2.41 **Climate-change-related financial risks can have systemic effects that threaten financial markets' stability** (NGFS 2019)**.** Vulnerability to climate change can limit a country's access to capital markets. The most vulnerable countries can pay up to 275 basis points in additional costs on their sovereign

[22] GN-3028-2.

bonds (Volz, et al. 2020), and countries most frequently affected by hurricanes are typically able to place limited debt on the markets relative to the size of their economies (Mallucci 2020). Analysis by the Bank of England indicates that overall costs of the transition will be lower if earlier action is taken to manage GHG emissions (Bank of England 2022).

2.42 **Dedicated funds offering concessional finance have the potential to cover incremental costs and absorb risk but are also complex and resource-intensive to access, particularly for small economies.** At COP15 in 2009, the Copenhagen Accord pledged that US$100 billion would be made available annually by 2020 to help developing countries reduce GHG emissions and address climate change impacts. At COP21 in Paris, this goal was extended to 2025. OECD reporting against that target showed developed countries provided and mobilized US$83.3 billion in 2021 (OECD 2022). Discussions are underway to set a new collective quantified goal by 2025 from a floor of US$100 billion per year. From 2016 to 2020, an average of US$12.5 billion in climate finance was provided to or mobilized for to LAC (OECD 2022). The proliferation of climate funds and the complexity of the system has led to inefficiencies and limited the effectiveness of such funds (Amerasinghe, et al. 2016). In addition, several countries in the region have graduated as Official Development Assistance (ODA) eligible countries, limiting their access to concessional resources. Yet, they remain critically vulnerable to climate change. Among IDB Group borrowing member countries, five are ineligible to receive ODA: the Bahamas, Barbados, Chile, Trinidad and Tobago, and Uruguay.[23] Following the OECD classification, the share of ODA that is climate-related has been consistently higher in LAC than other regions (see Figure 6).

2.43 **When countries borrow repeatedly to pay for natural disasters, debt burdens grow.** Songwe and Stern (2022) indicate that this amounts to debt-as-insurance and is inefficient and unfair if shocks are expected to be more frequent and severe in the future.

III. Evidence on the Effectiveness of Climate Change Policies and Programs

3.1 Section III presents evidence on the effectiveness of climate change policies and programs that address each of the four challenges described in Section II. It presents overviews of broad policies; details about sector-specific interventions can be found in SFDs for specific sectors. Part A summarizes evidence on adapting to climate change and building resilience. Part B presents evidence that rapid decarbonization can bring economic and social benefits and is technically viable. Part C summarizes evidence on effective governance for addressing climate change. Part D provides evidence on the ways existing and new financial flows can be aligned and diversified to support net-zero emissions and climate-resilient development pathways.

[23] According to the DAC List of ODA Recipients effective for reporting on 2021 flows, Panama was to graduate from the list on Jan. 1, 2022. Panama remains on the DAC List of ODA Recipients effective for reporting on 2022 and 2023 flows.

A. Adapting and building climate resilience

3.2 Part A presents evidence that actions to build climate resilience are indispensable for meeting other development needs, that preventive measures are more efficient than reactionary ones, and that a systemic approach is needed.

3.3 **Social protection and poverty reduction policies and programs reduce vulnerability to climate change** (Costella, et al. 2023)**.** Overall, policies that foster inclusive economic growth lead to poverty reduction, which in turn reduces vulnerability to climate change (Hallegatte, Bangalore, et al. 2016). An important example is cash-transfer programs, which offer a social safety net against adverse events, including natural disasters (Hallegatte, et al. 2020). So-called “adaptive” or “shock-responsive” cash-transfer programs that expand disbursement and/or coverage after a natural disaster have proven effective in Ecuador, Haiti, and Peru (Beazley, Solórzano and Sossouvi 2017). However, to date, such programs have been used in an ad hoc manner, and challenges remain for financing and integrating them into disaster risk management and for identifying and paying their beneficiaries (Costella, et al. 2023). In addition to cash-transfer programs, local health systems should be included as part of adaptation and climate resilience strategies to surveille populations and treat illnesses related to climate change and to manage risks to health infrastructure caused by extreme meteorological events (WHO 2021).

3.4 **Investing in adaptation and resilience is more cost-effective than responding to disasters.** Building resilience is a good investment: Empirical evidence shows a cost-benefit ratio of four to seven dollars per dollar invested in prevention (Mechler 2016, Hallegatte, Rentschler and Rozenberg 2019). Nevertheless, countries tend to prioritize emergency response. This may be because companies, small producers, and households do not always fully grasp climate risks. A mix of knowledge production and sharing, early warnings, contingency planning and financing, technology adoption, insurance, and migration from areas with untenable conditions can help manage the impact of natural disasters and extreme-weather shocks (Guerrero and Lacambra forthcoming). By adapting their operations, assets, and supply chains to climate change, private actors can plan for business continuity and protect jobs and infrastructure. In addition, the private sector can provide services and products to help others (including the public sector) build climate resilience. The private sector has unique expertise and capacity for innovating and producing new technologies for adaptation and climate resilience building (Meirovich, Gómez and Araujo 2022).

3.5 **Building protective infrastructure, reinforcing existing infrastructure, and improving site selection can enhance resilience against impacts such as sea-level rise and increases in winds, temperature, and flooding.** Resilient infrastructure is cost-effective through lower maintenance, more resistance to extreme-weather events, fewer disruptions, and increased life expectancy (Hallegatte, Rentschler and Rozenberg 2019). For instance, reinforcing dams and turbines can improve their structural resistance against extreme precipitation events (IAEA 2019). Against coastal floods and erosion, seawalls, groynes and dikes provide effective protection and can deliver additional dividends thanks to increased economic activity in protected areas, as seen for instance in Barbados where this type of investments boosted local GDP by more than 10% (Corral and

Schling 2017). Resilient materials and construction methods reduce hazard losses for a wide range of building types (Bailey, et al. 2021).

3.6 **Building climate resilience at the system level is also essential.** Reinforcing individual assets is a poor proxy for resilience because infrastructure works within interconnected systems (Hallegatte, Rentschler and Rozenberg 2019). Focusing on individual assets may fail to consider specific disruption vulnerabilities. Reinforcing infrastructure should always be considered as part of maintaining the infrastructure system functionality, for instance the ability of the transportation networks to enable international trade or access to economic activities and basic services (see Box 5) or the ability of water supply system to provide for human consumption, ecosystems and irrigation (Groves, et al. 2021).

Box 5. Blue spot analysis in the Dominican Republic and Haiti

Blue spot analysis is a tool to identify and prioritize interventions to improve road network resilience taking into account the uncertainties of local climate change impacts (Espinet Alegre, et al. 2018, Axelsen and Larsen 2014). The Resilient Transportation Infrastructure Project in the Dominican Republic project (DR-T1173) applied blue spot analysis, incorporating a risk assessment for natural hazards and the impacts of both climatic and socioeconomic uncertainties (Olaya González, Suardí Gómez, et al. 2022). Alternative adaptation interventions were compared for performance under different possible future scenarios. The alternatives were evaluated based on robustness, effectiveness, costs, and benefits for the society related to maintaining basic services related to transportation. This systematic analysis of critical points in the transportation network allowed interventions to be prioritized based on resilience and enabled more efficient public spending. A similar approach was used in Haiti (Olaya González, Dewez, et al. 2020).

3.7 **Building redundancies and diversifying sources are key options for providing resilient infrastructure services.** For example, to increase water security in the face of declining precipitation and dam levels, Australia diversified its water sources by investing in seawater desalinization and recycled water plants (Cathala, Núñez and Ríos 2018). Barbados has made rainwater collection and storage systems compulsory for large new buildings (Ekwue 2010). Redundancies built into the Belgian and Moroccan road networks guarantee continued functionality even when specific assets are disrupted (Hallegatte, Rentschler and Rozenberg 2019). In the energy sector, adaptative island schemes (i.e., planned grid separations and microgrids, which are a subset of the grid that can operate detached from the main grid) help ensure portions of the grid are stable during power outages and local electricity demand is met (IEA 2021). Redundancy is essential for health sector infrastructure as well, given the need for uninterrupted services. Strategies for building resilience in the health system include training health sector staff, developing emergency management plans in health facilities, climate proofing health infrastructures, and public education and outreach (WHO 2022).

3.8 **Ex ante disaster risk identification and management are key tools to improve resilience** (Lacambra and Guerrero 2017). Closing knowledge gaps by improving data availability, training stakeholders, and developing early-warning systems can strengthen decision making related to extreme-weather events (Hallegatte, Rentschler and Rozenberg 2019). For instance, before Hurricane Sandy hit New York City in 2012, the Metropolitan Transit Authority was able to move its trains out of flood-prone areas, minimizing potential damage to its assets and allowing service to be restored relatively quickly (Hallegatte, Rentschler and Rozenberg 2019). There is room to improve the coverage of early-warning systems in the region. Among the 10 Caribbean states that Rozenberg et al. (2021) analyzed,

they only found evidence of a state-of-the art early-warning system in Jamaica. The authors document opportunities to use mobile phones to deliver early warnings. Contingency plans for extreme-weather events can also help improve climate resilience. For example, Japan requires that companies implement disaster risk management including by defining the roles they might play during disasters (Hallegatte, Rentschler and Rozenberg 2019).

3.9 **Actions for increasing resilience of the food system include adopting new crop varieties and practices, enhancing irrigation infrastructure, and promoting financial instruments and dietary changes.** As discussed in the Agriculture SFD,[24] agriculture can be adapted to climate change by adopting climate-resilient crop varieties, matching crops to local conditions, increasing soil organic matter, implementing erosion-control techniques, and diversifying the food system (IPCC 2022). Increasing water-management efficiency and expanding irrigation infrastructure can reduce the vulnerability to droughts and rainfall variability (Moreno, et al. 2021, IDB 2019). Sun et al find that a plant-based diet of nutrient-dense crops could contribute to more resilient and sustainable agrifood systems (Sun, Z., Scherer, L., Zhang, Q. et al. 2022). Policies enhancing insurance schemes, combined with those aimed at reducing risk, can promote the adoption of financial instruments by producers excluded from the insurance market (IDB 2019, Hallegatte, Bangalore, et al. 2016).

3.10 **Nature-based solutions (NbS) can be a cost-effective way to build climate resilience while delivering other benefits** (Watkins, et al. 2019).[25] For example, mangroves, seagrasses, and coral reefs can help make coastal infrastructure investments more resilient and financially attractive (Thiele, et al. 2020). High-altitude wetlands, such as *Bofedales* in the Central Andes Mountains and *Paramos* in the Northern Andes Mountains, can promote water storage when combined with existing water reservoirs (Muñoz Castillo and Crusman 2019). And native vegetation around dams can reduce the impact of land-use change on sedimentation.

3.11 **However, several barriers impede investments in NBS.** Most importantly, while the benefits and costs of deploying conventional gray infrastructure in any given situation are relatively well understood, there are large knowledge gaps concerning green infrastructure; both its performance in providing infrastructure services and its cost depend critically on site-specific factors. Green infrastructure requires policymakers to build specialized knowledge, capacity, and, often, funding streams (Blackman, et al. 2020).

3.12 **Planning climate change adaptation often requires specialized decision-making tools that take deep uncertainty into account.** Techniques for decision-making under deep uncertainty help inform strategic decisions when interested parties do not know or cannot agree on the likelihood of future events (e.g., whether it will rain less or more) or the relative importance of different outcomes (e.g., poverty reduction versus GHG emissions reductions). Examples where such approaches are particularly relevant include the planning for water supply and transportation systems (Lempert, Miro and Prosdocimi 2021, Groves, et al. 2021)

[24] GN-2709-10.

[25] Activities associated with the protection, management, enhancement, and restoration of natural capital to develop climate-resilient infrastructure (Watkins, et al. 2019).

and managing maladaptation risks in developing tourism infrastructure. Unfortunately, such techniques are not yet being used at scale (IPCC 2022).

B. Rapidly transitioning to a net-zero economy to avoid dangerous warming

3.13 Part B presents evidence that decarbonization can bring economic and social benefits, that decarbonization is technically feasible, and that urgent action is needed in many sectors to avoid carbon lock-in and to resolve the few remaining technical challenges.

3.14 **Benefit-cost studies indicate that comprehensive efforts to decarbonize the region's economies would generate substantial net benefits.** Wind and solar are now the cheapest and most abundant source of energy available to mankind, and their cost will continue to fall; while the price of fossil fuels is more volatile and depends on exogenous factors, as demonstrated by the impacts of the COVID-19 pandemic and the Russian War on Ukraine on oil and gas prices. Decarbonization of the region's energy and transportation sectors by 2050 could generate US$621 billion in savings per year (Vergara, Fenhann and Santos da Silva 2021). For example, the successful implementation of Costa Rica's National Decarbonization Plan, which aims to create a net-zero-emissions economy by 2050, could generate US$41 billion through energy savings, reduced cost of accidents and time wasted in congestion, improvements in ecosystem services, agriculture yields, and industrial competitivity (Groves, et al. 2020). In Peru, which is far more reliant on fossil fuels to produce electricity than Costa Rica, achieving net-zero emissions by 2050 could generate more than US$150 billion in net benefits (Quirós Tortós, et al. 2021).

3.15 **Technical solutions to decarbonize are now widely available and increasingly competitive, although knowledge gaps remain.** These solutions are centered around (1) generating zero-carbon electricity; (2) replacing fossil fuels in all sectors; (3) expanding, protecting, and restoring high-carbon ecosystems, which require reducing the footprint of the food system while preserving food security; and (4) advancing toward a circular economy by improving energy and material efficiency, recycling, and improving waste management (IPCC 2022). The following subparts consider each of these pillars of decarbonization in turn, followed by a subpart on remaining technical challenges and innovation.

1. Moving to zero-carbon electricity

3.16 **Ramping up renewable energy is the best option for achieving zero-carbon electricity.** Although more than half the electricity in LAC is now generated using renewable energy sources, work remains (see Figure 7)**.** Fortunately, renewable energy is already competitive in economic terms (IEA, 2022) (see Figure 8). Renewable-based electricity generation is also more job-intensive than fossil-fuel-based generation (Jaumotte, et al. 2020). Many technologies that cut emissions from electricity generation reduce emissions in the short term but still lead to substantial future committed emissions (IDB 2019). Natural gas is an important example. In LAC, natural gas represents 52% of GHG emissions from existing power plants and 63% of committed emissions from planned power plants. Replacing planned coal plants with natural gas ones would reduce committed emissions by only around 10% (González-Mahecha, et al. 2019).

3.17 **Renewable energy has geopolitical advantages** (IRENA 2019, Vakulchuk, Overl and Scholten 2020). Unlike fossil fuels, which are concentrated in specific geographic locations, renewable energy resources are available in most countries (although countries might depend on imports of renewable energy equipment). Also, unlike fossil fuels, most renewables do not exhaust themselves and are harder to disrupt. Finally, renewable energy sources can be deployed at almost any scale and lend themselves better than nonrenewable sources to decentralized forms of energy production.

2. Replacing fossil fuels in buildings, transportation, and industry

3.18 **Electrification can help displace fossil fuels in nearly all sectors** (IPCC 2022). Beyond electricity generation, energy is used in transportation, heating, and industry. Nearly 70% of the total energy supply in the region still comes from fossil fuels (see Figure 9). Pursuing electrification makes sense in parallel to moving to zero-carbon electricity, as both transformations will take decades (Audoly, et al. 2018). Electrification also improves energy efficiency; for instance, heat pumps and electric vehicles use about three times less energy than fossil-fueled alternatives (IEA, 2022). An adequate charging infrastructure network is essential for electric mobility (González-Salas, et al. 2021). Effective policies for promoting electric vehicles include financial incentives for purchase,[26] exclusive access rights (e.g., access to high-occupancy vehicle lanes), adjusting gasoline prices, and building charging infrastructure (Hodge, O'Neill and Coney 2020). Buildings can be electrified by using on-site renewable energy and replacing fossil-fuel-based heat appliances with electric solutions, such as heat pumps and electric cooking (Minoja, Fernández and Yurivilca 2018). Industrial fossil-fuel energy use can also mostly be replaced with electricity, except for very-high-temperature processes (see ¶3.26).

3.19 **Reducing fossil fuels in transportation also requires transit-oriented urban development.** By 2050, demand for urban passenger transport is expected to increase 3.5-fold in LAC (Blanco et al., 2022). As discussed in the Transportation SFD,[27] following the “avoid-shift-improve” framework, avoiding the need for transport is the most desirable option to improve energy efficiency and reduce GHG emissions but also the hardest to achieve (Creutzig et al., 2018). It can be done by using urban design that makes walking, biking, and taking public transport easier, thereby reducing the need for private mobility. Additionally, as indicated in the Transportation SFD, the prevalence of transportation informality in LAC is high, ranging between 20–40% of operations (Barbero, Fiadone and Millán 2020); the high number of microenterprises and individual operators with limited operational and financial capacities can limit efforts to increase electromobility. While the evidence is still scarce, it suggests that using information and communication technology, also known as digitalization, to increase teleworking and reduce the need for in-person meetings to do business or to interact with the government, can marginally reduce emissions from transport—for instance the IEA found that if all office workers globally teleworked one day per week, the demand for oil for transportation would be reduced 1% (Crow and Millot 2020). Shifting from individual motorized modes such as cars and motorcycles to public transport,

[26] Notably, point-of-sale rebates have been shown to be more impactful than income tax credits (Narassimhan and Johnson 2018).
[27] GN-2740-12.

biking, and walking greatly improves energy efficiency. Improving technology can also be a way to increase energy efficiency of each mode of transport. Meeting the goals of the Paris Agreement requires a reduction of trips by private cars of at least of 8% from current levels by 2030 (WRI 2021). Public green spaces associated with transit-oriented development also help increase resilience of the urban environment (OECD 2021).

3. Promoting low-carbon agriculture and high-carbon ecosystems

3.20 **Expanding, protecting, and restoring high-carbon ecosystems, such as forests, peatlands, and mangroves, can key play a role in reaching net-zero emissions** (IPCC 2022). Growing vegetation is the cheapest and most scalable way to capture carbon back from the atmosphere (Griscom, et al. 2017). Nature-based solutions can contribute an emission reduction of between 5 and 12 Gigatonnes CO_2e globally by 2030 through protection, restoration, and sustainable management practices. Of this mitigation potential, around 60% are attributed to forests, one-fourth to grasslands and croplands, one-tenth to peatlands, and the remainder to coastal and maritime areas (UNEP and IUCN, 2021). However, relying on nature to capture carbon should not be seen as an alternative to urgent and comprehensive emissions cuts (Fankhauser, et al. 2022). Land is finite—it is not possible to plant enough trees to meet the combined net-zero targets announced by governments and corporations if GHG emission from energy and sources are not drastically reduced (Oxfam 2021). In addition, land used for carbon capture competes with land used for food production (Dumas et al 2022). The longevity of carbon storage also varies considerably among various marine and terrestrial species (Röhr, et al. 2018).

3.21 **Forests and ecosystems can be protected.** As discussed in the Environment and Biodiversity SFD,[28] policies to protect forests include limiting road-network expansion, establishing protected areas, updating farmland regulations with a stronger focus on conservation, reducing the land footprint of the food system, enforcing protection laws and land titles, and supporting continued management by Indigenous peoples (Busch and Ferretti-Gallon 2017, Searchinger, et al. 2019). Payment for environmental and ecosystem services, if carefully designed, can discourage deforestation, and create revenue for local communities (Alpízar et al., 2020), but those services can be difficult to fund (IDB 2019). Additional options to help countries preserve high-carbon ecosystems include debt-for-nature swaps or conversions.[29]

3.22 **Supply- and demand-side options are available to reduce emissions from the food system while preserving food security** (Searchinger, et al. 2019). As for supply-side factors, the emissions footprints of different foods range widely, with impacts of the lowest-impact animal products typically exceeding those of the highest-impact vegetables (Poore and Nemecek 2018) (see Figure 10). Controlling for food type, supply-side emissions depend on yields per acre of land and the types of fertilizers used. Rice and livestock emit methane directly. Improving farming practices, changing livestock feeds, and cutting the use of fertilizers without reducing yields are key options for reducing emissions while

[28] GN-2827-8.

[29] A debt-for-nature swap is “an arrangement by which an indebted developing country undertakes, in exchange for cancellation of a portion of its foreign debt, to establish local currency funds to be used to finance a conservation program” (OECD 2001).

maintaining productivity (Searchinger, et al. 2019). These are discussed more in detail in the Agriculture SFD.[30] As for demand-side factors, by adjusting the basket of which agricultural products are produced, countries can reduce their GHG emissions while improving nutritional outcomes and maintaining food security. In LAC, diets are very heterogenous. The region hosts the countries with the highest beef consumption per capita in the world, at triple European averages and 50% above North American averages, as well as countries where poverty translates into food insecurity and inadequate levels of animal protein intake (Dumas, et al. 2022, IDB 2019). On average across the region, beef consumption is responsible for 55% emissions from agriculture and 60% of emissions from land-use change while contributing only 4% of calories and 12% of protein intake (Dumas, et al. 2022, IDB 2019). At the same time, the prevalence of food insecurity in the region is very high, at more than 75% (Benites-Zapata, et al. 2021). On the one hand, cattle ownership provides food security, on the other hand, overconsumption of beef was found to cause 66,000 premature and preventable deaths in 2018 in Argentina, Brazil, and Colombia alone (Yglesias-González et al. 2022). One challenge is to improve health outcomes by choosing diets that are both nutritious and have a low impact on GHG emissions and land-use change while managing adverse impacts for livestock producers and consumers who rely on it for food security, but knowledge is lacking on cost-effective options to do so. See also ¶3.9 on increasing resilience of the food system.

4. Advancing toward a circular economy

3.23 **Circular economy can help mitigate GHG emissions from food, industry, and buildings.** The circular economy is a strategy for limiting the adverse environmental impacts of economic activity, including GHG emissions, by reducing, reusing, and recycling material and resources and improving energy efficiency (Circular Economy Coalition 2022). Improving recycling of materials can reduce the demand for resources such as plastics, wood products, and metals, as well as the energy and associated GHG emissions for processing new primary materials (IPCC 2022). To implement a circular economy, working with industry and building regulators, architects, and manufacturing and construction firms on how the products of daily life, vehicles, appliances, buildings, and infrastructure are designed, made, and packaged such that they use fewer resources, last longer, are reusable for other end-uses, and can be easily taken apart and recycled at their end-of-life can improve recyclability (Zink and Greyer 2019). Green buildings can be part of the circular economy and help improve energy and material efficiency and reduce water consumption; their adoption can be supported by adopting standards for new construction and mandating retrofitting (Alemán, et al. 2020). Energy efficiency standards can also reduce emissions from energy used in commercial, residential, and industrial appliances.

3.24 **Circular economy principles can also reduce methane emissions from organic waste.** Improving water-treatment plants and waste management can reduce methane emissions while improving health outcomes (Delgado, et al. 2021). Reducing waste and losses is also important. While this is difficult to quantify, estimates are that up to 30% of global food production, which amounts to 1.3 billion tons annually, is not consumed but lost before reaching consumers or

[30] GN-2709-10.

wasted by end consumers (FAO 2014). This amounts to 28% of global arable land being used for growing food that is lost or wasted (WFP, 2021). About 2.2 $GtCO_2e$, or around 4% of global GHG emissions, are tied to food loss and waste (WWF 2021). Inefficient market designs, inefficient subsidies, and a lack of supply and cooling chains are driving global overproduction (PACE 2021). To reduce losses and waste, cooling facilities in several parts of the supply chain (i.e., farms, storage, transport, and markets) can be installed or upgraded, and subsidies can be reformed. In addition, globally, only 2% of the organic waste produced in cities is currently reused (Ellen MacArthur Foundation 2021). Municipalities can provide separate collection systems or neighborhood drop off sites for organic wastes.

5. Remaining knowledge gaps and innovation

3.25 **Beyond existing technical solutions, continued innovation can help close remaining knowledge gaps about decarbonized technology.** Key areas for innovation include green hydrogen, energy storage, industry, and heavy and long-distance transportation. These emerging solutions are promising although their potential for mass scale is still unknown. The following paragraphs consider each in turn.

3.26 **Green hydrogen, which is produced from renewable sources through electrolysis, can be used to store electricity, generate high-temperature heat used in industry, and decarbonize some industrial processes** (Fazekas, Bataille and Vogt-Schilb 2022). Hydrogen can be used as the energy vector in heavy-duty and long-distance transportation when batteries are not a viable solution. It can also be used to produce green iron, green steel, low-carbon cement, and green ammonia used to produce low-GHG fertilizers (Bataille 2018). LAC has an opportunity to play a role in the development of the hydrogen value chain on a global scale (IEA 2021).

3.27 **Energy storage is essential to accommodate electricity grids that have a very high penetration of variable renewable energy sources** (Baik, et al. 2021, IEA 2021). Variability can be addressed by deploying flexibility, storage, and demand management options. Wind and solar can provide 60%–90% of needed power and must be supported by sufficient active-demand management and flexible clean generation (e.g., impoundment hydropower and geothermal) and storage over multiple time frames (e.g., batteries, pumped hydro, green hydrogen) to balance supply and demand (F. Saravia, et al. 2022). At high variable renewable energy penetration levels, energy storage can reduce the need to build additional reserve generation capacity (Nate, et al. 2021).

3.28 **Metals such as copper, lithium, aluminum, silver, nickel, and zinc play a key role in decarbonization** (Hund, et al. 2020). They are used to produce batteries used for energy storage and electromobility, electric appliances, renewable energy equipment (e.g., windmills and solar panels) and sustainable building materials. Demand for these metals—which LAC holds large reserves of—is increasing. The expansion of electric mobility in the region and technological innovations in the mining industry present an opportunity for growth and job creation in the mining sector (Unzueta, Sucre and Cunha 2022). As the sector grows, it will be important to carefully manage the associated environmental risks. See also the Extractive Industries SFD.

3.29 **Technologies that can decarbonize industry are emerging** (Habert, et al. 2020, Scrivener, John and Gartner 2018). Technical solutions for deep emissions reductions in cement production include (1) minimizing cement use in concrete; (2) replacing cementitious material, or complementing it with fly ash, slags, alkaline wastes, ground limestone, organic fiber, recycled plastics, or calcined clays; and eventually (3) capturing carbon and storing it. Green hydrogen, biomass, and waste can be used as substitute sources for heat in cement production. Emissions-free steel can be produced from green hydrogen or with traditional fossil fuels coupled with carbon capture and storage. Synthetic fertilizers can also be produced from green hydrogen.

3.30 **Heavy and long-distance transportation can be decarbonized with electricity and green hydrogen.** Trucks and trains can shift to zero-emissions technologies such as electricity (from batteries or cables) or hydrogen fuel cell drivetrains, depending on the availability of infrastructure and fitness for typical trip length (Fazekas, Bataille and Vogt-Schilb 2022). Water and air transportation can use batteries for short ranges (e.g., river boats and ferries), while longer-range ships and planes are projected to use zero-carbon fuels (ammonia, methanol, or other synthetic fuels made from green hydrogen) or use green hydrogen directly to replace diesel and kerosene (Davis, S. J. et al. 2018, Azevedo, et al. 2021).

3.31 **Bioenergy and synthetic fuels have potential for waste-to-energy and long-haul transportation, but face risks and uncertainties.** Conventional biofuels, such as bioethanol and biodiesel, are more expensive and carbon-intensive than fossil fuels, when the impacts of fertilizer and land use are considered. Biofuel crops use land and aggravate deforestation even if the crops are situated away from forests (Searchinger, et al. 2018, Searchinger, Kammen and O'Hare 2021). In contrast, solar and wind produce much more energy per unit of land and should therefore be favored. In addition, electric vehicles (EV) have quickly become the favored option to decarbonize short-and-medium-distance road transport. As batteries are quickly becoming cheaper and able to sustain long ranges, the market share of EVs has reached 14% of new road vehicles in 2022, from 9% in 2021 (IEA, Global EV outllok 2022). Biofuels also reduce food security, threaten biodiversity, and aggravate water scarcity, all issues that are paramount in the region (Searchinger, Kammen and O'Hare 2021), and their commercial viability often depends on subsidies that take a toll on fiscal resources (Marahrens 2022). To avoid competing with food production and biodiversity preservation, waste-based biofuels utilize used cooking oil or animal fats as feedstock, but limited feedstock availability and technological readiness have left waste to only provide 8% of total biofuels in 2021 (IEA 2022). Proposed new technologies would use non-food feedstock from agriculture to produce biofuels or synthetic fuels, including so-called sustainable aviation fuels, but their potential and future costs are unknown and they require substantial research and development to become mature (NREL 2022). Biogas from organic waste is sustainably used to generate heat for domestic and industrial applications, avoiding its release as methane in the atmosphere.

C. Strengthening climate governance

3.32 With effective legal, regulatory, and institutional frameworks, inclusive economic growth can be achieved while reducing emissions and building climate resilience. This part offers an analysis of climate change plans in LAC and considers other elements of effective climate governance, such as inclusive dialogue.

3.33 **Current NDCs are not sufficient for planning government action** (UNFCCC 2021). Most countries in LAC have submitted an updated NDC, many have set net-zero emission targets, and some have submitted an LTS (see Figure 11 and Figure 12). NDCs represent an important part of the process, but their short time horizons and focus on marginal improvements may risk investing in assets that are incompatible with long-term temperature and climate resilience goals. Also, NDCs often lack ambition (UNFCCC 2021). Nevertheless, pledges made at the 26th Conference of the Parties to the UN Climate Change Convention (COP26) in Glasgow, which are not all reflected in NDCs, could bring projected warming to below 2°C (Meinshausen, et al. 2021). A long-term perspective is essential for guiding countries' efforts and investments. However, the formulation of LTSs requires technical capacity that is not always readily available at the local level, and for this and other reasons, relatively few developing countries have developed an LTS. In LAC, Argentina, Belize, Chile, Colombia, Costa Rica, Guatemala, Mexico, and Uruguay have published an LTS as of May 2023. In addition, as of April 2023, ten member countries in the region have pledged or committed to reach net-zero emissions, most of them aiming to reach this goal in 2050, and seven others are discussing similar targets (Net Zero Tracker 2023) (see Annex II). Not all countries that have a net-zero target have submitted a corresponding NDC or LTS, and not all LTSs are aligned with net-zero pledges (see Box 6).

Box 6. Examples of Country Efforts

Chile's climate-change-framework law mandates that all key ministries and all regional government and municipalities design their own climate change plans to reach climate resilience and carbon neutrality. Costa Rica's decarbonization strategy establishes what sectoral transformations, organized over 10 lines of action will allow the country to reach net-zero emissions by 2050 and provides more than 70 government interventions for 35 agencies to implement by 2023, 2030, and 2050 to enable public and private investment in the transition (Gov of Costa Rica 2019). The government also used the plan to attract financing from international financial institutions, including the IDB and the French Development Agency (Delgado, Eguino and Pereira 2021, Jaramillo, Quiros-Tortos, et al. 2023).

3.34 **Comprehensive climate strategies can help governments develop roadmaps for implementing climate-resilience and net-zero goals and for aligning financial flows with these goals** (Jaramillo and Saavedra 2021, Jaramillo, Quiros-Tortos, et al. 2023). NDCs and LTSs provide an opportunity for countries to translate the long-term climate goals into a series of changes that need to happen in all sectors over time. The focus of the policy discussion can move to identifying barriers to change and designing government interventions that can enable the transition by removing these barriers (Fazekas, Bataille and Vogt-Schilb 2022). The rest of this section explains why comprehensive strategies designed starting from the local context are required to design and select climate policy instruments.

3.35 **Inaction and delayed action increase the cost of the transition.** For instance, a development trajectory that would allow investments in natural gas and coal power plants to continue through 2030 and then rapidly change course toward reaching net-zero emissions by 2050 would result in stranding US$37–90 billion worth of power plants in LAC more than a trajectory that immediately starts investing in the transition to a net-zero energy system (Binsted, et al. 2019). More generally, to the extent that renewable energy technologies are cheaper than

fossil-fuel based alternatives and ex-ante adaptation is cheaper than ex-post reconstruction, delaying climate action results in net costs.

3.36 **In theory, carbon pricing can help incentivize the transition to a low-carbon economy.** Carbon prices can be imposed using domestic carbon markets or carbon taxes (Goulder and Schein 2013). The idea behind carbon price pricing is to internalize the climate change externality by making it more expensive to pollute, thus creating an economic incentive for emitters to reduce their emissions (Nordhaus 1991). The oldest carbon tax in the world was implemented by Sweden in 1991, at US\$30/tCO_2, and later increased to US\$132. This tax, when added to an expanded value added tax in the country to cover gasoline, is estimated to have reduced transportation emissions by 11% (Andersson 2019). See ¶3.55–3.57.

3.37 **In practice, carbon prices have so far had a marginal impact** (Lilliestam, Patt and Bersalli 2021, 2002; Green 2021). As discussed in the Fiscal Management SFD, empirical studies have found that carbon pricing has had a limited impact on emissions. Globally, 43 countries have implemented domestic carbon prices (most of them under the European carbon market). A recent review of 37 studies finds that the aggregate emissions reductions from existing carbon pricing is limited to between 0–2% per year (Green 2021). In addition, the evidence suggests that carbon prices have achieved these reductions by incentivizing marginal operational changes—such as using existing gas power plants instead of existing coal power plants—but not necessarily resulting in investments into the technology and infrastructure required to reach net-zero emissions—such as to deploy more wind and solar power (Lilliestam, Patt and Bersalli 2021, Lilliestam, Patt, and Bersalli 2022). One reason is that existing carbon prices tend to have a limited coverage of economic sectors; for instance, emissions from agriculture or private transport are often exempted. Another reason is that carbon prices tend be set at low levels (Lilliestam et al, 2021). In LAC, only five countries have a carbon tax, and all five have low coverage and rates (Forero, Rasteletti and Urrea 2022). Carbon markets in the region suffer from the same limitations (Aiello, et al. 2018). A related reason is that carbon pricing faces political economy challenges that limit significant price increases, as they create immediate economic losses concentrated on the owners of polluting capital, such as the owners of coal power plants or households who depend on combustion engine vehicles to commute to work (Jenkins 2014, IMF 2019, Rozenberg, Vogt-Schilb and Hallegatte 2020). These challenges can be overcome through gradual implementation, compensating vulnerable families and companies, using policy instruments that focus on incentivizing new investments, such as feebates instead of carbon prices, and using public consultations and communication strategies to design and explain policy packages (Rozenberg et al, 2020; IMF, 2019b).

3.38 **Many barriers prevent public and private spending in net-zero solutions** (Fazekas, Bataille and Vogt-Schilb 2022). As discussed more in depth in the respective SFDs, these include lack of infrastructure, regulations that prevent investment in net-zero solutions, high upfront costs of net-zero solutions, lack of knowledge, information, or capacity to act on them, and political economy issues. For instance, the absence of sidewalks, dedicated lanes, and traffic lights can make walking and biking less convenient and more dangerous than transportation in a private car. Market design can disincentivize the use of renewable energy or electric buses, despite lower lifetime costs. Trade tariffs can favor production of dirty goods domestically or impede the imports or critical goods and services

needed to reduce emissions (Dolabella and Mesquita Moreira 2022, Jakob, et al. 2022). The upfront costs of insulating buildings and switching to electric stoves, electric water heaters, and efficient heat pumps pose a significant barrier for most households. Farmers often have limited capacity to monitor or improve their use of synthetic fertilizers. Most households do not know the relative carbon content and health benefits of different diets. And finally, the phasing out of coal, oil, and gas power plants can be made difficult by the negative impacts it has on affected workers and communities, despite the net-positive socioeconomic impacts for society overall.

3.39 **Dozens of government interventions at the sector level are thus needed to enable a transition to a low-emission or net-zero economy** (Fazekas, Bataille and Vogt-Schilb 2022). As discussed in the respective SFDs, these include, among others, actions to build the necessary infrastructure, regulatory reforms, getting prices right or providing targeted subsidies, filling knowledge gaps, building capacity, providing information, and managing the political economy. To provide examples, governments can build sidewalks and bike paths that support safe walking and biking. They can redesign public transportation and electricity markets to enable profitable business models for electric bus drivers and renewable energy operators (Beltrán Real, Lefevre and Mojica 2021). They can mandate a fraction of new buildings to be well-insulated or ready for distributed solar energy, leveraging lower costs at the construction phase, or they can subsidize heat pumps or electric cookstoves. Governments can refocus their agriculture programs on GHG-conscious practices and inform citizens about healthy diets based on low-emission footprint products. They can ensure that workers and communities affected by the downsizing of coal power plants participate in the design of just transition policies and receive compensation and support to adapt. Governments can also use public procurement processes to create markets for green materials and lead the way with electric fleets, energy-efficient public buildings, or environmentally conscious meals in public schools and offices (Salazar Cota, Fernández and Dalaison 2018).

3.40 **Regulatory frameworks, institutional arrangements, and budget instruments are effective at reducing disaster risk.** For instance, governments can use mandatory criteria in their systems of public investments to make sure that government agencies analyze disaster risk and means to reduce when designing infrastructure projects (Lacambra and Guerrero 2017). Empirical evidence compiled by the IDB indicates that improvements in risk governance of 1%, measured through the Index of Governance and Public Policy in Disaster Risk Management (iGOPP), are associated with an average reduction of 3% in human casualties caused by disasters and of 6% in economic losses (Guerrero and Lacambra 2020, Guerrero and Lacambra forthcoming).

3.41 **Government interventions to enable a transition to a low-carbon and climate-resilient economy need to be investigated and decided at the sector and territorial levels** (Fazekas, Bataille and Vogt-Schilb 2022)**.** The examples above are not meant to rank the most important barriers or government interventions to enable the transition. Indeed, we do not know which government interventions to prioritize, as this depends on the local context. In addition, many of the barriers to climate action, such as misaligned tax incentives, lack of infrastructure, or counterproductive regulations are man-made and depend on the circumstances of each country. What government agency and level of government (e.g., municipal

vs. federal) should intervene depends on local institutions and legal attributions. A territorial approach is also useful to align climate, social, environmental, and economic objectives, as it enables a wholistic view of disaster risk management, agriculture and rural development, natural resources (including potential for renewable energy generation), water security, urban development, and tourism which are heterogenous within countries as they manifest at the local level**.** For example, in rural areas, unsustainable agricultural practices can reduce soil quality, increase GHG emissions, and affect hydrological cycles (Elmqvist, et al 2011). Governments should identify and manage these tradeoffs. Finally, the scope of the problem is too large to be addressed in this document, as in each sector, many different barriers typically prevent spending in net-zero solutions. These are discussed more in detailed in the respective SFDs (¶1.2) or dedicated IDB publications (Fazekas, Bataille and Vogt-Schilb 2022)**.** Countries can use this information and the instruments of the Paris Agreement, that is NDCs and LTS, to build their own diagnostic of the barriers and design their own plans of government interventions to transition to net-zero, climate-resilient economies (see ¶3.34). See Box 7.

Box 7. IDB's Amazon Initiative

In the Amazon region, the IDB is working on climate and nature as an integrated sustainability agenda. The IDB's Amazon Initiative has four thematic areas: (1) infrastructure, connectivity, and cities; (2) human capital; (3) agriculture and sustainable cattle; and (4) bioeconomy. To achieve sustainable and inclusive development in the Amazon, forest conservation and protection of traditional populations must be central to all operations and investments. Climate change mitigation and resilience are also core elements in all programs. Under the initiative, the IDB is working to advance nature-based solutions, sustainable landscape practices, and programs that sit at the intersection between social protection and climate resilience.

3.42 **Local governments can play a key role in identifying the adaptation measures that are best suited to their land and constituents.** The concentration of people in cities makes managing physical climate risk in them particularly important (see ¶2.16). An analysis of NDCs in LAC shows the relevance of including subnational governments in their design, update, and implementation, as NDC targets touch upon issues such as mobility, buildings, and waste management that are often managed at the local level (Vera, Uribe and Del Castillo 2023). Designing climate-resilient and low-carbon cities today is much easier than modernizing them tomorrow (Birkmann, et al. 2022). Although many cities are already addressing climate impacts, adaptation is a complex challenge and obstacles remain, such as the lack of knowledge, current local data, the absence of finance, and institutional constraints (Vera, Uribe and Del Castillo 2023). Promoting climate resilience in cities is a broader opportunity to achieve economic growth and solve urban problems.

3.43 **Dialogue between diverse actors is required to ensure the relevance and broad acceptance of climate strategies** (WRI 2020, Calfucoy, et al. 2022). This includes the various levels (federal, regional, and local) and segments of governments, the private sector, academia, and civil society—across all sectors. For instance, the health sector can coordinate and share information with governmental, nongovernmental, and international agencies to establish early-warning systems against heat waves or diseases associated with climate change (World Bank 2017). Engaging ministries of finance can put climate change at the center of domestic decision-making (Cárdenas, Bonilla and Brusa 2021, Delgado, Eguino and Pereira 2021) and ministries for energy, agriculture, transportation,

and water are essential to the process (Fazekas, Bataille and Vogt-Schilb 2022). Social and labor ministries are also critical to ensuring that climate resilience and a just transition are considered in the design and implementation of climate policies (Saget, Vogt-Schilb and Luu 2020). An IDB study found that linking climate change goals to domestic priorities is essential to garner the buy in of the private sector, academia, and civil society (Calfucoy, et al. 2022). How challenging it is to coordinate between sectors and levels of governments is influenced by the source of the institutional mandate that justifies the design of climate policy (e.g., long-term climate goals enacted in a law, international commitment, or mandate given by head of state) and how prominent climate goals are in the policy debate (WRI, 2020). Evidence is still lacking on the relative merits of different approaches to coordinating actors and involving subnational governments (Solecki, et al. 2021, WRI 2020).

3.44 **Availability of reliable data is key for developing informed climate policies.** For instance, in the energy sector, using accurate data on weather allows wind power plants to minimize damage by shutting down their facilities before a hurricane strike (Hallegatte, Rentschler and Rozenberg 2019). Countries need to build capacity for reporting climate actions using comparable metrics (Singh, Finnegan and Levin 2016). The Paris Agreement established an enhanced transparency framework for action and support in which countries regularly provide an inventory of emissions and removals, information on climate impacts and adaptation, and information on financial, technology-transfer, and capacity-building support provided, needed, and received (Singh, Finnegan and Levin 2016). Further investment in data and statistics is needed to enhance climate policies.

3.45 **Information campaigns and educational interventions can aid effective climate governance.** At an individual level, evidence suggests that people have little knowledge about what climate action they can take: they underestimate GHG emissions associated with air travel and meat consumption, and in general, do not have the information they need to assess the merits of climate-friendly behavioral changes (Wynes, Zhao and Donner 2020). Making more information available about these changes through, for example, carbon labeling and mainstreaming climate change and green skills into all levels of education may help facilitate behavioral change (Thøgersen 2021). Extending communication strategies for showing the negative effects of energy subsidies and positive effects of comprehensive reforms that include compensation mechanisms have been shown to effectively improve the odds of successful subsidy reform (Vieites, et al. 2022).

3.46 **Policy packages can be designed to benefit consumers.** Cash transfers, which are present in all countries in the region, are a keyway to compensate poor households for the impacts of pricing policies aimed at cutting GHG emissions, including reducing fossil fuel subsidies. Existing cash-transfer programs are not a perfect vehicle for that purpose (Missbach, Steckel and Vogt-Schilb 2023). Because some rich or middle-class households benefit from transfers, it costs, on average, US$2 to send every US$1 to a household in the bottom 40% of the income distribution (Feng, et al. 2018). But fossil fuel subsidies are an even less efficient way to reach the poor since a larger proportion of the benefits accrue to the rich. For example, it costs US$12 to deliver US$1 to the bottom 40% using gasoline subsidies (Feng, et al. 2018). As a result, if governments repurpose 10–35% of revenues from diesel, gasoline, electricity, natural gas, or liquified

petroleum gas (LPG) subsidies to increase existing cash transfers, poor households become net beneficiaries of subsidy reform (Feng, et al. 2018). In-kind transfers are also an option for compensating households (Missbach, Steckel and Vogt-Schilb 2023, Schaffitzel, et al. 2020). For instance, in Ecuador, removing gasoline, diesel, electricity, and LPG subsidies while increasing the main domestic cash transfer per household by US$17/month and providing one free LPG cylinder and free public transportation to the bottom-40% households would eliminate all poverty impacts of the subsidy removal while saving the government US$1.6 billion per year (Schaffitzel, et al. 2020).

3.47 **Policies can be designed to ensure a just transition of the workforce.** To facilitate a just transition to net-zero emissions, policymakers must anticipate the effects of decarbonization on labor markets through active labor policies and upskilling and reskilling for low-carbon jobs. Social protection programs such as unemployment benefits also play a role in the just transition by supporting workers while they transition from one job to another. The impact on the quality of employment will depend on how workers, firms, and governments react to the transition (Saget, Vogt-Schilb and Luu 2020). For example, in the energy sector, emerging activities, such as electromobility, batteries and storage, energy efficiency, hydrogen, and demand management, have the highest potential for creating jobs; according to one study, investing US$1 million in these areas can directly create between 11 and 36 jobs (Ravillard, et al. 2021). Specific policies are needed to ensure gender equality. Saget et al. (2020) found that more than 80% of the new jobs created by the decarbonization agenda in LAC will be in today's male-dominated sectors. Women will not benefit from job creation unless the current gender segregation by occupation is addressed (Saget, Vogt-Schilb and Luu 2020). One study of the impact of the energy sector's transition to net-zero emissions on labor markets concluded that renewable-energy-generation companies are recruiting women particularly for non-STEM positions (Arias, et al. 2022).

3.48 **A long-term view can help countries minimize and compensate for the financial, trade, and fiscal impacts of stranded assets** (Delgado, Eguino and Pereira 2021). Some fossil-fuel-producing countries, like Uganda and South Africa, have quantified the macroeconomic impacts of their fossil fuel assets becoming stranded (including on trade balance and GDP), assessed the distribution of the impacts within the country (e.g., between distinct levels of government or between private and public sectors), and anticipated what investments would worsen the situation. As a result, they have planned for the progressive phaseout of fossil fuels and diversification of the economy (Huxham, Anwar and Nelson 2019, Huxham, Anwar and Strutt, et al. 2020). In countries that tax gasoline and electric vehicles, a long-term fiscal strategy can identify alternative revenue bases—such as electricity, vehicle ownership, and usage (e.g., road tolls)—that can be mobilized progressively to preserve fiscal balances as the transportation sector is decarbonized while incentives to switch to electric mobility are maintained (Rodríguez-Zúñiga, et al. 2021). Because electric mobility is fundamentally cheaper than fossil-fuel mobility, switching to electric vehicles brings a net economic benefit to society, that can be distributed into gains for car owners and fiscal revenues (Rodríguez-Zúñiga, et al. 2021).

3.49 **A supportive regulatory environment is needed to promote innovation** (OECD 2019). Developing incentives for science, technology, and innovation to

concentrate efforts on climate action will be fundamental. Coordination among government and private sector actors is key for sharing technological risks, catalyzing new business models, and paving the way for solutions that do not yet exist or are underdeveloped due to market failures. Policy options include: (i) financing of pilot and demonstration projects to support learning, research, and development to test technical and economic feasibility; (ii) talent training and knowledge intermediation programs; (iii) public purchase of innovations to establish sufficient and constant demand; and (iv) financing of solutions in different degrees of technological maturity to share risks and accelerate technological adoption in multiple sectors. The private sector offers key opportunities to promote new market-driven solutions for climate change. With most innovation flowing from the private sector, accelerating the development of solutions is key.

3.50 **Digitalization can be part of improving climate governance.** Digital technology, also known as information and communication technology, can improve the efficiency and responsiveness of the government and the private sector. For instance, early warning systems via text message are one of the most cost-effective interventions to reduce fatalities from natural disasters (S. Hallegatte, A. Vogt-Schilb, et al. 2017). Digitalization of personal finance is also key for building resilience, for instance by enabling governments or other organizations to deliver humanitarian aid or post-disaster relief to remote communities in the form of digital transfers (ibid.). Digital technology can also improve the resilience of services; for instance smart grids, which use remote sensors and switches to digitalize the operation of power transmissions and distribution systems, can enhance the ability of energy operators to integrate variable renewable power sources, and to respond against disruptions and extreme-weather events (IEA 2021). Digitalization can also help reduce emissions, for instance by reducing demand for transportation (see ¶3.19), but the energy and carbon footprint of digitalization also needs to be managed. In general, servers and computers consume very little energy compared to the alternatives they displace (e-mail and web servers typically consume much less energy and emit much less GHGs than using physical mail or doing paperwork in person). However, blockchain-based technologies can be an exception: those used to create transparent and secure ledgers used more energy than Spain in 2022 (Gschossmann, et al. 2022). Alternative software can be more efficient (ibid.). Also, to contribute to climate mitigation, computer servers and digital hardware can be designed with energy efficiency and ease of recycling in mind (García Zaballos and Iglesias Rodriguez 2018).

D. Diversifying and aligning financial flows

3.51 **Most climate action will be financed by redirecting the everyday spending decisions of households, firms, and governments** (Galindo Paliza, Hoffmann and Vogt-Schilb 2022, Songwe, Stern and Bhattacharya 2022). The climate strategies discussed in the previous section are essential to enable such a redirection. In addition, a variety of financial tools and instruments can incentivize (re)allocating financial flows for climate action. This part provides an analysis of (1) financial system oversight; (2) environmental tax reform and carbon markets; (3) sustainable debt instruments and green budgeting; (4) climate risk financing; and (5) the role of MDBs, in particular for climate finance.

1. Financial system oversight

3.52 **Global financial regulators and supervisors are promoting sustainable finance and integrating climate change risks into their financial-stability mandates.** To assess financial-stability threats, central banks and supervisors have been introducing scenario analysis and climate change stress testing (BoE 2022). To facilitate sustainable markets' growth—while preventing market abuse and greenwashing—regulators are introducing various tools. The EU, China, and Colombia have issued sustainable finance taxonomies to clarify which investments can be considered sustainable and aligned with scientific evidence, to prevent misrepresentation, and to reduce transaction costs (Ehlers, Gao and Packer 2021). In addition, the International Sustainability Standards Board (ISSB) is issuing standards for sustainability disclosures, aiming to facilitate reporting from issuers and to provide investors with transparent, fair, and comparable information on sustainability performance (aligned with the Task Force on Climate-Related Financial Disclosures (TCFD) framework and the Sustainability Accounting Standards Board (SASB) standards). Finally, the U.S. Securities and Exchange Commission is forming a Climate and ESG Task Force in the Division of Enforcement with a mandate to protect investors from misrepresentation of sustainability disclosures by companies, financial intermediaries, and market entities (SEC 2021).[31]

3.53 **Financial markets in LAC are making use of a combination of regulatory, supervisory, and voluntary practices to transition toward sustainable finance.** While a handful of countries in the region have established financial regulation that addresses climate change as either a risk or an opportunity (Brazil, Chile, Colombia, and Paraguay), most regulators' actions have focused on supervision, market education, and capacity building (in Costa Rica, Mexico, and Panama) (Frisari, Gallardo, et al. 2019). Nevertheless, many countries financial institutions have advanced with self-regulation initiatives, such as the Green Protocols (Brazil and Colombia), the Public-Private Sustainable Finance Roundtable (Argentina, Chile, and Panama), and the Sustainable Committees for banks and capital markets (Mexico) (Frisari, Gallardo, et al. 2019). Improving data through standardized assessment frameworks can enable private sector actors to better understand (and be willing to take on) risks (Songwe, Stern and Bhattacharya 2022).

2. Environmental tax reform and carbon markets

3.54 **Governments can raise resources through environmental tax reforms.** Currently, the region shows low levels of environmental taxes, subsidizing fossil fuels instead. In 2018, on average countries in the region spent 1.1% of GDP on fossil fuel subsidies, well above the global average of 0.7% of GDP (Conte Grand, Rasteletti and Muñoz 2022). In addition, taxes on fossil fuels tend to be low in the region. As a result, net collection from fossil fuels averages 0.06% of GDP, compared to 0.7% of GDP globally (ibid).[32] Environmental tax reform, that would

[31] As of August 2022, ISSB and SEC have published draft requirements for climate-related financial disclosures, aiming at effectiveness in 2023.

[32] Excluding Venezuela, on average countries spend 0.65% of GDP on subsidies, and the net collection is 0.46%.

remove subsidies and implement efficient taxes on fossil fuels, could raise around 3.8% of GDP in the average country in the region (Coady, et al. 2019).

3.55 **Mandatory and voluntary carbon markets modestly contribute to climate financing.** In 2021, mandatory carbon markets globally reached US$56 billion, with 60% of that generated by the EU ETS (Songwe, Stern and Bhattacharya 2022). The voluntary market, in which private company and other nonstate actors buy offsets to compensate their carbon footprint, was worth nearly US$2 billion the same year, and is projected to reach US$10–40 billion globally by 2030 (Songwe, Stern and Bhattacharya 2022). The voluntary market can provide funding directly for emission reduction or carbon removal projects in the region. One issue however is that current prices on the voluntary market are low, averaging US$4/t$CO_2$e (Songwe, Stern and Bhattacharya 2022). Important knowledge gaps remain on the potential for carbon markets to provide substantial funding to countries in the region.

3.56 **Scaling the voluntary market could require improving its transparency, stringency, and efficacy** (Haya, et al. 2020, Songwe, Stern and Bhattacharya 2022)**.** For a voluntary market to operate with integrity, its activities should be additional, permanent, and avoid leakage. Unfortunately, the state-of-the-art offset credits do not meet these standards. While under half of all credits in the market in 2021 were provided by forestry projects, an international consortium of journalists found that 90% of credits certified by a leading agency did not actually result in emission reductions (Greenfield 2023). Academic studies have similarly found that offsets traded in the voluntary market are often allocated to projects that would have been built anyway (Calel, et al. 2021), and that forestry projects overestimate emission reductions (West, et al. 2020). Another critique of offsets is that they incentivize buyer organizations to neglect emission reductions (Calel, et al. 2021, Haya, et al. 2020). Organizations willing to contribute to reaching net-zero economies should use all levers available to reduce emissions from their operations and use offsets only as a last resort (SBTi 2023, Fankhauser, et al. 2022). Country-led transition planning could help ensure integrity by providing confidence in baseline emissions, targeted emissions reductions, and identifying projects that deliver those reductions (Songwe, Stern and Bhattacharya 2022, Haya, et al. 2020).

3.57 **Article 6 of the Paris Agreement limits the ability of countries to use carbon offsets to meet the emissions reduction targets stated in their NDCs.** To avoid double counting, Article 6.5 establishes that emission reductions financed through internationally transferred mitigation outcomes should count towards meeting either the buyer’s or the seller’s emission reduction commitments but not both (UNFCCC 2015). Also, the institutional architecture around Article 6 is not yet complete. Specific regulations are missing for both Article 6.4 (the evolution of the Clean Development Mechanism, defining rules and governance for a regulated global market) and 6.2, which frames the possibility of transactions of credits (called Internationally Transferred Mitigation Outcomes) between countries and the "new conditions" under which the Voluntary Carbon Market should operate, as well as local/national markets (Di Leva and Vaughan 2021).

3. Sustainable debt instruments and green budgeting

3.58 **Institutional investors' interest in sustainable assets is increasing.** Green bonds, sustainable bonds, and sustainability-linked bonds can contribute to financing climate action (Galindo Paliza, Hoffmann and Vogt-Schilb 2022). So-called ESG debt can be structured as either use-of-proceeds (proceeds used exclusively to finance projects with clear environmental, social, or governance benefits) or target-linked (proceeds used for general purposes with progress tracked using key performance indicators) (Núñez, Velloso and Da Silva 2022). Green bonds have a marginal pricing advantage to the issuer over conventional bonds, referred to as the green premium or "greenium." Greeniums are small compared to country spreads and typical day-to-day variations of market rates. For instance, Colombia simultaneously emitted green and conventional bonds in 2021 with financially identical terms, and the green bonds traded on average at 10 basis points below conventional bonds (Hussain 2022). The total market for sustainable bonds[33] was US$600 billion in 2020 (Lester 2021). Green bond issuance in LAC went from $US13.6 billion in September 2019 to $US30.2 billion at the end of June 2021 (Green Finance LAC Platform 2022). See Annex II for the list of countries in LAC that have issued sovereign green bonds. Redirection of pension funds, which in LAC amount to approximately US$3 trillion, can also contribute to climate action (Cavallo, et al., 2020). However, the demand for liquid and scalable assets is not well matched to the supply (mostly private and small transactions) (Frisari, Trabacchi, et al. 2020).

3.59 **To tap these funds, governments need to develop clear climate targets and work with the private sector to set up portfolios of sustainable and economically viable investment projects** (Delgado, et al., 2021, Conde and Sanz, 2021). Governments can also play a role by establishing mandatory standards, which, in combination with existing voluntary ones, may help prevent greenwashing – making misleading, false, or unsubstantiated statements or claims about the sustainability of a product or a service (Gatti, Seele and Rademacher 2019). The IDB and IDB Invest provide technical assistance to build investor confidence by promoting transparency, participating in anchor investments, and issuing partial credit guarantees. Since 2019, the IDB has supported four countries to issue 23 sovereign thematic bonds that raised US$33.4 billion.

3.60 **Accounting for climate risk and expenditures in government budgets can help mobilize resources for the transition to a net-zero-emissions and climate-resilient economy** (Delgado, Eguino and Pereira 2021). Accounting for both public and private expenditures in climate change, increasing available information about climate-related risks, and establishing disclosure regulation can help decision-makers assess the exposure of their assets to climate change, which will improve their investment allocation and help fund green infrastructure.

4. Climate risk financing

3.61 **A range of financial instruments can help countries manage physical climate risk.** For medium to high probability, low impact events, governments can use budget (re)allocation, contingency funds, and reserve funds to absorb losses. For lower probability and medium- to high-impact events, additional risk retention

[33] Includes green bonds, social bonds, sustainable bonds, and sustainability-linked bonds.

options include contingent credit and climate-resilient debt clauses. For very low probability, very high-impact events, risk transfer options include insurance, catastrophe bonds, and risk pools (Figure 13).

3.62 **MDBs provide finance** (see ¶3.67) **and technical assistance targeting risk reduction**, recognizing that investing ex-ante in adaptation and resilience is more cost-effective than responding to disasters (see ¶3.4). In particular, the IDB's Index of Governance and Public Policy in Disaster Risk Management (iGOPP) systemically evaluates the existence of legal, institutional, and budgetary conditions in IDB client countries to facilitate disaster risk management (Lacambra, Suarez, et al. 2014). In addition, the World Bank Group recently began publishing Country Climate and Development Reports, which provide integrated diagnostics of climate change and development considerations and suggest concrete actions to support a low-carbon, climate-resilient transition.

3.63 **Contingent loans are arranged ex-ante so they can provide liquidity soon after a disaster.** The IDB's Contingent Credit Facility for Natural Disaster Emergencies (CCF) issues loans with predefined parametric triggers (type, location, and intensity) and strong incentives to reduce risks and improve DRM. As of November 2022, CCF loans that include climate-risks cover 12 countries with over US$2.6 billion. Other IFIs also offer contingent loans: (1) the World Bank catastrophe deferred drawdown option (Cat DDO) requires a satisfactory DRM program and predefines triggers (usually the declaration of a state of emergency), (2) the IMF Rapid Credit Facility provides rapid concessional financial assistance to qualifying low-income countries facing an urgent balance of payments need from a wide variety of circumstances, including natural disasters (IMF 2023), and (3) the Asian Development Bank's Contingent Disaster Financing under Policy-Based Lending in Response to Natural Hazards bases eligibility to withdraw funds on the achievement of prior resilience-related policy actions and disburses when a state of emergency is declared (Cissé 2021).

3.64 **Climate-resilient debt clauses—sometimes referred to as "hurricane clauses"—are gaining momentum.** Under such clauses, borrowers have the option to defer principal repayments for two years after the occurrence of an eligible event and pay those amounts in future amortization installments. The deferred payments allow the country to cover public expenses at its discretion. Calls for their use in MDBs' (and other debt issuers') lending instruments are growing, including through the Bridgetown Initiative (see ¶3.66) (Barbados Ministry of Foreign Affairs and Foreign Trade 2022) and G20 (G20 2023). As of March 2023, the IDB is the only MDB to offer a climate-resilient debt clause, called the Principal Payment Option (PPO). The clause has been included in all new loans since 2021, but only borrowing member countries with an active Contingent Credit Facility loan are eligible to use the option, as the parametric triggers are defined in the CCF loan. Thus far, two countries (Bahamas and Barbados) have purchased the option (in both cases covering hurricane risk), but the PPO has yet to be triggered. IDB Invest offers a similar climate-event clause. It allows clients to reschedule capital payments for one year after extreme weather events (if the client meets certain requirements). The clause has already been used in four loans (Meirovich, Gómez and Araujo 2022).

3.65 **Climate risk insurance and catastrophe bonds can improve protection against climate-related loss and damage** (BMZ 2022). At the sovereign level, regional insurance pools are an option. The proportion of insured losses is below

10% globally, in part due to high premiums and basis risks (Munich RE 2022). Governments can insure specific public assets against disasters, prioritizing critical infrastructure (Cissé 2021). Climate risk insurance can also protect individual households (Solórzano and Cárdenes 2019). Despite the rise in coastal hazards due to climate change, there is continued demand for housing through new coastal residential development. This suggests that including the cost of mandated insurance in the price of coastal property would underscore the climate-change-related risks of investing in coastal property (Storey, et al. 2020). Governments have a role to play in creating and enforcing quality standards for parametric insurance products (Cissé 2021).

3.66 **A key outcome at COP27 was the agreement to provide loss and damage funding to developing countries that are particularly vulnerable to the adverse effects of climate change.** A transitional committee to operationalize funding arrangements has begun meeting and developed a workplan (United Nations 2023). Losses and damages may be economic or non-economic and can result from extreme weather events and slow-onset changes (Bhandari, et al. 2022). We do not know yet how this agreement will affect countries in the region.

5. Role of MDB climate finance

3.67 **MDBs and other public financial institutions play an important role in ensuring vulnerable countries are not shut out of development finance, particularly in relatively riskier areas where the poor reside.** In 2021, climate finance from MDBs to LAC reached US$10.8 billion (see Table 2 and Table 3 for a breakdown by sector). At the IDB, climate finance as a share of total approvals has increased from 18% in 2016 to 43% in 2022, largely thanks to consistent mainstreaming across sectors and instruments. Furthermore, the CCAP sets a series of actions to promote the consistency of all financial flows with low-carbon and climate-resilient development and to integrate Paris Agreement alignment into IDB and IDB Invest operational procedures. See the IDB Group CCAP 2021–2025 Implementation Progress Reports[34] for further information.

3.68 **MDBs are a key channel of concessional and blended resources, which can help create markets and address market failures when used strategically.** Key uses of concessional finance include reducing risk and piloting new projects to crowd in private capital (IFC 2020, OECD 2022). MDB funds are instrumental in mobilizing further resources. For example, Viguri et al. (2021) found that for every US$1 of IDB financing, an additional US$2.6 of other resources was mobilized. IDB Invest increased its private capital mobilization from US$425 million in 2016 to US$1.9 billion in 2021. Concessional funding in climate finance transactions served to reduce the risks of investing in new technologies like bifacial solar panels or battery storage. The strategic allocation of scarce blended finance resources has focused on creating knowledge spillovers that can affect market behavior and fixing weak links in complementary production networks.

3.69 **MDBs have limited capital and there are numerous calls for MDBs to extend it further to address climate change.** The G20 International Financial Architecture Working Group has reviewed MDBs' Capital Adequacy Frameworks, recommending shifts to (1) adapt approach to defining risk tolerance, (2) give more credit to callable capital, (3) expand uses of financial innovations (see Box 8), (4)

[34] 2021: GN-2848-11. The 2022 report is forthcoming.

improve credit rating agency assessment of MDB financial strength, and (5) increase access to MDB data and analysis (Léautier, F., et al 2022). In addition, the 2022 Bridgetown Initiative for the Reform of the Global Financial Architecture calls for the expansion of multilateral lending by US$1 trillion by using "remaining headroom, increased risk appetite, new guarantees, and the holding of Special Drawing Rights (SDR)." [35]

Box 8. Debt-for-Nature[36] in Barbados

A program in Barbados provides an innovative use of guarantees to leverage resources from international markets to promote conservation and sustainability outcomes. Barbados has completed a debt-for-nature conversion (DFNC) backed by a US$100 million guarantee from the IDB and another US$50 million guarantee from The Nature Conservancy, allowing the country to reduce borrowing costs and use savings to finance a long-term marine conservation program. Through this operation, the IDB is the first MDB to support a DFNC using a policy-based guarantee. The operation also includes the first ever co-guaranteed financial instrument between a multilateral and a non-governmental organization, paving the way to a more efficient way of collaborating. It is expected to free up approximately US$50 million to support environmental and sustainable development actions in Barbados over the next 15 years. The benefits of this project are not only in the flows of funds to conservation, but also in the policy reforms required by the IDB policy matrix and the conservation agreement.

3.70 **The International Monetary Fund's (IMF) Resilience and Sustainability Trust (RST) aims to help address structural challenges—including climate change—that risk undermining prospective balance of payments stability.** Specifically, the RST will provide longer-term financing to strengthen economic resilience and sustainability by (1) supporting policy reforms that reduce macro-critical risks associated with climate change and pandemic preparedness; and (2) augmenting policy space and financial buffers to mitigate the risks arising from such longer-term structural challenges. About three-quarters of the IMF's membership is eligible for RST financing, including all low-income countries, all developing and vulnerable small states, and lower middle-income countries (IMF 2022). In addition to channeling Special Drawing Rights (SDRs) through the RST and the IMF's Poverty Reduction and Growth Trust, the IMF is exploring providing assistance to certain SDR prescribed holders by developing viable options for channeling SDRs through MDBs, including the IDB.[37]

3.71 At the same time, it is important to recognize that MDBs' most important support is unlikely to come via direct financing, but rather through technical support for planning and reforms (Galindo Paliza, Hoffmann and Vogt-Schilb 2022).

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[35] The SDR is an international reserve asset created by the IMF to supplement the official reserves of its member countries. It is a potential claim on the freely usable currencies of IMF members. As such, SDRs can provide a country with liquidity. SDR draw from a basket of currencies: US dollar, euro, renminbi, yen, and sterling (IMF 2022).

[36] Debt-for-nature conversions are a type of a debt exchange in which the country issues a new bond and uses the proceeds to buy back outstanding higher-cost bonds, generating savings on the interest rate coupon and/or the bond principal in the process.

[37] The IMF's Executive Board approved in February 2023 the applications of the Caribbean Development Bank, the Development Bank of Latin America, the European Bank for Reconstruction and Development, the European Investment Bank, and the IDB to become prescribed holders of SDRs (IMF 2023). Prescribed holders may acquire, hold, and use SDRs in transactions by agreement and in operations.

IV. LESSONS LEARNED FROM THE IDB GROUP'S EXPERIENCE IN THE CLIMATE CHANGE SECTOR

4.1 This section summarizes the key lessons learned from IDB Group's experiences assisting LAC countries in developing their climate change agendas. Since climate change is a cross-cutting issue, the lessons learned are drawn from operations across the IDB Group. The overall analysis is based on a dedicated workshop organized in coordination with the Knowledge, Innovation, and Communications Sector and on portfolio analysis the Climate Change Division carried out to inform the IDB Group's commitment to align its operations with the Paris Agreement. The main lessons learned are summarized below, organized around the same four themes used in the previous sections: adaptation and climate resilience, decarbonization, governance, and financial flows.

A. Supporting countries to build climate resilience

4.2 **Increased focus is needed to build resilience *before* disasters happen.** Flexible financing tools set up before disasters strike can help address climate-related emergencies. For example, when Hurricane Dorian struck the Bahamas in 2019, an IDB contingent loan made the first disbursement to support government efforts to provide humanitarian relief and restore basic services for the affected population.

4.3 **Investment projects should consider climate change and disaster risks systematically from concept to decommissioning.** Before project development even begins, it is important to determine where to best invest limited resources, considering the uncertainties posed by climate change. Tools to assess the vulnerability of assets to climate change and disaster risks can help with those investment decisions. For example, in a project in the Dominican Republic, the IDB provided support through a technical cooperation operation to (1) update and geo-reference existing infrastructure assets; (2) identify critical points in the country's transport network and their vulnerability to disaster risks; and (3) incorporate hydrological modeling with climatic variables into new road and bridge design and maintenance regulations. Identifying vulnerable points in the transport network was carried out using Blue Spot Analysis, a method for prioritizing the most cost-effective actions for the transportation system. As a result, the country was able to improve and rehabilitate key road segments as part of a subsequent loan program and select interventions in areas with high levels of vulnerability and criticality, thereby reducing the risk of future losses.

4.4 **More broadly, the IDB's Disaster and Climate Change Risk Assessment (DCCRA) methodology is at the core of efforts to increase the climate resilience of operations.** The methodology takes a phased approach to allow resources to be used commensurate with risk. Through the CRF, the IDB committed to having 100% of projects with moderate or high disaster and climate change risk analyze risks to identify resilience actions by 2023.

4.5 **Project results matrices and targets should clearly reflect climate resilience objectives.** Enhancing climate resilience requires ensuring that resilience objectives are a fundamental part of the outcomes defined for a project. In the case of agriculture, for example, this means targets to measure success must go beyond productivity. A project in Nicaragua that promoted agroecological systems

for adapting to climate change showed that when supporting the shift toward nonconventional agricultural practices, nontraditional productivity indicators are needed (see project PCR). The indicators that had been included in the project results matrix measured increased land productivity of monoculture crops and did not reflect the project's ambition to promote diversified production systems. The recommendations drawn from this operation suggest that interventions focused on enhancing resilience in agriculture should include indicators that measure a broader scope of sustainability factors, such as environmental health and biodiversity, and of productivity indicators, such as the gross value of production or the land equivalent ratio.[38] These lessons were later used in the design of a sustainable agricultural innovation project in Panama, which included indicators such as the percentage of farms increasing their level of productive diversification and the percentage of farms increasing the organic matter in the soil.

4.6 The 2022 Development Effectiveness Overview takes a deeper look at lessons learned from the IDB Group's work to help countries and clients in the region build resilience to climate change and effectively managing disaster risks in the face of the mounting threats posed by climate change.

B. Supporting countries to decarbonize

4.7 **It is important to consider countries' commitments to the Paris Agreement as part of the project preparation process.** At the IDB, preliminary analysis of 114 operations approved in 2019 showed that 96 (84%) were aligned to the Paris Agreement. The majority either actively contributed to low-carbon, climate-resilient pathways (46 operations) or had no material impact from a climate perspective (32 operations). However, the ex-post approach used to assess operations and establish the baseline meant there was no opportunity to adjust course or add relevant details needed to validate alignment. As a result, the analysis concluded that 18 operations were not aligned with Paris Agreement goals. Of these 18, 14 did not manage high transition risks and/or had second-order impacts in a climate-sensitive context (e.g., support for coastal tourism sector without climate-resilience strategies, and efficiency improvements for the oil and gas sector without considering transition risks). Had they received additional support on design, data, and risk management, these operations could have been aligned to the Paris Agreement. The remaining four operations showed evidence of high emissions and/or non-resilient pathways and would have required a substantially or fundamentally different approach to be aligned (e.g., components leading to carbon lock-ins, and deforestation for road construction). These were considered irreconcilable with Paris Agreement objectives. Further work is underway to implement the IDB Group's commitment to fully align its operations to the Paris Agreement. The alignment of IDB Group operations with the Paris Agreement is assessed taking country circumstances and development pathways into account. The process seeks to identify opportunities to support countries and clients in their transition to climate-resilient and net-zero emissions economies.

[38] Land equivalent ratio refers to the monoculture crop land that would be needed to produce the same quantity as land using a diversified system.

C. Supporting countries to build effective climate governance

4.8 **To reach net-zero-emissions and climate-resilient development, pathways need to be long term and transversal.** In addition to aligning their own operations to the Paris Agreement, MDBs can play a key role in supporting countries to establish net-zero emissions and climate-resilient development pathways through directly supporting the development and implementation of LTSs and NDCs.

4.9 Furthermore, the preparation of IDB country strategies and the design of projects should systematically take into consideration countries' commitments to the Paris Agreement and climate change risks.

D. Supporting countries to diversify and align financial flows

4.10 **Methodologies for climate finance, Paris Agreement alignment, and green finance should be fit-for-purpose to incentivize designing projects to achieve results on climate action.** Systematic screening of the project pipeline for opportunities to mainstream climate change have increased climate finance—in many cases, thanks to the technical support of subject matter experts, who are increasingly based in the region.

4.11 **The IDB can help countries face the climate change challenge by supporting the structuring of thematic bonds.** For example, the IDB's Green Bond Transparency Platform brings greater transparency to the green bond market in LAC by facilitating harmonized issuance reporting and verification. Issuers, investors, and other market actors can upload and research information on transaction details, bond performance, use of proceeds, and environmental impacts of green bonds in the region. In addition, the IDB supported Chile's Ministry of Finance in issuing the first sovereign green bond in the region, which now has had very successful issuances. Finally, based on impact evaluations, the IDB can identify a portfolio of key investments that have been shown to be efficient and effective in fostering adaptation and increasing climate resilience.

4.12 **Ministries of economy and finance can contribute to climate action**, including addressing fiscal pressure resulting from extreme weather events, aligning budgetary expenditures, managing fiscal risks from the transition and the disruption to tax revenues from fossil fuels in the context of a decarbonized world, addressing distributional impacts on affected sectors and workers, and facilitating investment in resilient infrastructure (Delgado, Eguino and Pereira 2021). The IDB's Regional Climate Change Platform for Ministries of Economy and Finance can support these contributions.

V. Lines of Actions for IDB Group Work in the Climate Change Sector

5.1 Specific country pathways to net-zero emissions and climate-resilient development depend on individual country circumstances (see ¶3.41). Building on the diagnostic, evidence, and lessons already presented, this section provides an overview of concrete actions countries can take to adapt and build climate resilience to climate change, decarbonize rapidly, build effective climate governance, and align and diversify financial flows. See also Annex II of the IDB Group CCAP 2021–2025, which elaborates a menu of possible interventions for

the IDB Group to provide flexible support to countries, consistent with the demand-driven nature of its programming.

A. Line of Action 1: Adapt and build climate resilience

5.2 To adapt and build resilience to climate change, the IDB Group can offer support to the public and private sectors to:

a. **Mainstream adaptation and climate resilience in all sectors.** This means assessing climate risk and the options for managing it at all stages of the productive process and projects, including in the planning, siting, and designing of infrastructure, the selection of crops and practices that can thrive in a changing climate, and the (domestic or international) transportation and distribution of goods and services. This line of action concerns all ministries, not only ministries of productive sector—for instance, the ministry in charge of health or education can be involved in building infrastructure such as hospitals and schools.

b. **Make adaptation and climate resilience a high-priority goal of public policy.** Align sector strategies with adaptation and resilience objectives and incorporate resilience requirements into public expenditures and public-private partnerships.

c. **Improve disaster risk assessment, reduction, and management.** This entails closing knowledge gaps by performing hazard and vulnerability assessments; building the capacity of citizens, government agencies, and firms to act on it; developing or strengthening early warning systems; establishing technical standards; promoting technology adoption; preparing contingency plans and financing; and creating incentives, including insurance mandates, to move people and economic activities away from areas with untenable conditions.

d. **Build socioeconomic resilience by integrating climate change considerations into policies and programs targeting social protection, education, health, and labor markets.** Socioeconomic resilience also entails building the capacity of actors from these sectors to analyze the effects of climate change on their own activities and how their activities can help the rest of the economy adapt to climate change impacts. This also requires closing knowledge gaps by further exploring the nexus between conflict, gender, and climate change.

e. **Conserve, restore, and expand natural ecosystems.** This entails considering nature-based solutions in all sectors, integrating biodiversity into economic planning, developing policies that promote the use of NBS and the preservation of ecosystems, and bridge knowledge gaps by investigating better the costs and potentials of NBS at the sector and territorial levels.

f. **Use a territorial approach to building climate resilience.** This entails strengthening regional- and municipal-level knowledge and capacity to consult interested parties, gather new data, and create new knowledge related to resilience, identify the impacts of climate change on different sectors, and develop strategies or action plans to adapt to these impacts (e.g., regulatory changes, infrastructure deployment, and communication campaigns)—all at the territorial level.

g. **Take climate risk and uncertainty into account in decision-making.** This entails gathering existing knowledge and generating new knowledge on the range of likely future physical manifestations of climate change, on the impact of those manifestations on socioeconomic activities and the environment, and on options to manage that risk. It also entails using techniques for decision-making under deep uncertainty (including sector specific approaches such as blue spot analysis for transport) and building the capacity of regional research institutions to use such techniques to inform public decisions. On the private-sector side, support is needed to assess the climate vulnerability of the supply chain.

B. Line of Action 2: Decarbonize rapidly

5.3 To foster development pathways that are consistent with a rapid transition to net-zero emissions, the IDB Group can offer support to the public and private sectors to:

a. **Mainstream decarbonization goals into all sector strategies.** This can be accomplished by, for each sector, engaging with academia and analysts to investigate emissions reduction scenarios and establish numerical emissions reduction targets; identifying concrete changes required to reduce emissions, avoid carbon lock-in, and achieve other development goals; assessing the costs and benefits of strategies to reduce emissions (including current and updated NDCs and LTSs); identifying barriers to decarbonization; investigating interventions to remove those barriers, and using the resulting knowledge to develop sector-scale strategies that fully embrace decarbonization goals.

b. **Implement already available decarbonization solutions.** This can be accomplished by making investments and changing regulations and processes to implement the solutions described in section III B, including to produce zero-carbon electricity in a reliable and affordable way; replacing fossil fuels in all sectors through electrification and green hydrogen; improving energy efficiency, including by promoting green buildings; reducing reliance on private cars; reducing the carbon footprint of the food system without compromising food security; expanding and restoring high-carbon ecosystems; reducing emissions from heavy industry and long-distance and heavy transport; and advancing toward a circular economy, including by reducing waste, enhancing material efficiency, and improving recycling.

c. **Ensure the transition to net-zero emissions is just.** This requires closing knowledge gaps, for instance by performing ex ante and ex post assessments of the distributional impacts of emissions reduction strategies and policies, for instance the labor impact of the early retirement of fossil fuels assets, the transition to electric mobility, or the transition to food production systems with a lower environmental footprint that guarantees food security. It also entails assessing how policies can be designed to minimize or compensate for losses concentrated among certain actors, sectors, or geographies (such as unemployment benefits for workers transitioning to new jobs or cash or in-kind transfers to compensate consumers for the negative impacts of climate policies). It also requires filling knowledge gaps, especially in options to ensure a just rural transition and in how to manage risk for producers of high-

footprint commodities such as beef and dairy. A just transition also entails anticipating and then promoting skills and competences workers and managers need to perform well in a low-carbon economy.

d. **Foster innovation that will facilitate decarbonization.** Research and investment in innovative technologies are needed. Establish training centers for emerging and evolving technologies to spread the skillsets needed to take full advantage of decarbonization opportunities. This also entails closing knowledge gaps on how to reduce emissions in hard-to-abate sectors, including heavy industry and long-haul transportation.

C. Line of Action 3: Build effective governance

5.4 To build effective climate governance, the IDB Group can offer support to the public and private sectors to:

a. **Design and regularly update climate strategies.** Key strategies include national long-term climate strategies and NDCs to be submitted to the UNFCC, national mitigation and adaptation plans, sector plans aligned with decarbonization and climate-resilience goals, and financial plans. These instruments can be used to translate long-term climate goals into roadmaps of specific government and private-sector interventions. Climate plans should also be aligned with National Biodiversity Strategies and Action Plans. Developing these plans entails closing knowledge gaps in terms of which approaches can be used to reduce emissions at the country, local, and sector levels given local conditions.

b. **Generate GHG and climate data to inform climate policy.** Basic data includes data on GHG emissions at the country, sector, and subnational levels, such as updated national GHG inventories to be submitted to the UNFCCC. This also includes leveraging data on local weather patterns, through direct measurement or modelling, and projecting how climate change can affect local temperature, precipitation, and other weather patterns. Furthermore, the IDB can support countries to develop and improve monitoring, reporting, and verification (MRV) systems.

c. **Operationalize existing climate strategies.** This entails closing knowledge gaps in terms of the costs and benefits of emissions reduction and adaptation strategies and the distribution of these costs and benefits, barriers to implementation, and policies and programs for removing these barriers, including building new infrastructure, reforming regulation, building human and technical capacity, and managing distributional impacts. This means in particular helping countries identify and manage the negative consequences associated with energy and agriculture subsidy reform, environmental tax reforms, and other climate policy instruments.

d. **Promote engagement and participatory approaches to climate policy design.** This can be accomplished by engaging with both the public and private sector, including line ministries (e.g., ministries of transport, agriculture, energy, and housing and urban development), transversal ministries (e.g., ministries of planning and finance), different levels of government (e.g., from federal to municipal), academia, think tanks, guilds, trade unions, firms, Indigenous peoples' organizations, and ordinary citizens.

This includes national governments supporting subnational governments to decarbonize. The IDB's Regional Climate Change Platform of Economy and Finance Ministries will establish a specialized regional mechanism to support finance ministries in LAC in the search for knowledge, experiences, and tangible solutions to address the socioeconomic challenges associated with climate change and sustainable development.

e. **Generate, compile, and analyze knowledge on climate government practices,** for instance in terms of the effective design of coordination mechanisms between sectors, involvement of subnational government and other actors mentioned in the point above, impact of domestic and foreign trade policy on climate change goals, and providing institutional mandates for change.

f. **Promote climate communication, education, and capacity building.** Promote communication of climate change issues to a broad audience and build the knowledge of various stakeholders on climate action, including through education (from early years to higher education) and capacity building. Emphasis should be placed on the specific role target audiences can play as public servants, consumers, or producers.

g. **Mainstream climate change goals into public and private financial systems.** This includes developing and implementing criteria to identify climate-related spending in public budgets, developing taxonomies of (public and private) activities related to climate change, and incorporate climate change criteria into the processes that governments use to monitor or authorize public spending (including national public investment systems and public procurement systems).

h. **Assess and reduce transition risks.** Assess the risks a global or national transition to a net-zero emission (driven by climate policy, trade restrictions on high-carbon goods, technology changes, or consumer preferences) poses in terms of creation of stranded assets, for instance in the case of investment in fossil fuels, carbon-intensive industrial goods, and goods linked to deforestation. Assess the fiscal, trade balance, and private-sector impact of stranded assets. Quantify options to reduce such risk, including by reducing the GHG footprint of high-value activities, diversifying the economy toward lower-GHG-footprint economic activities, and quantifying strategies to manage the fiscal impact of the transition.

i. **Promote efficient digitalization.** This entails improving access to technology to promote telework, digital paperwork, digital money, the use of digital technologies to deliver early warning system, the use of digital systems to improve the efficiency, responsiveness, and resilience of infrastructure and other systems, and ensure digital technology is energy efficient and easy to recycle.

D. Line of Action 4: Diversify and align financial flows

5.5 To reach the necessary scale of investment, the IDB Group can offer support to the public and the private sectors to:

a. **Redirect public and private financing to climate solutions.** This can be accomplished by financing interventions at all levels of government that remove barriers to the adoption of climate solutions in each sector.

b. **Empower National Development Banks to develop lending models**, including risk-sharing products, to be implemented via local financial intermediaries, and direct lending to finance low-carbon and climate-resilient investments.

c. **Support environmental tax reforms**, including fossil fuel and agriculture subsidy reforms, and the implementation of environmental taxes.

d. **Improve capacity to use carbon markets to provide funding.** This entails closing knowledge gaps about the potential and challenges surrounding the potential of carbon markets as a financing tool, providing support for the establishment of institutional structure, regulation, and instruments for the registration and certification of carbon credit projects, and improving MRV of emission reduction projects.

e. **Support the development of green, thematic, and sustainability-linked bonds** via the supply, demand, and regulatory side by leverage existing platform and networks such as the Green Bond Transparency Platform, public-private dialogue and regulatory forums.

f. **Support access to climate risk financing.** Continue to use existing climate risk financing instruments, expand their use, and develop innovative applications, including through analysis of risk, ex-ante planning for risk reduction and recovery, contingent loans, climate-resilient debt clauses, guarantees, nature-based solutions, and design or adaptive social protection and cash transfer programs.

g. **Leverage additional funds.** This entails attracting national and international investors by promoting the use of thematic bonds, improving access to concessional funds such as the Green Climate Fund (GCF) and the Global Environment Facility (GEF), developing financial instruments that consider adaptation benefits, and promoting strategies to attract philanthropic funding.

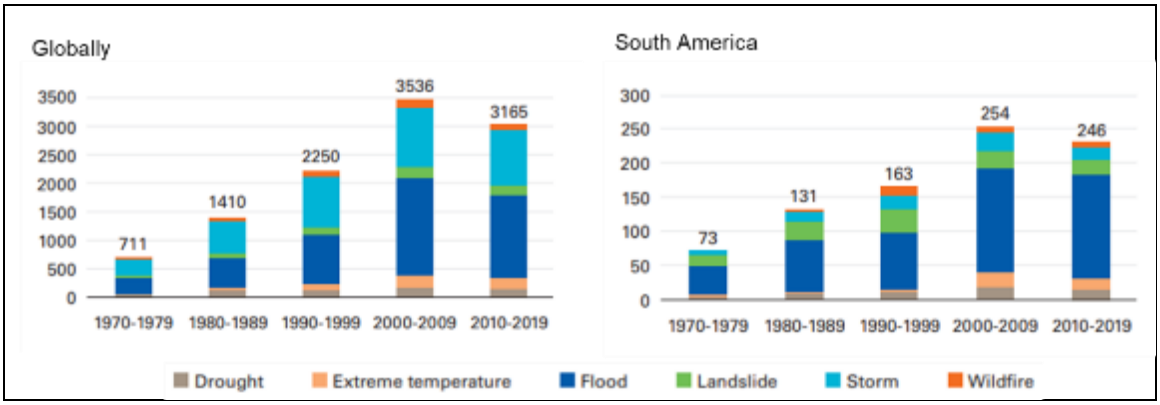
h. **Establish regulatory frameworks that can align public and private interests and provide service continuity.** This can be accomplished by supporting private-sector disclosure (e.g., through the TCFD framework and other mechanisms), supporting climate-smart innovations, providing technical assistance to private-sector actors to decarbonize and adapt their business models, and building the capacity of financial institutions to assess and address climate change risks.

i. **Use limited public resources strategically.** Public resources, particularly those that are concessional, can serve to overcome barriers to investment, but time spent accessing them can be substantial, and they should be directed toward driving transformation.

Annex I. Tables and Figures

Figure 1. The number of disasters globally and in South America has increased dramatically since 1970

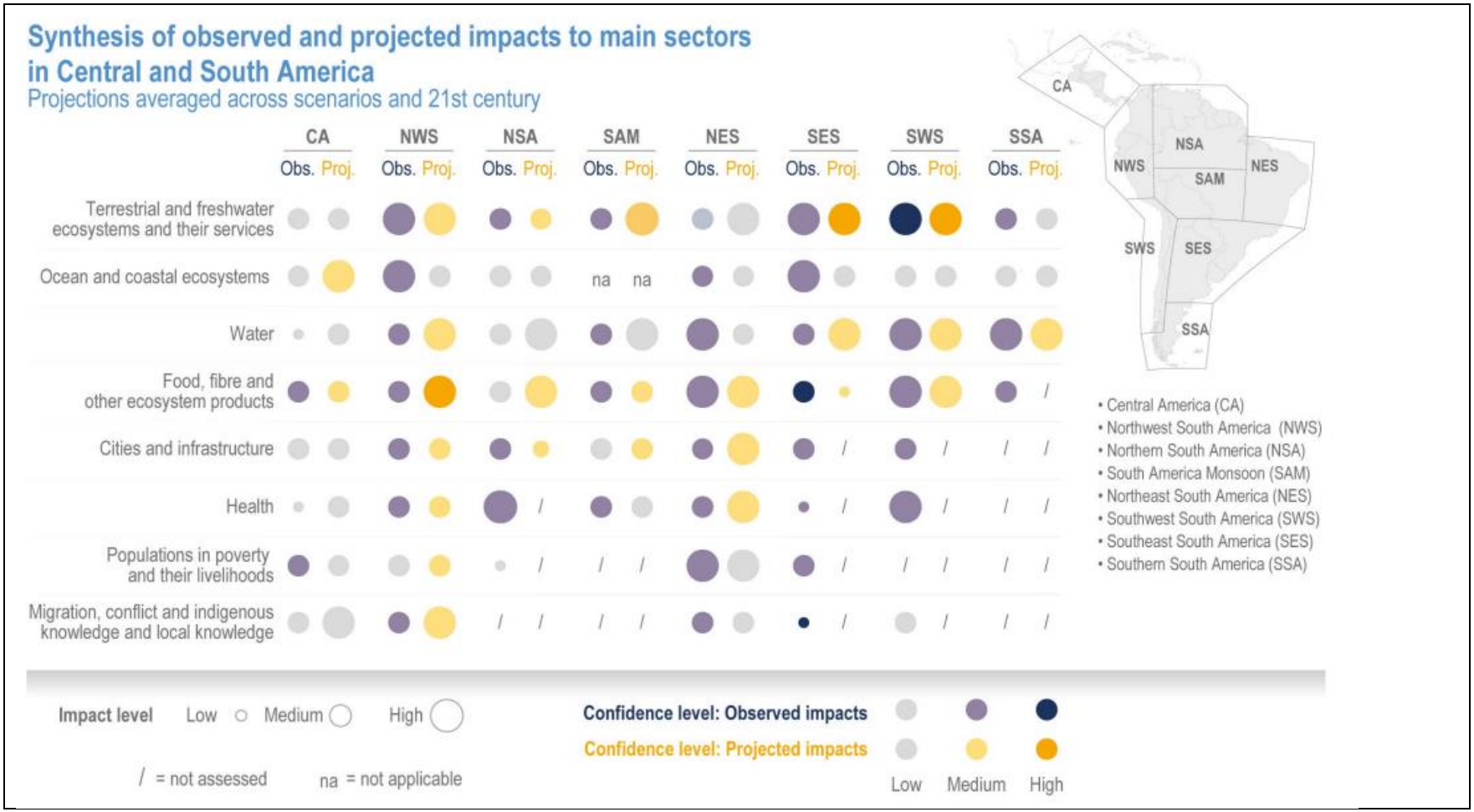
[Return to main document ¶2.5]



Source: (WMO 2021).

Figure 2. Observed and projected climate change impacts vary by subregion

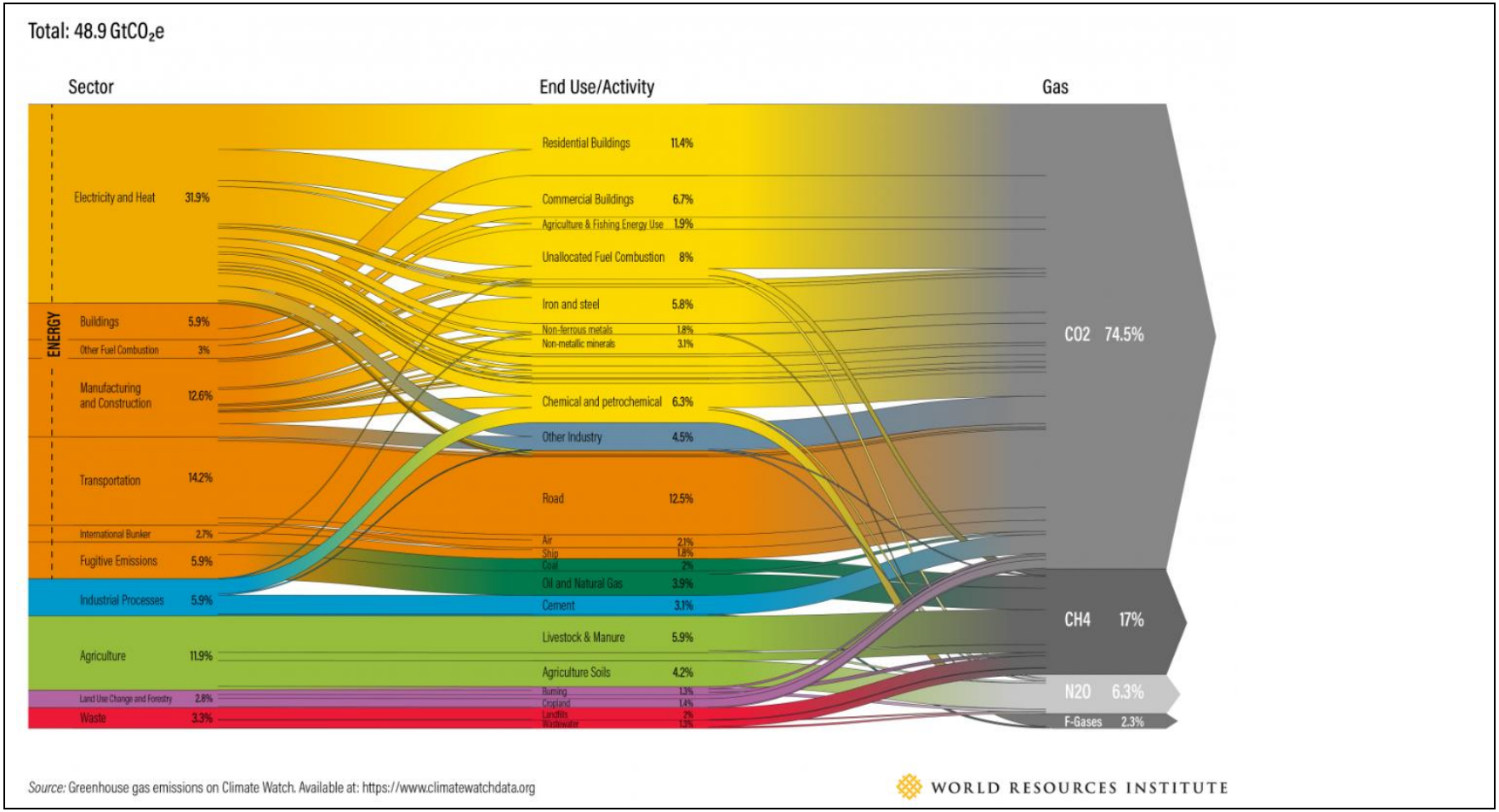
[Return to main document ¶2.15]



Source: (IPCC 2021).

Figure 3. A comprehensive view of global GHG emissions in 2018, tracing the sources and activities that produce emissions to the type and volume of gases associated with each activity

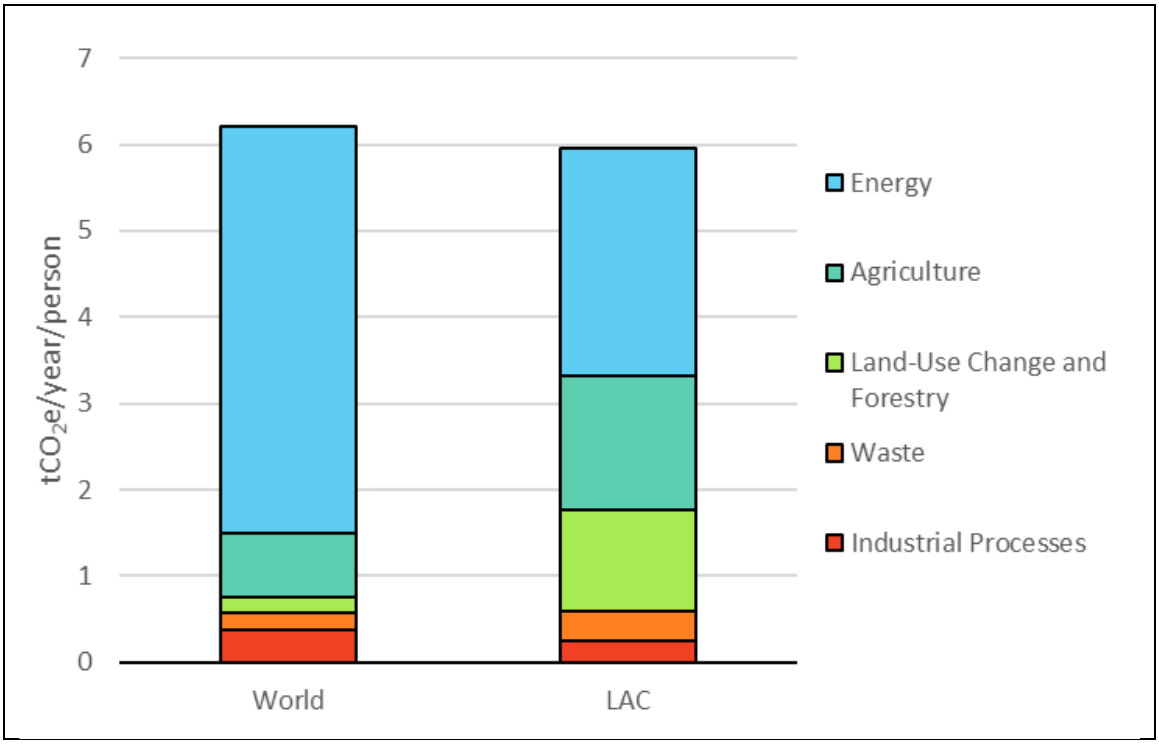
[Return to main document ¶2.21]



Source: (WRI 2021).

Figure 4. Per capita GHG emissions from agriculture and land-use change, and forestry have been higher in LAC than the rest of world

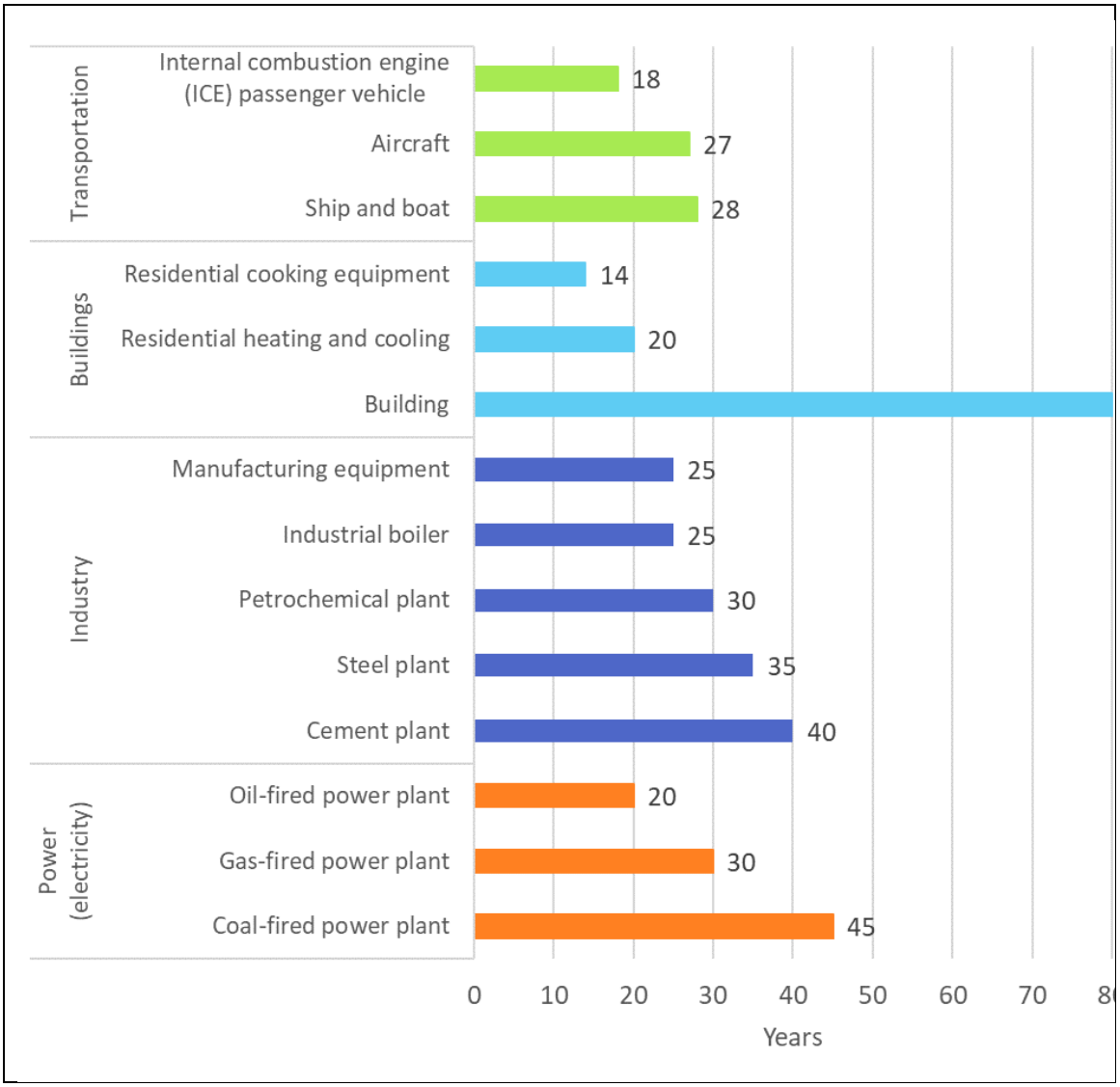
[Return to main document ¶2.22]



Source: CCS, using 2019 data from (WRI 2021).

Figure 5. The typical lifetime of infrastructure ranges from 14 to 80 years

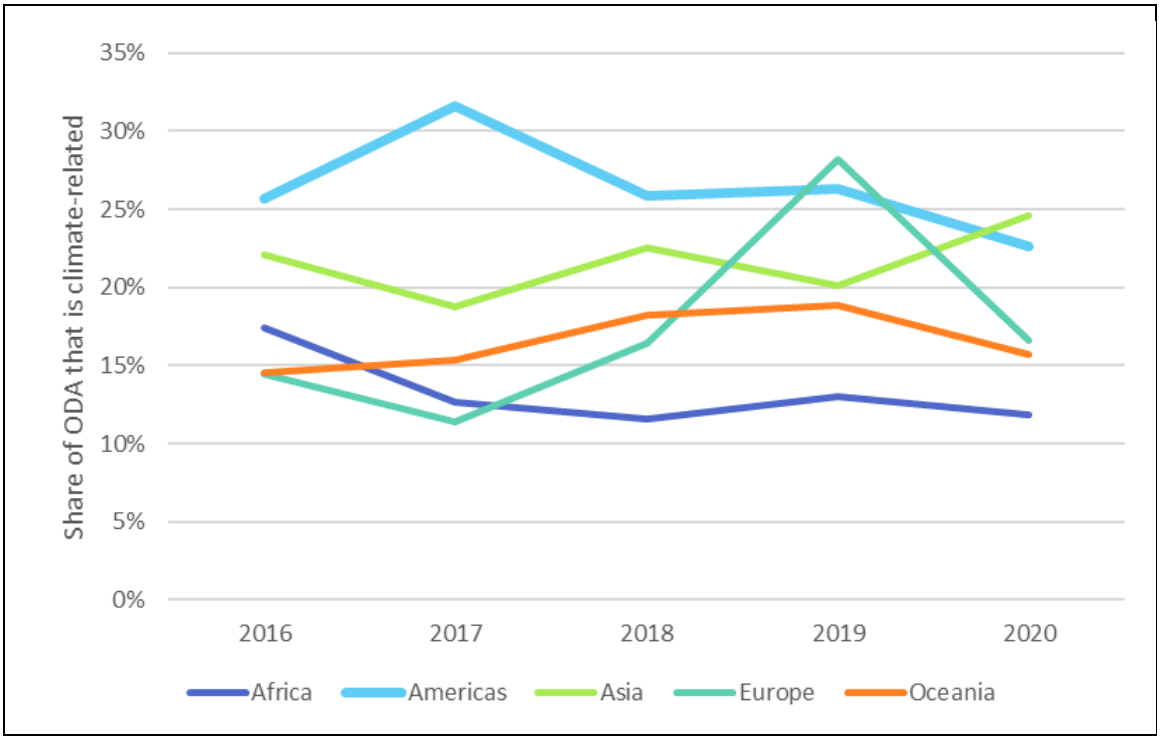
[Return to main document ¶2.24]



Source: (WRI 2021).

Figure 6. The share of ODA that is climate-related has been consistently higher in LAC than other regions

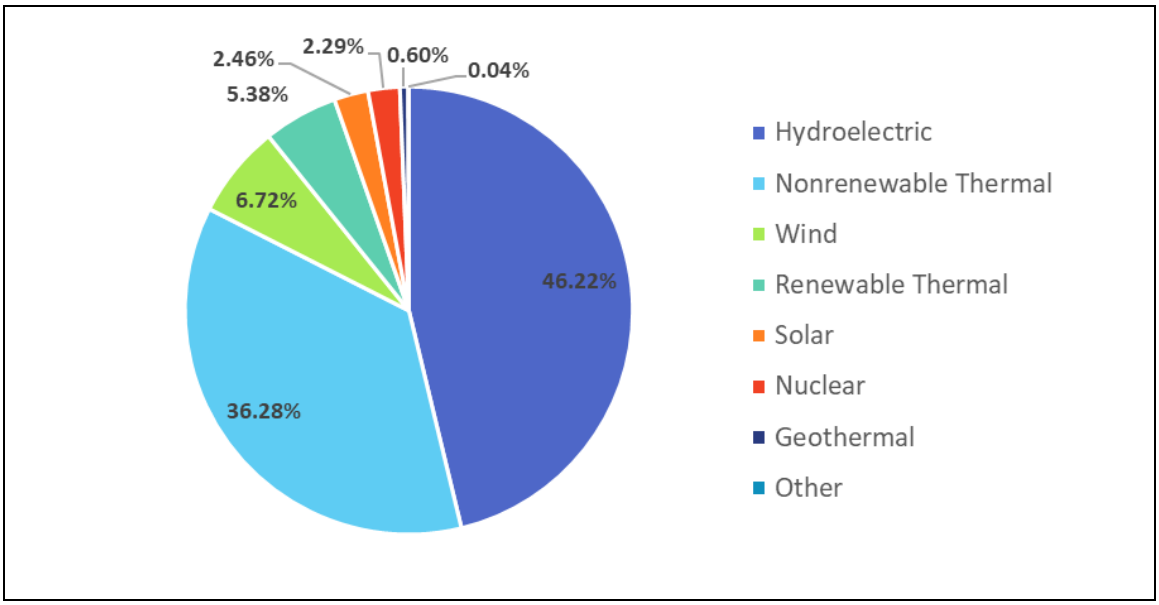
[Return to main document ¶2.42]



Source: CCS, based on OECD-DAC data.

Figure 7. Renewables already comprise a large share of power generation in LAC

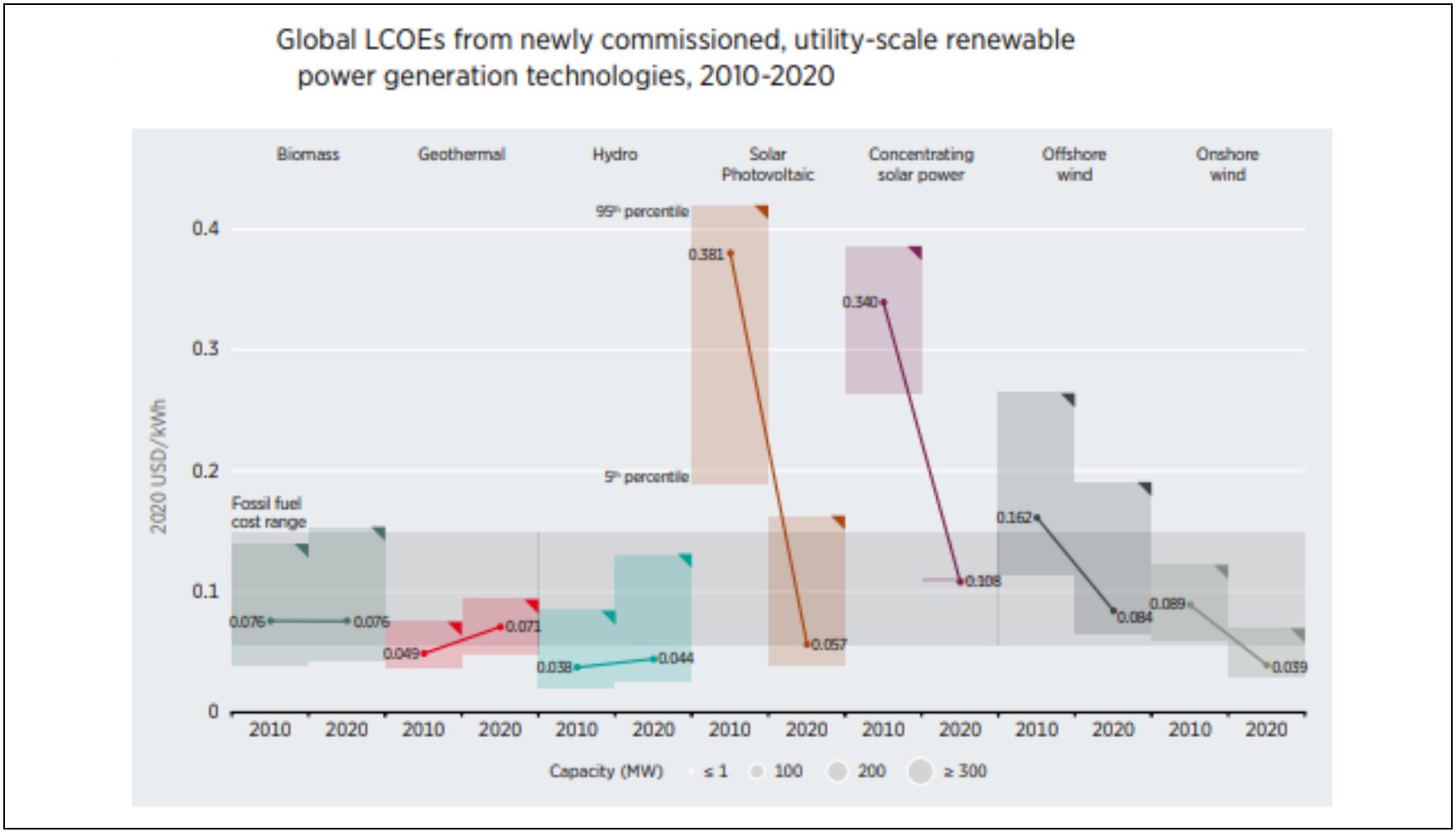
[Return to main document ¶3.16]



Source: (Energy HUB 2022).

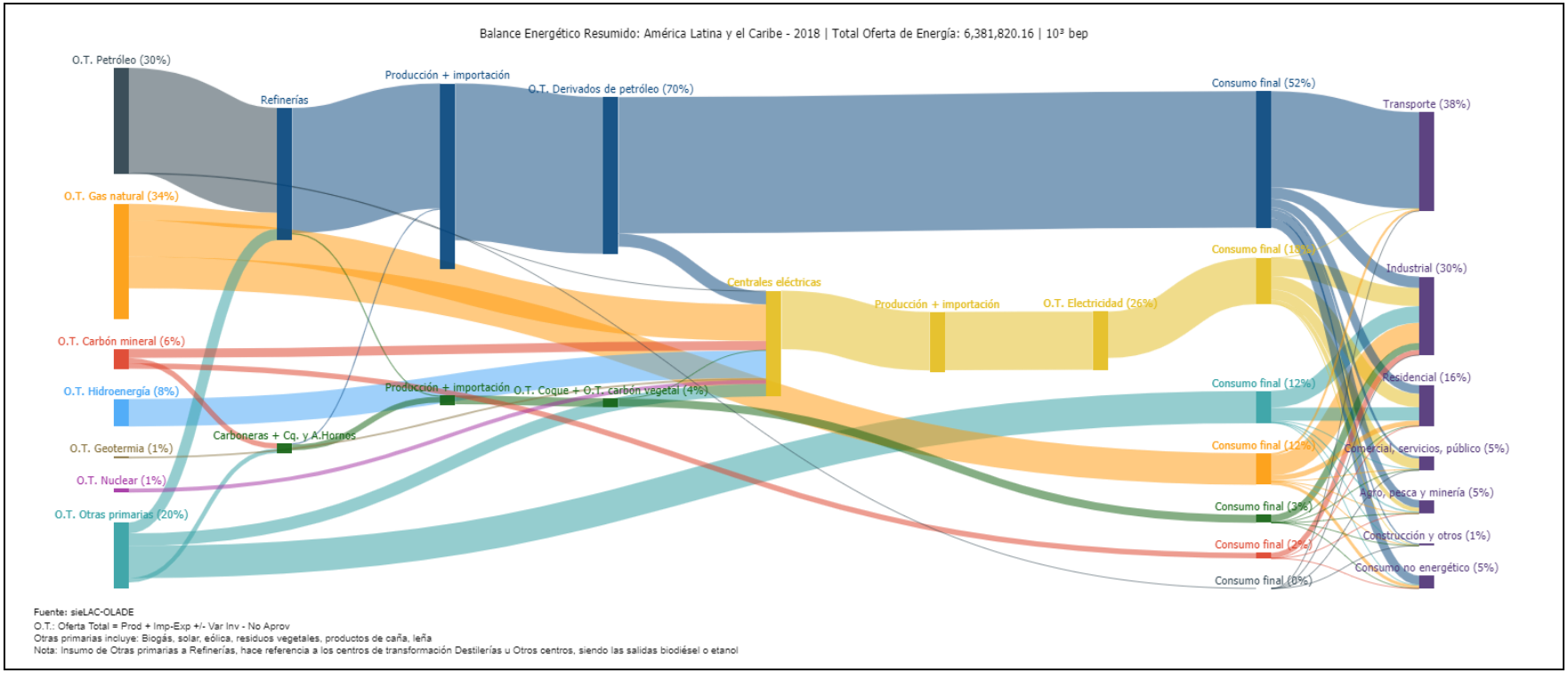
Figure 8. The global weighted average levelized cost of electricity (LCOE) from renewable sources has fallen dramatically in the past decade

[Return to main document ¶3.16]



Source: (IRENA 2021).

Figure 9. Energy balance for LAC in 2018. Energy sources appear on the left and flow to final use on the right. See also the IEA's interactive tool
[Return to main document ¶3.18]



Source: (OLADE 2022)

Figure 10. Emissions footprint of different foods range widely (kilograms of GHG emissions per serving)

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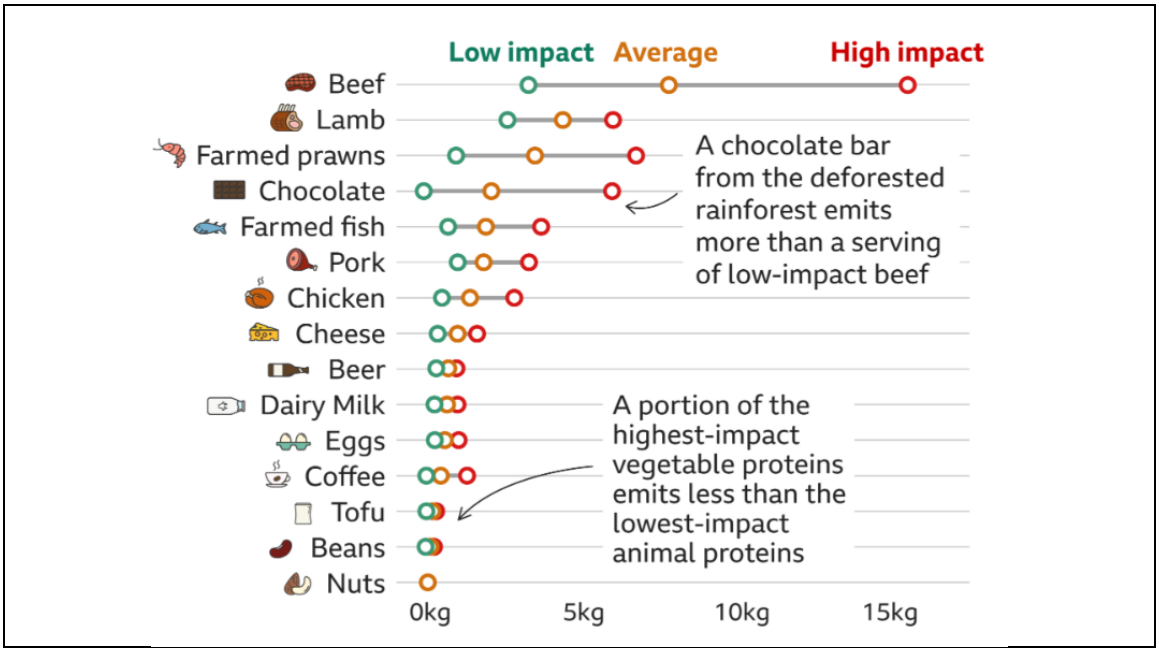
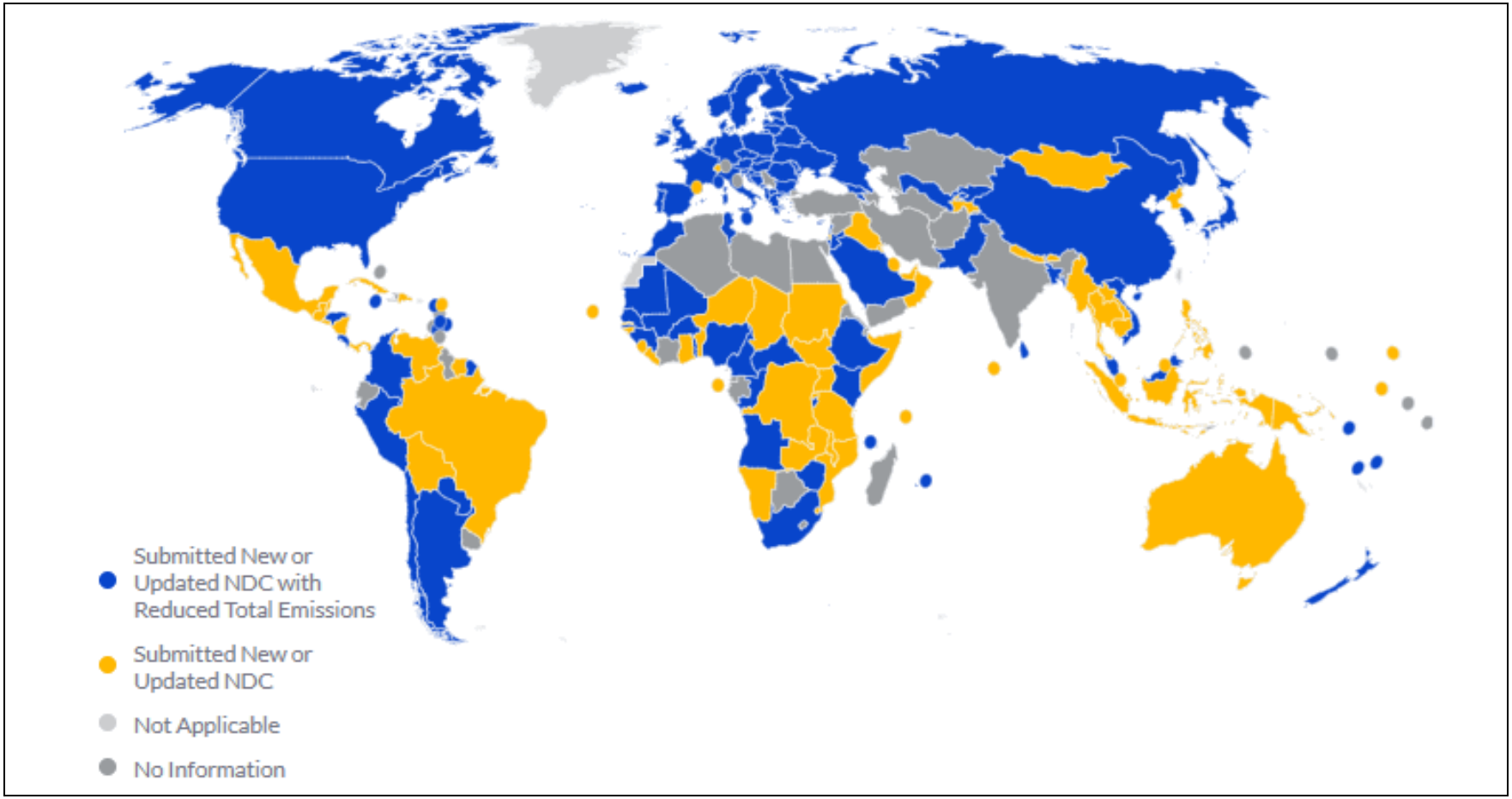


Source: Graphic from the BBC. (Stylianou, Guibourg and Briggs 2019), based on data from (Poore and Nemecek 2018).

Figure 11. Most countries had submitted at least one NDC as of COP26

[Return to main document ¶3.33]



Source: (Climate Watch 2022).

Figure 12. Few countries had submitted an LTS as of COP26

[Return to main document ¶3.33]

Source: (Climate Watch 2022).

Figure 13. Risk Financing Instruments

[Return to main document ¶3.61]

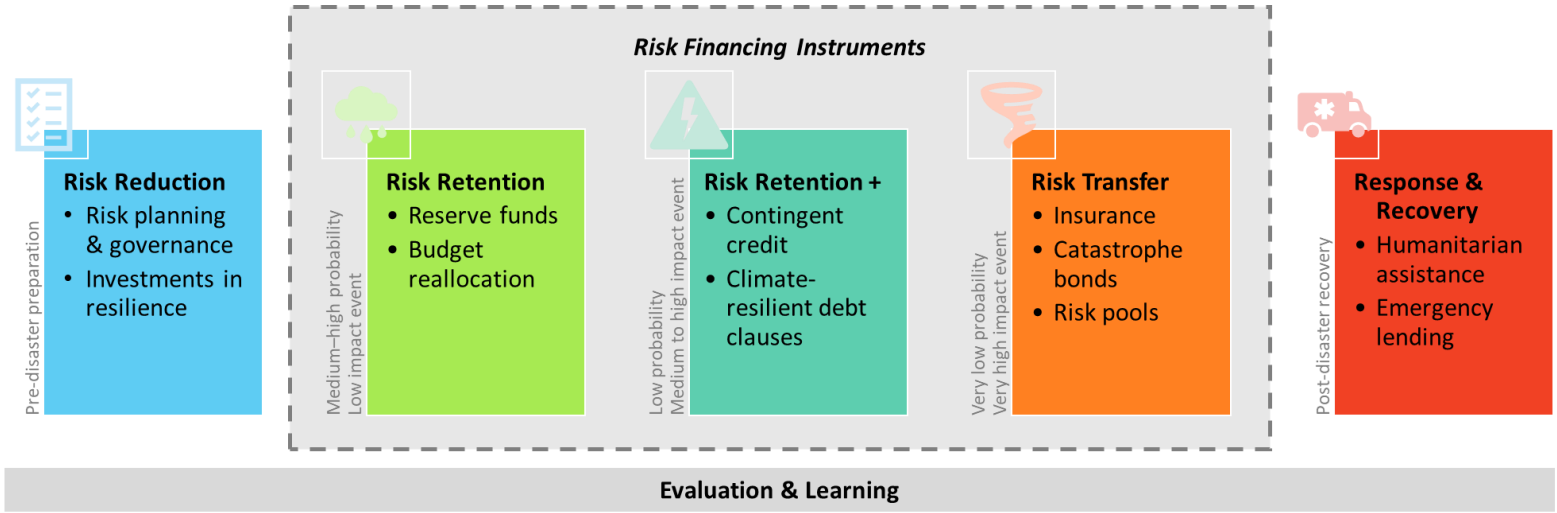


Table 1. Projected climate change impacts on the Caribbean

[Return to main document ¶2.15]

Phenomena	Trend
Air Temperature	Projected temperature increases.
Precipitation	Drier climate in the west and north and slightly wetter in the east. Projected more extreme seasonality.
Tropical Cyclones	Slightly fewer storms, with a projected decrease of 12% drop in the Lesser Antilles by 2060.
Health	Increased mortality and morbidity from heatwaves, food and water insecurity, and disease outbreaks like Zika.
Food Security	Adverse impact on crop and fishing yields due to effects on freshwater, available land, weather conditions and ecosystem degradation. Relative costs of importing food may increase food security risks.
Freshwater	Loss of freshwater sources, including groundwater, due to salinization from sea level rise.

Source: **(Mycoo 2022)**.

Table 2. Total MDB adaptation finance by sector and by region, 2021 (in US$ million)

[Return to main document ¶3.67]

	Central Asia	East Asia and the Pacific	Europe: EU	Europe: Non-EU	Latin America and the Caribbean	Middle East and North Africa	South Asia	Sub-Saharan Africa	Multi-regional	Total
Coastal and riverine infrastructure	-	33	-	-	165	-	164	179	153	694
Crop and food production	42	52	78	38	63	257	270	975	7	1 781
Cross-cutting sectors	139	569	3	36	542	247	477	1 068	6	3 087
Energy, transport and other built environment and infrastructure	210*	611	467	332	428	94	695*	2 132	17	4 985
Financial services	1	270	37	19	198	229	399	691	33	1 875
Industry, manufacturing and trade	0	-	27	2	-	13	-	13	6	61
Information and communications technology	7	-	-	4	14	8	18	126	-	176
Institutional capacity support or technical assistance	12	299	372	7	1 382	85	373*	314	33	2 877
Other agricultural and ecological resources	34	37	6	40	226	6	53*	227	52	681
Water and wastewater systems	41	439	308	64	239	162	586*	1 126	4	2 970
	485	**2 310**	**1 299**	**542**	**3 256**	**1 100**	**3 034**	**6 849**	**312**	**19 187**

(*) Considering the explanation provided in Figures 1a, 1b and 2 about ADB external resources, climate adaptation finance from AIIB financing for three projects reported under ERUM, amounting to $3 million and $17 million, is excluded from the Central Asia and South Asia climate adaptation amounts, respectively, to avoid double counting.

Source: (MDB Climate Change Working Group 2022).

Table 3. Total MDB mitigation finance by sector and by region, 2021 (in US$ million)

[Return to main document ¶3.67]

	Central Asia	East Asia and the Pacific	Europe: EU	Europe: Non-EU	Latin America and the Caribbean	Middle East and North Africa	South Asia	Sub-Saharan Africa	Multi-regional	Total
Energy	370	1 496	14 042	1 892	1 462	485	1 601*	2 386	450	24 184
Mining and metal production for climate action	-	-	18	-	-	-	-	-	-	18
Manufacturing	52	46	165	824	75	282	88	147	211	1 889
Agriculture, forestry, land use and fisheries	100	405	109	86	758	66	146	704	172	2 547
Water supply and wastewater	115	126	177	31	482	27	401*	80	16	1 455
Solid waste management	19	408	235	189	130	78	381*	112	155	1 708
Transport	398*	426	9 291	1 413	618	1 726	1 454*	388	293	16 007
Buildings, public installations and end-use energy efficiency	83	299	1 166	389	615	100	227	198	328	3 406
Information and communications technology (ICT) and digital technologies	-	-	-	6	225	-	-	2	125	357
Research, development and innovation	3	1	1 849	66	11	10	2	-	18	1 960
Cross-sectoral activities	304	466	1 879	114	3 146	213	825	1 898	154	8 999
Total	**1 444**	**3 673**	**28 932**	**5 011**	**7 521**	**2 987**	**5 125**	**5 914**	**1 922**	**62 530**

(*) Considering the explanation provided in Figures 1a, 1b and 2 about ADB external resources, climate mitigation finance from AIIB financing for three projects reported under ERUM, amounting to $105 million and $788 million, is excluded from the Central Asia and South Asia climate mitigation amounts, respectively, to avoid double counting.

Source: (MDB Climate Change Working Group 2022).

Annex II. Country-Level Information on Climate Action

	Adaptation and Climate Resilience	**Decarbonization**			**Governance**				**Financial Flows**		
Country	**Long-Term Climate Risk** (ranked index 2000-2019, lower score = more affected)[39]	**CO_2 Emissions** (metric tons per capita)	**Renewable Energy** (electricity production from renewables 2021)	**Proven Reserves of Oil and/or Gas**	**LTS**	**Net Zero Pledge**	**NDC**	**National Adaptation Plan** (NAP)	**Finance Needs** stated in NDC	**Task Force on Climate-related Financial Disclosures** (TCFD)[40]	**Sovereign Green Bond Issuance**
Source	*Germanwatch*	*World Bank*	*Our World in Data*	*BP*	*UNFCCC*	*Net Zero Tracker* *as of April 13, 2023*	*UNFCCC*	*UNFCCC*	*CCS analysis based on NDCs*	*Financial Stability Board*	*Green Finance LAC Platform*
Argentina	80	3.7	25%	Yes	LTS|2022	Net zero|2050|Pledge	2nd NDC (updated)|2021			TCFD Supporters	Yes
Bahamas	6	7.0	0%			Net zero|2050|In discussion	2nd NDC|2022		>US$4B		
Barbados	148	4.5	7%			Carbon neutral|2030|Policy document	1st NDC (updated)|2021				

[39] Based on past data (which should not be used to project future impacts). Focused on extreme weather events (does not take slow-onset processes, such as sea level rise, into account).
[40] TCFD supporters = country has at least one TCFD supporter (includes organizations with public debt or equity, asset managers and owners, industry associations, central banks, governments, and regulators).

	Adaptation and Climate Resilience	Decarbonization			Governance				Financial Flows		
Country	**Long-Term Climate Risk** (ranked index 2000-2019, lower score = more affected)[39]	**CO_2 Emissions** (metric tons per capita)	**Renewable Energy** (electricity production from renewables 2021)	**Proven Reserves of Oil and/or Gas**	**LTS**	**Net Zero Pledge**	**NDC**	**National Adaptation Plan** (NAP)	**Finance Needs** stated in NDC	**Task Force on Climate-related Financial Disclosures** (TCFD)[40]	**Sovereign Green Bond Issuance**
Belize	33	1.6	41%		LTS|2023	Net zero|2050|Policy document	1st NDC (updated)|2021		US$1.71B		
Bolivia	25	1.9	42%	Yes			NDC|2022				
Brazil	81	2.1	77%	Yes		Carbon neutral|2050|Pledge	1st NDC (updated)|2022	NAP|2016		TCFD-Aligned Official Reporting Requirements[41]	Yes
Chile	83	4.8	43%		LTS|2021	Carbon neutral|2050|Law	1st NDC (updated)|2020	NAP|2017		TCFD Supporters*	Yes
Colombia	38	1.6	74%	Yes	LTS|2021	Carbon neutral|2050| In discussion	1st NDC (updated)|2020	NAP|2018		TCFD Supporters*	Yes

[41] In September 2021, the Central Bank of Brazil announced mandatory TCFD-aligned disclosure requirements.

	Adaptation and Climate Resilience	**Decarbonization**			**Governance**				**Financial Flows**		
Country	**Long-Term Climate Risk** (ranked index 2000-2019, lower score = more affected)[39]	**CO_2 Emissions** (metric tons per capita)	**Renewable Energy** (electricity production from renewables 2021)	**Proven Reserves of Oil and/or Gas**	**LTS**	**Net Zero Pledge**	**NDC**	**National Adaptation Plan** (NAP)	**Finance Needs** stated in NDC	**Task Force on Climate-related Financial Disclosures** (TCFD)[40]	**Sovereign Green Bond Issuance**
Costa Rica	89	1.6	99%		LTS|2019	Net zero|2050|Policy document	1st NDC (updated)|2020	NAP|2022		TCFD Supporters*	Yes
Dominican Republic	50	2.5	17%			Net zero|2050|In discussion	1st NDC (updated)|2020		US$17.6B	TCFD Supporters*	
Ecuador	103	2.3	84%	Yes		Zero carbon|2050|Policy document	1st NDC|2019			TCFD Supporters*	Yes
El Salvador	28	1.2	80%				1st NDC (updated)|2022				
Guatemala	16	1.2	67%		LTS|2021		NDC (updated)|2022	NAP|2019			

	Adaptation and Climate Resilience	Decarbonization			Governance				Financial Flows		
Country	**Long-Term Climate Risk** (ranked index 2000-2019, lower score = more affected)[39]	**CO_2 Emissions** (metric tons per capita)	**Renewable Energy** (electricity production from renewables 2021)	**Proven Reserves of Oil and/or Gas**	**LTS**	**Net Zero Pledge**	**NDC**	**National Adaptation Plan** (NAP)	**Finance Needs** stated in NDC	**Task Force on Climate-related Financial Disclosures** (TCFD)[40]	**Sovereign Green Bond Issuance**
Guyana	119	3.6	13%	Yes[42]			1st NDC|2016		US$1.5B (adaptation only)		
Haiti	3	0.3	13%				NDC (updated)|2022	NAP|2023	US$22.04B		
Honduras	44	1.0	52%				1st NDC (updated)|2021			TCFD Supporters*	
Jamaica	54	3.0	16%			Net zero|2050|In discussion	1st NDC (updated)|2020			TCFD Supporters*	
Mexico	59	3.6	24%		LTS|2016	Carbon neutral|2050|In discussion	NDC (updated)|2022			TCFD Supporters*	Yes

[42] ExxonMobil.

	Adaptation and Climate Resilience	Decarbonization			Governance				Financial Flows		
Country	**Long-Term Climate Risk** (ranked index 2000-2019, lower score = more affected)[39]	**CO_2 Emissions** (metric tons per capita)	**Renewable Energy** (electricity production from renewables 2021)	**Proven Reserves of Oil and/or Gas**	**LTS**	**Net Zero Pledge**	**NDC**	**National Adaptation Plan** (NAP)	**Finance Needs** stated in NDC	**Task Force on Climate-related Financial Disclosures** (TCFD)[40]	**Sovereign Green Bond Issuance**
Nicaragua	35	0.8	55%			Net zero|2050|In discussion	1st NDC (updated)|2020		US$1.8B		
Panama	118	3.2	74%			Net zero|2050|Policy document	1st NDC (updated)|2020			TCFD Supporters*	Yes
Paraguay	61	1.3	100%				1st NDC (updated)|2021	NAP (updated)|2022			
Peru	45	1.7	61%	Yes		Net zero|2050|Policy document	1st NDC (updated)|2020	NAP|2021		TCFD Supporters*	Yes
Suriname	171	4.4	50%				2nd NDC|2019	NAP|2020	US$0.7B		
Trinidad & Tobago	159	11.3	0%	Yes		Net zero|2050|In discussion	1st NDC|2018		US$2B	TCFD Supporters*	
Uruguay	96	1.9	78%		LTS|2021	Net zero|2050|Policy document	2nd NDC|2022	NAP (agriculture)|2019			

	Adaptation and Climate Resilience	**Decarbonization**			**Governance**				**Financial Flows**		
Country	**Long-Term Climate Risk** (ranked index 2000-2019, lower score = more affected)[39]	**CO_2 Emissions** (metric tons per capita)	**Renewable Energy** (electricity production from renewables 2021)	**Proven Reserves of Oil and/or Gas**	**LTS**	**Net Zero Pledge**	**NDC**	**National Adaptation Plan** (NAP)	**Finance Needs** stated in NDC	**Task Force on Climate-related Financial Disclosures** (TCFD)[40]	**Sovereign Green Bond Issuance**
Venezuela	145	3.9	64%	Yes			1st NDC (updated)|2021			TCFD Supporters*	

Annex III. Climate Change in other Sector Framework Documents

This annex extracts points from each of the other 22 SFDs corresponding to the six criteria for mainstreaming climate change into SFDs that were established in the CCAP: (i) Sector's role in reaching net-zero emissions; (ii) Effects of expected changes to sector policies and technology; (iii) Transition risks the sector faces; (iv) Sector's contributions to a just transition; (v) Vulnerability of the sector to climate change impacts; and (vi) Tools available to face climate change risks.

1. Agriculture SFD (GN-2709-10) (2020)

(i) Sector's role in reaching net-zero emissions:

a. Forty-two percent of the region's total emissions are attributable to agriculture and land-use change (and land-use change is primarily caused by agriculture) (¶2.35).

b. A major source of GHG emissions is livestock farming, which is the principal cause of deforestation in LAC and emits more than its equivalent subsector anywhere else in the world (¶2.37).

c. Efficiency gains could occur at all points along the chain, from input use (notably the use of nitrogen fertilizers, which produce nitrous oxide when used in excess) through processing and transportation (to reduce energy consumption and losses) to the consumer (who also plays an important role in food losses and waste) (¶3.31).

d. Effective measures are available for reducing GHG emissions per unit of animal product, including improving the quality of fodder, making more efficient use of dietetic nutrients, implementing various manure utilization practices, and improving animal health and productivity (¶3.35).

e. Food production consistent with healthy diets—focused on plant-based foods and lower red meat consumption—would generate considerably lower GHG emissions than the current production system, and implementing this dietary change is essential if agriculture is to achieve the GHG emissions reductions required to ensure that the global temperature does not rise more than 2°C with respect to preindustrial levels (¶3.37).

(ii) Effects of expected changes to sector policies and technology:

a. Regulatory frameworks also pose a challenge since they do not always facilitate the development of leading-edge technologies (such as developments in biotechnology) (e.g., lactose-free milk) and are not harmonized with the frameworks in other countries within and outside the region (¶2.19).

(iii) Transition risks faced by the sector: Not covered.

(iv) Sector's contributions to a just transition: Not covered.

(v) Vulnerability of sector to climate change impacts:

a. Food systems in LAC need to adapt their production capacity to the new and changing climate conditions, including the risks of extreme climate events (¶2.24).

b. Water availability will be a risk factor aggravated by climate change (¶2.27).

c. The agriculture sector is by nature highly vulnerable to extreme climate events. For example, between 2003 and 2013, the sector's worldwide losses due to such events amounted to US$80 billion (averaging 22% of all losses due to natural disasters) (¶2.30).

(vi) Tools available to face climate change risks:

a. Irrigation is an effective way to reduce the risks of drought and rainfall variability (¶3.23).

b. Agricultural insurance can be an effective instrument for financial protection against climate risks. Although the development of indexed or parametric insurance markets in LAC is limited, these policies provide an opportunity to obtain efficient coverage against climate risks. Until now, there has been little demand for such instruments, often prompting governments to step in to promote their use. However, better risk measurement based on new digital technologies and on remote sensing, as well as better design of the insurance policies, may make them more acceptable to producers. In any event, since these instruments may continue to be costly for the region's small producers, some authors have indicated the importance of combining them with other risk-reducing technologies, such as the use of resistant varieties (¶3.24).

c. Agroecology seeks to create equitable food systems that are more productive, resilient, and environmentally sustainable. Agroecological principles include diversification of species, varieties, and strains at the plot, farm, and landscape levels; management of habitats for biodiversity; biological pest control; improvement of soil structure and health; biological nitrogen fixation; and nutrient and waste recycling (¶3.28).

2. Skills Development SFD (GN-3012-3) (2020)

(i) Sector's role in reaching net-zero emissions:

a. Developing skills needed to expand climate-friendly industries and transition to green jobs, financing resource-efficient and climate-resilient schools, and including climate change in the curriculum, educational materials, and teacher learning (¶4.12).

(ii) Effects of expected changes to sector policies and technology:

a. Technology can reduce energy consumption and carbon emissions by reducing travel demands (¶3.39).

(iii) Transition risks faced by the sector: Not applicable.

(iv) Sector's contributions to a just transition:

a. Climate change and the transition to a low-carbon and climate-resilient economy are also reshaping occupations demanding new tasks and skills (¶2.1).

b. Training programs for displaced workers display nonnegligible effects on employment and wages and provide a potentially viable route for reskilling workers (¶3.39).

(v) Vulnerability of sector to climate change impacts:

a. Given the trends in climate change and increased recurrence of natural disasters, it is key to build sustainable and resilient schools that mitigate the effects of construction on the environment and provide a safe location for students, teachers, and the community (¶3.7).

(vi) Tools available to face climate change risks: Not applicable.

3. Integration and Trade SFD (GN-2715-11) (2019)

(i) Sector's role in reaching net-zero emissions:

a. Consumers have a growing interest in buying goods and services that have a lower carbon footprint (¶4.15).

b. Reliable data could be gathered to measure GHG emissions directly released into the atmosphere as a result of the region's trade, thus identifying general trends associated with trade partners and products traded in recent decades; projections of possible changes in these direct environmental costs of trade could be made, in line with the expected or likely changes in the region's trading patterns (¶5.3).

(ii) Effects of expected changes to sector policies and technology:

a. Production of new knowledge for the design, monitoring, and evaluation of interventions in trade and investment promotion—generating evidence on, among other things, the impact of the use of new technologies on the implementation and execution of promotion policies (¶5.5.c).

(iii) Transition risks faced by the sector:

a. The adoption of carbon emission measures and regulations either by export destination countries or by the International Maritime Organization could affect costs or market access for the region's exports (¶4.15).

b. The trade and welfare impacts of the environmental measures currently being adopted, and measures being considered for possible adoption by the region's main trade partners, and carbon tariffs (import tariffs based on the carbon emissions incorporated into the product) could be estimated (¶5.3).

(iv) Sector's contributions to a just transition: Not covered.

(v) Vulnerability of sector to climate change impacts:

a. The consequences of climate change can adversely impact trade. For example, maritime transport, which accounts for close to 80% of global trade, can be seriously affected because of more frequent port closures due to extreme climate events (¶3.3).

(vi) Tools available to face climate change risks:

a. The IDB Group should be prepared to introduce climate change issues into trade and investment policies and programs, which could lead to substantial progress toward achieving the goals of the Paris Agreement (¶4.15).

4. Housing and Urban Development SFD (GN-2732-11) (2020)

(i) Sector's role in reaching net-zero emissions:

a. The absence of plans to enable a transition to a net-zero carbon economy undermines regional efforts to reduce GHG emissions (¶2.8).

b. Reducing urban GHG emissions relies on integrating urban planning with greener mobility and buildings and a new approach to consumption (¶3.21).

c. Evidence from several cities shows that integrating mixed land use in urban planning with promotion of nonmotorized, zero-emission, and electric vehicles can effectively reduce emissions related to transportation in cities (¶3.22).

(ii) Effects of expected changes to sector policies and technology:

a. Command-and-control regulations like emissions standards, technology standards, and driving restrictions continue to be the workhorse of environmental regulatory regimes throughout LAC (¶3.17).

b. Empirical studies about reducing urban emissions conclude that (1) emissions from urban transport can be reduced by combining territorial planning with vehicle regulations and (2) national building codes are cost-effective measures to promote energy-efficient homes (¶3.21).

(iii) Transition risks faced by the sector: Not covered.

(iv) Sector's contributions to a just transition:

a. Increasing access to adequate housing: improving rural housing stock to reduce exposure to endemic and pandemic diseases, environmental hazards, and climate risks; supporting inclusion of women on property deeds; promoting access to affordable and resilient housing in areas that match households' location needs and consider geographic and climatic conditions (¶5.5).

(v) Vulnerability of sector to climate change impacts:

a. LAC cities are particularly vulnerable to natural hazards and climate change. Roughly half the region's population lives less than 100 kilometers from the coast, a higher proportion than any other region in the world. Lack of disaster and climate-change-resilient development exposes residents to serious climatic events (¶2.8).

(vi) Tools available to face climate change risks:

a. Actions require a whole-of-the-city approach along with targeted interventions for vulnerable neighborhoods. These actions rely on (1) implementing approaches that incorporate disaster risk management and climate change criteria and fully integrate natural ecosystems as risk management measures, such as buffer zoning codes and planned floods; (2) promoting the use of NBS to prevent and reduce disasters and climatic change impacts; (3) identifying and prioritizing protective and emergency actions where vulnerable populations and critical city infrastructure are located; and (4) monitoring and preventing slow-onset but critical hazards related to changes in drinking-water availability, provision, and quality (¶5.11).

5. Health SFD (GN-2735-12) (2021)

(i) Sector's role in reaching net-zero emissions:

a. Policies that encourage plant-rich diets can improve health and the environment, especially by reducing GHG emissions (¶3.14).

b. Digital health has other benefits, too; for example, replacing physical visits with remote consultations can generate significant reductions in carbon emissions (¶3.56).

(ii) Effects of expected changes to sector policies and technology:

a. Reducing tropical deforestation improves health by slowing climate change and its effects; and by reducing contact between human beings and sources of new infectious disease (¶3.14).

(iii) Transition risks faced by the sector: Not applicable.

(iv) Sector's contributions to a just transition: Throughout.

(v) Vulnerability of sector to climate change impacts:

a. Environmental degradation and climate change increase human exposure to zoonotic diseases and air pollution (¶2.6).

b. Unpredicted diseases, such as COVID-19, and catastrophic events driven by climate change threaten mental health by causing anxiety, depression, stress, anger, and violence (¶2.11).

c. Climate change is also exacerbating health risks. Sudden increases in temperatures can lead to heat stroke, dehydration, and death. Warmer temperatures increase transmission of vector-borne diseases. Droughts reduce quality and quantity of food production, contributing to malnutrition (¶2.16).

(vi) Tools available to face climate change risks:

a. More frequent natural disasters associated with climate change and epidemics will require hospitals that are resilient, function reliably under adverse conditions, and reallocate beds and equipment in the face of rapid changes (¶3.35).

b. Knowledge about public health preparedness is highly developed because of previous health emergencies. Based on the experiences with natural

disasters exacerbated by climate change, refugee crises, and especially recent epidemics, the international community knows a lot about public investments in preparedness that can lower the risks of social disruption and mitigate crises (¶3.73).

6. Labor SFD (GN-2741-12) (2021)

(i) Sector's role in reaching net-zero emissions:

a. Skills development programs are also essential in the transition to a green and climate-resilient economy with low GHG emissions and reduced vulnerability to climate change and shocks. Coherent environmental and labor policies will be needed to decarbonize LAC economies and ensure a green and climate-resilient transition (¶3.12).

(ii) Effects of expected changes to sector policies and technology:

a. Climate change also exposes the assets of social security systems, such as pension funds, to financially material climate-related risks. So far, more than 60% of the world's 100 largest public pension funds—and all LAC funds surveyed—have little or no approach to climate change (¶2.29).

(iii) Transition risks faced by the sector: Not applicable.

(iv) Sector's contributions to a just transition:

a. New jobs can be created (e.g., in the shift to renewable energy) if adequate skilling and reskilling policies are implemented. Incorporating climate-smart practices into vocational training is also key to reducing vulnerabilities: for example, they can enable farmers to anticipate, absorb, and recover from weather shocks. Unfortunately, skills for a green and climate-resilient transition are not yet part of most formal technical and vocational education and training curricula in LAC (¶3.12).

(v) Vulnerability of sector to climate change impacts:

a. Beyond the pandemic, labor markets are vulnerable to four trends—technology, demography, climate change, and migration—likely to reshape LAC economies in the coming decades. The region is also highly vulnerable to climate change; the anticipated increase in the frequency and intensity of natural disasters together with the slow-onset impacts of climate change is already disrupting economic activities and leading to job and productivity losses (¶2.4).

(vi) Tools available to face climate change risks:

a. Given the region's high vulnerability to climate change, social insurance systems will also have to anticipate and consider climate-change-related risks as well as changes in the demand for services and benefits and develop both effective preemptive measures and post-event responses (¶3.32).

b. Modern institutions need to provide guidance for firms and workers on how to upgrade the skills of the labor force in LAC, supporting education and training in institutions that implement curricula and learning approaches aligned with labor market demands and help mitigate climate change vulnerability (¶5.6).

7. Transportation SFD (GN-2740-12) (2020)

(i) Sector's role in reaching net-zero emissions:

a. LAC must promote a transportation system based on the avoid-shift-improve approach (i.e., avoid and manage trips, shift to more sustainable modes, and improve energy efficiency) (¶2.2).

(ii) Effects of expected changes to sector policies and technology:

a. New trends and technologies applied to transportation are leading to an unprecedented speed of change. The main advances—in addition to traditional Intelligent Transportation System solutions—can be summarized as Autonomous, Connected, Electric, and Shared transportation. The benefits of these technologies would have a transformational impact on the sector, helping achieve more efficient, inclusive, and sustainable transportation (¶2.42).

b. Risks of the new transportation technologies (presented in Table 5 of the Transportation SFD).

(iii) Transition risks faced by the sector: Not covered.

(iv) Sector's contributions to a just transition: Not covered.

(v) Vulnerability of sector to climate change impacts:

a. The weaknesses in road infrastructure are the result of a series of factors that include vulnerability to natural disasters and climate change (¶2.18).

b. Moreover, the project cycle seldom considers the climate resilience and adaptation capacity of infrastructure. Climate change may damage or destroy infrastructure, inflicting significant social and economic costs estimated at between 1.5% and 5.0% of regional GDP (¶2.20).

(vi) Tools available to face climate change risks:

a. Including climate change criteria as part of the design, construction, and operation of transportation infrastructure requires strengthening the planning and pre-investment systems by (1) including adaptation parameters such as adopting resilient construction methods and materials, (2) evaluating extreme climate vulnerability (Blue Spot Analysis) for asset management and identifying and prioritizing interventions to ensure the resilience of the transportation network, and (3) updating national infrastructure design guidelines and adopting technical standards that ensure climate-change-resilient transportation infrastructure (¶3.31).

8. Long-Term Financing SFD (GN-2768-9) (2023, final version forthcoming)

(i) Sector's role in reaching net-zero emissions:

a. As climate change unfolds, the region needs a financial sector that can mobilize financial resources toward investments in achieving carbon neutrality and in mitigation and adaptation activities (¶2.2).

b. The fight against climate change requires the mobilization of enough capital to finance long-term needs related to renewable energy generation, industrial energy efficiency, agricultural adaptation and the bioeconomy, sustainable transportation, and resilient infrastructure (¶2.17).

(ii) Effects of expected changes to sector policies and technology:

a. A type of public intervention concerns requirements to disclose climate risks (footnote 44 of the Long-Term Financing SFD).

(iii) Transition risks faced by the sector:

a. Transition risks are a challenge for the economies of the region that are more dependent on the exploitation and use of fossil fuels and for financial intermediaries whose portfolios are dependent on those sectors. This could pose a solvency risk to financial institutions whose balance sheets are highly expose to these industries (¶2.43).

(iv) Sector's contributions to a just transition: Indirectly.

(v) Vulnerability of sector to climate change impacts:

a. The financial sector of the future will need to balance the risks that undermine its stability and limit its resilience, with a view to navigating a complex transition, including climate change and its potential effects on financial risks in the sector (¶2.31).

b. There is a rising trend in the number of natural disasters and associated economic losses, which means that the region's financial institutions are also more exposed to physical risks through their investments and loan portfolios in economic sectors that are vulnerable to the impact of climate change and natural disasters. For example, given that banks in the Caribbean are highly exposed to tourism investments and banks in Central America are highly exposed to agricultural loans, they are vulnerable to potential nonpayment and deteriorations in the value of their assets (¶2.43).

(vi) Tools available to face climate change risks:

a. The region has not systematically used other financial solutions for transferring climate risks, such as climate derivatives or the issuance of insurance-linked securities (ILS) or catastrophe bonds. Mexico is the only country of the region that has issued catastrophe bonds (footnote 41 of the Long-Term Financing SFD).

b. Climate risk tools seek to integrate climate risks in decision-making for capital allocation and support climate objectives by changing demand for green investments and the relative price thereof. Key examples include required climate-related financial disclosures, corporate governance reforms, and classifications of sustainable activities (¶3.19).

9. Citizen Security and Justice SFD (GN-2771-12) (2023)

(i) Sector's role in reaching net-zero emissions: Not applicable.

(ii) Effects of expected changes to sector policies and technology: Not applicable.

(iii) Transition risks faced by the sector: Not applicable.

(iv) Sector's contributions to a just transition: Not applicable.

(v) Vulnerability of sector to climate change impacts:

a. Natural disasters and climate change as risk factors that drive violence (¶1.4).

(vi) Tools available to face climate change risks: Not covered.

10. Tourism SFD (GN-2779-12) (2022)

(i) Sector's role in reaching net-zero emissions:

a. The tourism sector needs to reduce emissions. A study conducted in 160 countries around the world indicates the carbon footprint of the tourism sector represented about 8% of GHG emissions from 2009 to 2013, four times higher than previous estimates. Transportation is one of the main contributors to tourism emissions: flights account for 40%, vehicle journeys for 32%, and accommodation for 21% (¶2.26).

b. A dependence on offsets exposes the sector to rising carbon costs and could be perceived as climate inaction (¶3.46).

(ii) Effects of expected changes to sector policies and technology:

a. The transition to circular economy models can improve tourism sustainability by prioritizing zero-emissions and zero-waste production processes. Guides to good environmental practices in the hotel sector contain numerous examples of circular economy initiatives; these have focused essentially on resource consumption and solid waste production (¶3.38).

(iii) Transition risks faced by the sector:

a. The significance of climate change for the tourism sector must be considered in sector planning and investment. Support urgently needs to be provided for the sector's active transition to the low-carbon economy, strengthening above all its resilience to climate change at the local level. To this end, tools for evaluating risks and potential impacts should strengthen analyses of climate vulnerability (¶4.11).

(iv) Sector's contributions to a just transition: Covered indirectly.

(v) Vulnerability of sector to climate change impacts:

a. Climate change adaptation and mitigation measures are critical for the resilience and sustainability of tourism destinations (¶2.23).

b. Climate change is affecting the attractiveness of tourist destinations in LAC. The main consequences of climate change for tourism are a loss of destination appeal due to increased risks to visitors, impacts on infrastructure, and challenges to the viability of tourism businesses, including insurance costs and the risk that tourism assets will be rendered worthless (¶2.24).

(vi) Tools available to face climate change risks:

a. For some types of destinations, adaptation measures will be essential for coping with climate change risks: promoting vacation packages in the off season, expanding shaded areas, artificial snow production, developing standards and specifications for enhanced resilience of infrastructure, restoration of beaches and dunes, and reinforcement of sea defense walls, among others (¶3.40 and ¶3.41).

11. Social Protection and Poverty SFD (GN-2784-12) (2021)

(i) Sector's role in reaching net-zero emissions:

a. Price controls and subsidies are still widely used, mainly for food and energy, and are typically justified as redistributive policies. In LAC, energy subsidies represent about 1% of GDP, and tax expenditures (such as exemptions, exclusions, deductions, deferrals, credits, and tax rates that benefit specific activities or groups) amount to about 3% of GDP, with 80% benefiting nonpoor population groups. In addition to being inefficient from the redistributive point of view, energy subsidies contribute to increased GHG emissions. Reducing energy taxes and compensating low-income groups for price increases through cash transfers has been proposed as part of fiscal and environmental reforms. In this fashion, cash-transfer programs have the potential to contribute to just transitions—that is, to a fair and inclusive energy transition that leaves no one behind and compensates the communities that bear the worst impact from decarbonization (¶3.2).

(ii) Effects of expected changes to sector policies and technology: See (i).

(iii) Transition risks faced by the sector: Not applicable.

(iv) Sector's contributions to a just transition: Throughout.

(v) Vulnerability of sector to climate change impacts:

a. The outlook of poverty and social exclusion in the region will be affected during recovery and beyond by four trends: demography, migration, climate change, and technology—and social protection systems must be able to adapt. The region is vulnerable to the effects of climate change; anticipated increases in frequency and intensity of natural disasters, together with the slow-onset impacts of climate change, are already disrupting economic activities and causing temporary poverty (¶2.8).

(vi) Tools available to face climate change risks:

a. Although conditional cash transfer programs were designed to address structural poverty, there is evidence that receiving them increases resilience against idiosyncratic and widespread shocks, such as extreme-weather events that have become more frequent and intense due to climate change (¶3.16).

b. Flexible unconditional cash-transfer programs are key in responding to large transitory shocks such as pandemics, extreme climate-related events, or natural disasters (¶5.3).

12. Water and Sanitation SFD (GN-2781-13) (2021)

(i) Sector's role in reaching net-zero emissions:

a. Final disposal sites for solid waste are the third largest anthropogenic source of methane emissions internationally, responsible for 14% of methane emissions and 5% of overall GHG emissions. Water and sanitation providers are thought to contribute to climate change, with between 3% and 7% of total GHG emissions (¶2.23).

b. In the case of solid waste, there is clear potential to mitigate climate change by using low-GHG-emission technologies to collect waste and active capture of biogas from sanitary landfills (¶3.8).

(ii) Effects of expected changes to sector policies and technology: Not covered.

(iii) Transition risks faced by the sector:

a. A failure to exploit the opportunities of the circular economy to reduce volumes of untreated wastewater and solid waste and the transition to a more climate-resilient economy with zero GHG emissions (¶2.20).

(iv) Sector's contributions to a just transition: Not covered.

(v) Vulnerability of sector to climate change impacts:

a. The availability of water resources for the supply of drinking water in many cities is increasingly affected by climate change (¶2.20).

b. Climate change is altering rainfall patterns and intensity, generating extreme events (floods and droughts) that damage the infrastructure of water and sanitation providers and challenge their ability to meet demand and forcing them to turn to distant water sources with higher costs and risks for the hydrological cycle (¶2.21).

c. Rising temperatures as a result of climate change may accelerate the degradation of water sources by increasing the presence of cyanobacteria (¶2.22).

d. Resilience involves having water to satisfy all uses and preserve its quality while also taking into account issues of climate change and risk management for natural disasters when planning infrastructure (¶3.14).

(vi) Tools available to face climate change risks:

a. Many operators of water and sanitation services lack risk management areas, early-warning systems, and contingency plans for dealing with extreme events. This is the case with respect to water safety plans for water sources that help increase the resilience of systems to the effects of climate change (¶2.25).

b. Successful practices have converged on the following: integrated water resource management; planning infrastructure works resilient to climate change; incorporating adaptation plans into sector management and investment plans; implementing demand management strategies; and ensuring adequate price or rate levels and structures for water and sanitation services (¶3.15).

13. Innovation, Science, and Technology SFD (GN-2791-13) (2022)

(i) Sector's role in reaching net-zero emissions:

a. Green procurement helps align public spending with countries' national policies on environmental sustainability and advance fulfillment of international climate change targets and commitments (footnote 27 of the Innovation, Science, and Technology SFD).

b. IDB Group operations in the sector will address climate challenges by strengthening the capacity of counterparts in designing and implementing

science, technology, and innovation policies and programs focused on climate change mitigation and adaptation. Demand from beneficiaries will be stimulated through actions to raise awareness of the impacts of climate change and through implementing projects that demonstrate opportunities for climate action (¶5.3.h).

(ii) Effects of expected changes to sector policies and technology:

a. Major advances in science, technology, and innovation (STI) have been triggered by profound crises, forcing us to rethink and redesign how to deliver solutions and respond to problems that have arisen during difficult times. Health is one area, but the current climate crisis, heightened social tensions, and the need for greater connectivity are also areas in which an STI-based response can deliver technically and economically viable solutions (¶2.2).

(iii) Transition risks faced by the sector: Not covered.

(iv) Sector's contributions to a just transition:

a. There is also resounding evidence of the effect innovation activities have on job quality, better wages, income distribution, more sophisticated production, and export diversification (¶2.5).

(v) Vulnerability of sector to climate change impacts: Not covered.

(vi) Tools available to face climate change risks:

a. Procurement systems can stimulate innovation by expanding the market for new goods and facilitating the adoption of new standards by, for example, incorporating guidelines for products and works with environmental and climate change considerations (¶3.3.c).

14. Gender and Diversity SFD (GN-2800-13) (2022)

(i) Sector's role in reaching net-zero emissions:

a. Studies show that secured land ownership enables communities to invest in their physical and human capital and contribute to climate change mitigation (¶3.10).

(ii) Effects of expected changes to sector policies and technology: Not applicable.

(iii) Transition risks faced by the sector: Not applicable.

(iv) Sector's contributions to a just transition:

a. As the IDB Group promotes climate-resilient economies with low-GHG emissions and the reduction in vulnerabilities to climate change, a strategic lesson learned is that there are currently no instruments in place to implement this transition with a gender and diversity perspective. Specifically, it is necessary to develop evidence-based skills programs that facilitate women's and diverse groups' entry into green jobs, where they are traditionally under-represented, and stewardship programs that reward the expertise of IP and AD communities to protect biodiversity and prevent deforestation and allow to replicate such efforts (¶4.20).

(v) Vulnerability of sector to climate change impacts: Throughout.

(vi) Tools available to face climate change risks:

a. Persons with disabilities are more likely to be left behind in natural disasters due to a lack of adequate planning, as well as inaccessible transportation and services. Moving forward, a strategic lesson learned from the pandemic is the need to strengthen preparedness, such as disability inclusive National Plans for Emergencies, even more urgent with climate change (¶4.18).

15. Decentralization and Subnational Governments SFD (GN-2813-8) (2018)

(i) Sector's role in reaching net-zero emissions:

a. Sector interventions will seek to increase subnational governments' capacity to manage spending and deliver efficient and quality services, addressing the population's needs and demands and contributing to territorial development (prioritizing low-carbon, resilient development) (¶5.5).

(ii) Effects of expected changes to sector policies and technology: Not applicable.

(iii) Transition risks faced by the sector: Not covered.

(iv) Sector's contributions to a just transition:

a. In other cases, at least 20% of cash transfers were not received by beneficiary households due to problems of local capture; similar issues meant that almost 60% of subsidies for certain inputs (fertilizers) were appropriated by local authorities. In these examples, vulnerable groups are the ones most affected by the lack of transparency and accountability, highlighting the importance of providing information with a view to fostering efficiency in the use of public resources (¶2.31).

(v) Vulnerability of sector to climate change impacts: Not applicable.

(vi) Tools available to face climate change risks:

a. Recent years have seen greater progress in devolving new responsibilities to local entities. These include aspects of environmental management, given the interest of subnational governments in working with ecological or environmental taxes. Ecotaxes are an innovative source of subnational revenue, due to their ability to correct externalities and shift the development of cities onto a more sustainable fiscal and environmental footing (¶4.14).

16. Environment and Biodiversity SFD (GN-2827-8) (2018)

(i) Sector's role in reaching net-zero emissions:

a. Jaffe et al. (1995) is a well-cited study which finds little evidence in support of environmental regulation having an adverse impact on manufacturing sector competitiveness in the United States. Dechezleprêtre and Sato (2017) focus on the manufacturing sector and regulations targeting emissions and find that since Jaffe et al. (1995) conclusions of studies—that employ more robust databases, more advanced econometric techniques, and finer levels of data disaggregation—have only strengthened the authors' conclusions (¶2.32).

b. Short-lived climate pollutants are another type of air pollutant that also negatively impact human health and contribute to climate change. The good news is that they remain in the atmosphere only a relatively short period of

time and, hence, can be quickly controlled through policy interventions and technological changes. Black carbon, which lasts days to weeks in the atmosphere, hydrofluorocarbons (~15 years), methane (~a decade), and tropospheric ozone, also known as smog (~weeks to months) are the four main short-lived climate pollutants (¶3.31).

(ii) Effects of expected changes to sector policies and technology: Not applicable.

(iii) Transition risks faced by the sector: Not applicable.

(iv) Sector's contributions to a just transition: Not applicable.

(v) Vulnerability of sector to climate change impacts: Throughout.

a. The retreat of Andean glaciers, the drying up of wetlands and heathlands caused by climate change are substantially altering stream flow patterns. Climate change will continue to impact the Amazon ecosystem and it will threaten LAC terrestrial biodiversity due to species range shifts. It will also reduce agricultural yields, livestock, and fisheries, although there may be opportunities in adaptation such as increasing rice yield in several LAC countries or higher fish catch potential in the southernmost South American waters. Climate change related impacts such as increase in sea surface temperature and ocean acidification could alter the region's marine and coastal biodiversity. Specifically, coral reefs, mangroves, fish species, and other benthic marine invertebrates are threatened by those climate-induced phenomena. For instance, it is predicted that the Mesoamerican coral reef will collapse by mid-century (between 2050 and 2070) due to ocean acidification, causing major economic and environmental losses. Regions like the Southern Gulf of Mexico and the Caribbean are particularly vulnerable to sea level rise and changes in the seasonal storm behavior. Also, there is climate modelling evidence that suggests an increase in the occurrences of El-Niño, which could affect the Pacific coastline of LAC. It is estimated that nowadays in LAC more than 7.5 million inhabitants and US$334 billion in built capital are exposed to flooding. With extreme sea levels, changes in storm behavior, and population growth, over nine million people could be exposed and vulnerable to flooding by the end of the century.

(vi) Tools available to face climate change risks:

a. Command and control policies directly regulate activities through legislation, for example, through emissions standards or land-use restrictions. Economic instruments such as payment for ecosystem Services by contrast, are designed to create economic incentives to induce a desirable behavior (¶2.7).

17. Energy SFD (TBD) (2023, forthcoming)

(i) Sector's role in reaching net-zero emissions: Tbd

(ii) Effects of expected changes to sector policies and technology: Tbd

(iii) Transition risks faced by the sector: Tbd

(iv) Sector's contributions to a just transition: Tbd

(v) Vulnerability of sector to climate change impacts: Tbd

(vi) Tools available to face climate change risks: Tbd

18. Fiscal Management (GN-2831-13) (2023)

(i) Sector's role in reaching net-zero emissions:

a. Achieving targets for reductions in greenhouse gas emissions will involve promoting behavioral changes and planning substantial transformations across all sectors of the economy so as to ensure an orderly transition to a low-carbon economy. Finance ministries play a key role in this area, not only because they allocate public resources to finance climate actions, but also because they can play a leadership role by using fiscal tools to modify private sector incentives and by establishing rules, mechanisms, processes, and controls to ensure that public program and project decisions support an orderly, just, and inclusive transition, thus avoiding future costs (¶2.55).

(ii) Effects of expected changes to sector policies and technology:

a. The inclusion of climate considerations in PFM could help to improve the effectiveness of climate actions by governments. Almost all countries in the region lack clear and effective ministry of finance guidelines that explain how to integrate climate change considerations into budget programs, public procurement, and the structuring of investments (¶2.65).

(iii) Transition risks faced by the sector:

a. The global energy transition will reduce future demand and prices for fossil fuels, as well as public revenues from this source. Accordingly, the finances of several countries in the region will be severely affected by falling hydrocarbon revenues and the existence of physical resources and assets that they will be unable to exploit (¶2.62).

(iv) Sector's contributions to a just transition:

a. Despite the potential benefits in terms of reducing emissions, international experience shows the political difficulty of reducing fuel subsidies. This is partly due to the possible effects on inequality and poverty (¶3.51).

(v) Vulnerability of sector to climate change impacts:

a. In the context of increasingly frequent climate events of growing magnitude, fiscal strategies to reduce the fiscal impact of these events have become increasingly important, yet these currently exist in only a few countries in the region. Similarly, although several countries have occasionally hedged against climate events through the issue of catastrophe bonds or insurance contracts, these actions are not generally carried out systematically or in coordination with a general strategy for managing climate risks (¶2.60).

(vi) Tools available to face climate change risks:

a. There is a degree of consensus that carbon pricing policies that increase the cost of emitting greenhouse gases can play a role in countries' emissions reduction strategies—for example, where the price is applied to sectors in which green technologies are not yet competitive. Carbon taxes are of particular importance; these are usually considered to be efficient tools for reducing carbon dioxide emissions. In LAC, only five countries have carbon taxes. However, these taxes are characterized by low rates and low levels

of coverage, and this reduces their effectiveness in reducing carbon dioxide emissions. It is important to take into account the political economy challenges associated with price reforms, for example by ensuring gradual implementation, compensating vulnerable families and businesses, and organizing public consultations and communication strategies (¶2.56).

b. Currently, little is known regarding climate spending by the countries in the region, mainly due to the absence of robust budget tagging that would allow these expenditures to be identified. (¶2.65).

19. Early Childhood Development SFD (GN-2966-2) (2019)

(i) Sector's role in reaching net-zero emissions: Not covered.

(ii) Effects of expected changes to sector policies and technology: Not applicable.

(iii) Transition risks faced by the sector: Not applicable.

(iv) Sector's contributions to a just transition: Not covered.

(v) Vulnerability of sector to climate change impacts:

a. An exhaustive review of this literature (Almond, Currie, and Duque 2018) focuses on the long-term impact of various types of early childhood experiences: changes in nutrition, nutritional supplements, exposure to stress, infectious diseases, environmental pollution, climate phenomena, or alcohol and tobacco consumption (footnote 1 of the Early Childhood Development SFD).

(vi) Tools available to face climate change risks: Not applicable.

20. Transparency and Integrity SFD (GN-2981-2) (2019)

(i) Sector's role in reaching net-zero emissions: Not covered.

(ii) Effects of expected changes to sector policies and technology: Not applicable.

(iii) Transition risks faced by the sector: Not applicable.

(iv) Sector's contributions to a just transition: Not applicable.

(v) Vulnerability of sector to climate change impacts: Not applicable.

(vi) Tools available to face climate change risks: Not applicable.

21. Extractive Industries SFD (GN-3028-2) (2021)

(i) Sector's role in reaching net-zero emissions:

a. Extractive industries contribute to climate change, which can exacerbate the impact on biodiversity, natural capital, and ecosystem services. To prevent or mitigate these negative impacts, the region needs to strengthen environmental rules, standards, and procedures, including the circular economy, and conduct ongoing monitoring of these impacts (¶2.16).

b. There is a need to address the costs and distortions created by subsidies for fossil fuel production in the region (¶2.30).

c. The energy transition will entail a more intensive use of minerals and metals than in the past, including lithium, which will open new opportunities for the mining sector in the region (¶2.31–2.32).

(ii) Effects of expected changes to sector policies and technology:

a. In addition, new technologies can help reduce the environmental risks and impacts of extractive industries (¶2.16).

b. Future demand for fossil fuels will depend on climate policies and the energy transition (¶2.26).

(iii) Transition risks faced by the sector:

a. Stranded assets created by the energy transition could have serious adverse consequences for the region. Stranded assets include oil, gas, and coal fields that remain untapped due to the energy transition, as well as exploitation, transportation, processing, and utilization infrastructure (¶2.28).

b. One of the main risks associated with stranded assets is a drastic decline in government revenue from the extractive sector (¶2.28).

c. There is currently no consistency between countries' mining and energy, climate, and fiscal objectives, and this represents an obstacle to an orderly process of energy transition in LAC (¶2.29).

(iv) Sector's contributions to a just transition:

a. Governments in the region face the challenge of developing long-term strategies that anticipate costs, deal with compensation, and ensure a just transition while being careful to minimize the impact on social groups that might be negatively affected, such as workers in the fossil fuel industries (¶2.29).

(v) Vulnerability of sector to climate change impacts:

a. The demand for fossil fuels from LAC countries is vulnerable to the energy transition process associated with fulfillment of the Paris Agreement (¶2.27).

(vi) Tools available to face climate change risks: Not covered.

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