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CLIMATE CHANGE SECTOR FRAMEWORK DOCUMENT

CLIMATE CHANGE DIVISION

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ABBREVIATIONS

ADB	Asian Development Bank
CARICOM	Caribbean Community
CIF	Climate Investment Funds
CO_2e	Carbon-dioxide equivalent
CRI	Climate Risk Index
CSA	Climate-smart agriculture
DARA	Development Assistance Research Associates
ECLAC	Economic Commission for Latin America and the Caribbean
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
GHG	Greenhouse gas
IPCC	Intergovernmental Panel on Climate Change
LAC	Latin America and the Caribbean region
LPG	liquefied petroleum gas
LTS	Long-term low GHG emission development strategies
MDB	Multilateral development bank
NDC	Nationally Determined Contribution
ND-GAIN	Notre Dame Global Adaptation Index
OECD	Organization for Economic Co-operation and Development
OVE	Office of Evaluation and Oversight
ppm	parts per million
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RISE	Readiness for Investment in Sustainable Energy
SDG	Sustainable Development Goals
SFD	Sector Framework Document
tCO_2e	Tons of carbon dioxide equivalent
tpc	Tons per capita
UNFCCC	United Nations Framework Convention on Climate Change
WRI	World Resources Institute

EXECUTIVE SUMMARY

i. Long-term economic growth and the reduction of poverty and inequality in Latin America and the Caribbean (LAC) depend on development that is economically, financially, environmentally, socially, and institutionally sustainable. Climate change is a challenge for sustainable development in the region. LAC is vulnerable to sea level rise, an increase in intensity and frequency of weather-related natural hazards, water and vector-borne diseases, and changing precipitation and temperature patterns. Marginalization, poverty, and development gaps are key drivers of vulnerability to climate change impacts; inclusive social development will be key to building resilience. The size, geography, and location of small island states makes them particularly vulnerable to climate change.

ii. The 2015 Paris Agreement has three objectives: (i) limit the global temperature rise this century to well below 2°C above pre-industrial levels; (ii) increase climate resilience; and (iii) make finance flows consistent with a pathway toward low greenhouse gas (GHG) emissions and climate-resilient development. The world needs to transition to net zero carbon emissions before the end of the century, but current country-level commitments fall short of that objective. A world with net zero emissions is technically possible and consistent with economic growth.

iii. The IDB is ready to support LAC in delivering objectives and commitments made by countries under the Paris Agreement, and this Sector Framework Document (SFD) intends to orient the Bank's work on climate change. Based on the analysis of the international evidence and lessons learned from past IDB experience, four main challenges emerge for the region related to climate change. First, the right institutions must be in place to guide climate action. Next, more resources—public and private, concessional and non-concessional—are needed for the region to finance climate action. Third, some important knowledge gaps remain. Finally, climate change must be considered at the sector level.

iv. **Institutions for climate action.** Effective legal, regulatory, and institutional frameworks are needed for climate-resilient and low-carbon development, and LAC has made gradual progress. Short-term action needs to be aligned with the long-term decarbonization goal, climate resilience, and other development goals. Engaging ministries of finance can help put climate change at the center of domestic decision making. Decision-making processes must factor in the deep uncertainty of climate change impacts. National systems articulating disaster risk management and adaptation are the core of a country's capacity to confront the challenge of climate change. Overcoming market and government failures is key to creating innovative investments and markets that are climate-resilient and low-carbon. The presence or absence of clear ground rules affect market incentives for climate action in the private sector.

v. **Finance for climate action.** Existing flows of finance for climate action are insufficient to cover the region's needs. Further investment, particularly in sustainable infrastructure, is needed. Climate change-related investments in developing countries face a variety of risks and barriers, and public policy has a key role in addressing them. Concessional finance can cover incremental costs and absorb risk. However, the architecture of international concessional climate finance can be difficult to navigate. To reach the necessary scale of investment, sources of finance must be diversified, and innovative approaches are needed to mobilize private finance.

vi. **Knowledge and innovation for climate action.** Local capacity is needed to generate high quality data and analysis to inform public and private decisions. There are challenges to determining the effectiveness of climate adaptation programs and the alignment of short-term action with the long-term decarbonization goal. Risk management and innovative decision making under deep uncertainty tools are increasingly seen as relevant to help governments make decisions in the face of uncertain climate change impacts. Promoting dialogue between diverse actors strengthens the nexus between science and decision making.

vii. **Sector approach to climate action.** The participation of key sectors is central to achieving climate-resilient and low-carbon development.

a. Countries need to take steps to decarbonize their economies in a socially-acceptable way to ensure compatibility with other sustainable development goals and ensure an inclusive and just transition. Poverty is a critical driver of vulnerability to climate change impacts, and climate change impacts and extreme weather events push people into poverty and affect human health (e.g. malaria, dengue fever, cholera, and heat stress).

b. Climate risks are a growing concern. Climate-related stranded assets are an important risk for the region, given its fossil fuel resources; there is a growing interest in managing these risks.

c. Infrastructure choices will be a major driver of future emissions and identifying a range of possible impacts of climate change and considering them in infrastructure planning and design is an essential part of increasing resilience. The region has a considerable endowment of natural resources that could facilitate the decarbonization of energy in LAC and renewable energy also provides opportunities to bolster climate resilience. Transit-oriented urban development can help mitigate climate change by reducing fuel consumption. The circular economy is increasingly recognized as a key opportunity for sustainability by minimizing waste. The transportation sector is vulnerable to natural disasters. Unsustainable water resource management practices in LAC threaten water security.

d. A sustainable landscapes approach is needed to align social, environmental, and economic objectives. There are key opportunities to reduce emissions through reforestation. Climate change will impact agricultural productivity and agricultural and livestock practices need to be transformed. The region's marine ecosystems and fishery productivity are being threatened by climate change and ocean acidification. The protection of biodiversity and other ecosystem functions contributes to maintaining a more resilient state of natural resources, which will allow for easier adaptation to climate change.

viii. **Dimensions of success.** During the period that this SFD is in effect, the IDB will prioritize four dimensions of success: (i) countries have institutions and markets that are supporting their objectives and commitments, including under the Paris Agreement, for climate-resilient and low-carbon development; (ii) countries improve their access to climate finance and the effectiveness of its use; (iii) countries apply tailored knowledge to effectively support climate-resilient and low-carbon development; and (iv) countries make progress on mainstreaming climate considerations across sectors.

I. THE SECTOR FRAMEWORK DOCUMENT IN THE CONTEXT OF EXISTING REGULATIONS AND THE INSTITUTIONAL STRATEGY 2010-2020

A. The Climate Change Sector Framework Document as part of existing regulations

1.1 The Climate Change Sector Framework Document intends to orient the Inter-American Development Bank's (IDB) work on climate change. It serves as a guide for incorporating the concepts of climate-resilient and low-carbon development into the design and implementation of analytical work and operations supporting the LAC region's needs, including those of the private sector. In accordance with paragraph 1.20 of document *"Strategies, Policies, Sector Frameworks, and Guidelines at the IDB"* (GN-2670-1), which stipulates that Sector Framework Documents (SFD) should be updated every three years, this document replaces the "*Climate Change Sector Framework Document"* (GN-2835-3) approved by the Operations Policy Committee in December 2015.

1.2 The update of this SFD reflects important recent international agreements, particularly the Paris Agreement and the 2030 Sustainable Development Agenda. All 26 IDB's borrowing member countries have signed the Paris Agreement and adopted the 17 SDGs, 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,[1] and participated in the third UN Conference on Housing and Sustainable Development (known as Habitat III) in Quito, Ecuador.

B. The Climate Change Sector Framework Document and the IDB Institutional Strategy

1.3 This SFD is consistent with the "*Update to the Institutional Strategy 2010-2020: Partnering with Latin America and the Caribbean to Improve Lives"* (AB-3008), which recognizes that LAC countries are highly vulnerable to the effects of climate change—physical damage as well as losses that are concentrated among the most vulnerable populations. Accordingly, climate change and environmental sustainability is included as one of the IDB Group's three cross-cutting issues.[2] The strategy notes that the three challenges and three cross-cutting issues are inter-related and that tackling them requires a multidisciplinary approach. It further commits the IDB Group to giving special attention to these issues in its interventions, guided by current policy, sector strategies, and action plans, and considering the specific country context reflected in country strategies.

1.4 In addition, this SFD is framed within the "*Integrated Strategy for Climate Change Adaptation and Mitigation, and Sustainable and Renewable Energy"* (GN-2609-1) and the "*Sustainable Infrastructure for Competitiveness and Inclusive Growth Strategy*" (GN-2710-5), as well as the "*Environment and Safeguards Compliance Policy"* (GN-2208-20), the "*Disaster Risk Management Policy"* (GN-2354-5), and their respective operating guidelines (GN-2208-25 and GN-2354-11).

1.5 Given the cross-cutting nature of climate change, this document also considers other SFDs, particularly Agriculture and Natural Resources Management (GN-2709-5);

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[1] 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.

[2] The other cross-cutting issues are: (i) gender equality and diversity; and (ii) institutions and the rule of law.

Decentralization and Subnational Governments (GN-2813-8); Energy (GN-2830-3); Environment and Biodiversity (GN-2827-3); Food Security (GN-2825-8); Gender and Diversity (GN-2800-8); Innovation, Science, and Technology (GN-2791-8); Integration and Trade (GN-2715-6); Social Protection and Poverty (GN-2784-7); Tourism (GN-2779-7); Transportation (GN-2740-7); Urban Development and Housing (GN-2732-6); and Water and Sanitation (GN-2781-8).

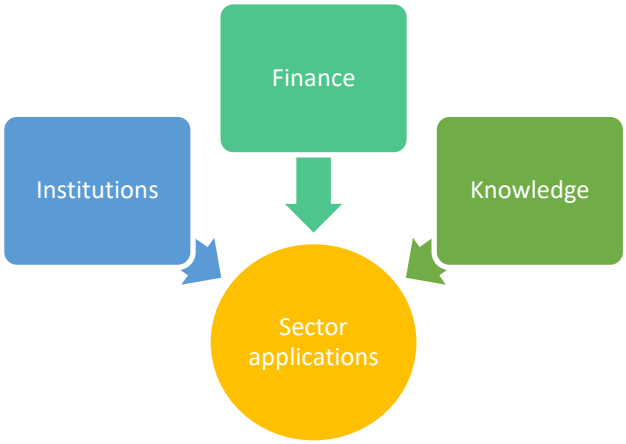
1.6 Finally, this SFD is aligned with the "*Climate Change Goal of the IDB and the IIC"* (AB-3067) and associated "*IDB Group Climate Change Action Plan 2016-2020"* (GN-2848-4); while related, these are different instruments. In April 2016, the IDB and IIC Boards of Governors endorsed the goal of increasing the financing of climate change-related projects to 30 percent of the IDB's and IIC's total approval volume of loans, guarantees, investment grants, technical cooperation, and equity operations by December 31, 2020, subject to demand from borrowing countries and clients, and access to external sources of concessional financing. Within the context of this resolution, Management also committed to improve the evaluation of climate risk and to identify opportunities for resilience and adaptation measures at the project concept stage and to accelerate efforts to mainstream climate change. The Climate Change Action Plan presents the IDB Group joint approach for achieving the 30 percent climate finance goal and systematically mainstreaming climate change into operations. The SFD is not regulatory in nature, nor is it a tool for mainstreaming. It presents a diagnostic of the main challenges in the region and identifies actions that, based on the evidence, could be used address those challenges.

II. International Evidence on the Effectiveness of Climate Change Policies and Programs

2.1 Long-term economic growth and the reduction of poverty and inequality in LAC depend on development that is economically, financially, environmentally, socially, and institutionally sustainable. Climate change is a critical challenge for sustainable development in the region. The Paris Agreement and the SDGs marked a turning point in the international commitment to deliver sustainable development.

2.2 The evidence on climate change policies and programs presented here is grouped into four principal areas: (i) how institutions can support climate action; (ii) how much and what type of financing is needed to support climate action; (iii) what knowledge gaps need to be filled to drive climate action; and (iv) how these first three areas apply to sectors (Figure II-1). This classification does not imply that there are strict divisions between these areas. Indeed, interaction, feedback, and synergies exist between them.

Figure II-1: Areas of Evidence



2.3 This section presents international evidence on the effectiveness of climate change policies and programs. Section III covers the challenges in the region that the IDB seeks to address. Section IV summarizes the lessons learned from the IDB's experience with climate change. To conclude, based on the empirical evidence and the lessons learned, Section V presents the dimensions of success that are proposed as priorities for the IDB's work with countries to address climate change challenges during the next three years: (i) countries have institutions and markets that are supporting objectives and commitments toward climate-resilient and low-carbon development; (ii) countries improve their access to finance for climate action and the effectiveness of its use; (iii) countries apply tailored knowledge to effectively support a just transition toward a climate-resilient and low-carbon economy; and (iv) countries make progress on mainstreaming climate considerations across sectors.

A. International climate change context and scope of climate actions

2.4 Part A of this section provides global context to frame the overall challenge of climate change.

2.5 **Climate change is a challenge for sustainable development** (IPCC 2014b). A warming world entails a threat to equitable and sustainable development, placing a heavier burden on the poor; thus, poverty alleviation, economic growth, and climate change mitigation and adaptation are critically linked (IPCC 2014b). If no action is taken, the impacts of already committed levels of climate change could push more than 120 million additional people into poverty by 2030 (Hallegatte, Bangalore, et al. 2016). Poor and vulnerable households are particularly at risk, because they tend to be affected more frequently by those impacts, lose relatively more when affected, and have less capacity to cope and recover than the average household (Hallegatte, Vogt-Schilb, et al. 2017). As such, poverty and development gaps are the key drivers of vulnerability to climate change impacts. Bridging development gaps and promoting inclusive growth can contribute to reducing vulnerability to climate change impacts (Hallegatte, Bangalore, et al. 2016). In other words, adaptation actions should be viewed as contributing to sustainable development.

2.6 Terms such as mitigation, resilience and risk take on specific meanings in the context of climate actions. Table A summarizes the key terms used in this document.

Table A: Glossary of Key Terms

Climate change. A change in the average state of the climate or its variability that persists over an extended period (normally decades or longer) that can be identified by statistical methods. Climate change may be due to natural internal processes, external forcings, or persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC 2014b).

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. Water vapor (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere. Moreover, there are several entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, dealt with under the Montreal Protocol. Beside CO_2, N_2O and CH_4, the Kyoto Protocol deals with the greenhouse gases sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs)."

Among GHGs, CO_2 and N_2O are special in that they can stay in the atmosphere for hundreds to thousands of years. Stabilizing climate change thus requires bringing net emissions of CO_2 and N_2O to zero, while emissions of short-lived GHGs including CH_4 and hydrofluorocarbons only need to be stabilized at a low level for climate change to be kept in check (Fay, Hallegatte, et al., Decarbonizing Development: Three Steps to a Zero-Carbon Future 2015a).

Mitigation [of climate change]. "A human intervention to reduce the sources or enhance the sinks of greenhouse gases" (IPCC 2014a).

Vulnerability [to climate change]. Vulnerability is the degree to which a system (natural, human or material capital) is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is dynamic and is a function of the exposure to a threat, the sensitivity, and capacity to adapt (IPCC 2014b). Any adaptation measure as a response to a climate change impact should begin with an analysis of vulnerability and the associated risks.

Adaptation [to climate change]. Refers to a process of adjustment to actual or expected climate change and its effects. Adaptation cannot be instantaneous, so it is implemented in phases, starting with the opportunities for adaptation (IPCC 2014b). By its nature, adaptation must be a continuous, repetitive, and inclusive process and must actively involve various levels of government.

Adaptive capacity. The set of resources and local actions that an individual or a group must face, cope with, or exploit the impacts of climate change. Adaptive capacity leads to a better ability to cope with climate risks and is a function of various determinants, including economic and physical resources; access to technology, information and skills; infrastructure; and institutions. There is broad recognition of the critical role of institutions and governance mechanisms in building and facilitating adaptive capacity. The Paris Agreement through its 7th article urges countries to invest in strengthening adaptive capacity.

Resilience [to climate change]. "The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change" (IPCC 2007). In the specific case of climate change, this refers to the extent to which a system can recover from the impact of a climatic event.

Risk. "Potential for consequences where something of value is at stake and where the outcome is uncertain, resulting from the interaction of climate-related hazards (gradual changes as well as extreme events) with the exposure and vulnerability of human and natural systems" (OECD 2015). "Risks from climate change impacts arise from the interaction between hazard (triggered by an event or trend related to climate change), vulnerability (susceptibility to harm), and exposure (people, assets, or ecosystems at risk) […] Risk is often represented as the probability of occurrence of hazardous events or trends multiplied by the magnitude of the consequences if these events occur. Therefore, high risk can result not only from high probability outcomes but also from low probability outcomes with very severe consequences" (IPCC 2014a).

2.7 **Climate change impacts society and natural resources through both gradual impacts and more frequent and more intense climate-related shocks** (IPCC 2014b). Over time, water resource availability will change, oceans will acidify, biodiversity will be reduced and its distribution modified, mass extinctions will occur, and crop yields will vary (projected to decline in most places and increase at low latitudes) (IPCC 2014b). Climate shocks include heat waves, droughts, floods, hurricanes, and wildfires (IPCC 2014b). These climate impacts affect human societies by disrupting ecosystems and food and water supplies, damaging infrastructure and productive capital, and increasing mortality and morbidity. Exacerbated conflict, humanitarian crisis and migrations are also possible impacts (Burke, Hsiang and Miguel 2015).

2.8 **Climate change impacts are *deeply uncertain*.** Deep uncertainty means that climate models and experts disagree on accurate projections or even probability distributions about the magnitude and sometimes the direction of future changes (Hallegatte, Shah, et al. 2012). Uncertainty about climate change impacts does not mean that climate action should be delayed, but rather that climate action should rely on innovative tools that inform decisions based on an understanding of risk and uncertainty.

2.9 **Climate risks, both direct physical and indirect transitional, are a growing concern.** Physical risks include damages from more frequent and severe weather events and crop failure caused by changing precipitation patterns, among others. There are also important systemic risks to the financial sector as economies decarbonize, as assets such as fossil fuel reserves and power plants could become stranded by new climate policies (Caldecott, Harnett, et al. 2016, McGlade and Ekins 2015, Pfeiffer, et al. 2018). Failing to manage these risks could have major economic and financial implications. Recognizing this, G20 Finance Ministers and Central Bank Governors asked the Financial Stability Board (FSB) to review how the financial sector can take climate change into account. While climate risks cannot be fully eliminated, the exposure and vulnerability of economies can be reduced (OECD 2015).

2.10 **The Paris Agreement's main objective is to limit the global temperature rise this century to well below 2°C—and as close to 1.5°C as possible—above pre-industrial levels.** This objective is ambitious: it requires reaching zero net emissions of carbon dioxide (CO_2) and drastically reducing emissions of other GHGs before the end of the century (Fay, Hallegatte, et al. 2015a, Rogelj, et al. 2015, Sanderson, O'Neill and Tebaldi 2016). The Paris Agreement further calls for increasing climate resilience and making finance flows consistent with a pathway toward climate-resilient and low-carbon development.

2.11 **Under the Paris Agreement, countries are required to periodically submit Nationally Determined Contributions (NDCs) and invited to submit LTSs.** NDCs are plans to reduce GHG emissions domestically and adapt to the impacts of climate change. Many of the first NDCs set emission reductions plans for 2025, and all NDCs are supposed to be updated—and strengthened—every five years. LTSs are visions of possible pathways countries can take to make progress toward deep decarbonization by 2050, ideally considering what short-term milestones are consistent with that long-term goal, what policy reforms can deliver them, and what financing mechanisms would be needed (Fay, Hallegatte, et al. 2015a, Ross and Fransen 2017, Vogt-Schilb and Hallegatte 2017).

2.12 **Taken together, the current NDCs fall short of limiting the global temperature increase to 2°C** (Millar, et al. 2017, Schleussner, et al. 2016, UNEP 2017). One risk of

weak NDCs is that they give space for countries to continue to invest in long-lived carbon-intensive infrastructure such as fossil fuel power plants and sprawling cities that rely on private cars for transportation. From there, reducing emissions quickly to meet the Paris temperature targets would create unnecessary costs, especially in the form of stranded assets (Johnson, et al. 2015, Pfeiffer, et al. 2018).[3] Making the NDCs more ambitious, aligning them with LTSs, and ensuring that all key sectors of the economy are starting to invest in decarbonization would result in a smoother transition that would reduce future stranded assets and the total costs of meeting the Paris Agreement (UNEP 2017, Fay, Hallegatte, et al. 2015b). NDCs are not the only drivers of emissions reductions, however. Progress on climate policy and GHG emission outcomes can outpace NDC formulation and implementation if NDCs and national policies are not synchronized; for instance, many countries have ambitious renewable energy targets that are not reflected in their NDCs. Actual investments on the ground, not NDCs per se, are the ultimate driver of whether a country is on track to meet the Paris Agreement.

2.13 **A world with net zero GHG emissions is technically possible**. At both the global and regional levels, GHG emissions are currently concentrated in the energy sector, followed by agriculture and land use change. To achieve net zero emissions, action is needed on five fronts (Bataille, et al. 2016, Fay, Hallegatte, et al. 2015a, IPCC 2014a): (i) decarbonizing the production of electricity (e.g. using renewable power); (ii) undertaking massive electrification (e.g. introducing electric vehicles), and where not possible, switching to cleaner fuels (e.g. biofuels); (iii) switching to less carbon-intensive materials (e.g. away from cement, the production of which results in CO_2 emissions, and toward sustainably sourced wood, which captures CO_2) and diets (e.g. away from beef); (iv) improving efficiency and reducing waste in all sectors; and (v) conserving and increasing natural carbon sinks, through sustainable management of forests, oceanic and other natural ecosystems, and soils, combating deforestation and illegal logging, and carefully planning the change of land use.

2.14 **Cities have a key role to play in the transition to zero carbon emissions**. Cities can use public transport, land-use, and fiscal policies to drive the transition to zero emissions by promoting city shapes that reduce the need for transport, making public transport and nonmotorized transport more appealing to the population, and electrifying public transportation (IPCC 2014a). Cities are also often in charge of waste management, a significant source of GHG emissions globally. The interest of cities in the issue of climate change is growing, many are committing to reduce GHG levels, and many initiatives are emerging to promote good practices (such as the global network of megacities C40, the 2050 Pathways Platform, or the WRI Ross Center for Sustainable Cities).

2.15 **Economic growth can be achieved while reducing emissions** (Altenburg, et al. 2017, Álvarez-Espinosa, et al. 2017, Global Commission on the Economy and Climate 2014). Resilience to climate change is directly linked to economic growth: (i) resilience prevents some of the impacts of natural disasters that can affect growth (Hallegatte, Vogt-Schilb, et al. 2017); (ii) resilience may attract more investments from the public and private sectors (by reducing risk); and (iii) resilience investments can be chosen to maximize development co-benefits (Surminski and Tanner 2016). To achieve climate-resilient and low-carbon growth, governments should pursue growth-enhancing fiscal and structural reforms that support low-emission, resilient investments (OECD 2017). The challenge for governments is to revise policies and regulatory frameworks in a manner that aligns

[3] Stranded assets are assets that have suffered from unanticipated or premature write-downs, devaluations, or conversion to liabilities (Caldecott, Harnett, et al. 2016).

incentives with long-term development goals. The perceived high economic and social costs of climate policies and concerns about competitive disadvantage if stringent climate policies are not mirrored elsewhere have contributed to the limited ambition of the NDCs (OECD 2017).

2.16 **Unmanaged impacts on concentrated groups could jeopardize the political economy of emission-reduction policies** (Vogt-Schilb and Hallegatte 2017). The transition to net zero emissions has the potential to create homogenous groups of losers—e.g.: (i) energy-intensive and trade-exposed companies (especially in power generation, manufacturing, and livestock) losing competitiveness due to environmental regulations (Branger and Quirion 2014); (ii) lobbyists and workers opposing the phase down of fossil-fuel energy (Jenkins 2014, ILO 2018); and (iii) consumers at risk of falling into poverty protesting the increase of food and energy prices (Feng, et al. 2018, Ivanic and Martin 2014, Renner 2018)—who could have the power to veto reforms (Trebilcock 2014). Stranded assets and stranded jobs are a particularly important risk. In the power sector alone, it is estimated that one fifth of existing coal, gas and diesel power plants globally, and most of those planned or under construction, are at risk of being prematurely closed if ambitious climate policies are implemented (Pfeiffer, et al. 2018). Beyond political feasibility, for ethical reasons, care should be taken to protect vulnerable populations and ensure the transition to a low-carbon economy is inclusive and just.

2.17 **Proven solutions to avoid or compensate concentrated losses and ensure a just transition to net zero emissions exist** (Vogt-Schilb and Hallegatte 2017). One option is to price carbon emissions at a level that is acceptable in a given country context (Jenkins 2014, Parry, Veung and Heine 2015), and to use carbon revenues to protect those negatively affected or generate other growth and development benefits (Klenert, et al. 2018). A second option is to select policy instruments that redirect new investments toward clean equipment (e.g. electric vehicles, efficient buildings, and clean power plants), for example using energy efficiency standards or rebates for *new* clean equipment, instead of using carbon prices, which penalize the use of *existing* carbon-intensive equipment (Rozenberg, Vogt-Schilb and Hallegatte 2017). Improved planning toward net zero emissions is key to designing sectoral policies that will avoid further carbon lock-in and exacerbate the problem of stranded assets and vested interests in the medium term (UNEP 2017, Fay, Hallegatte, et al. 2015b, 2050 Pathways Platform 2017, Johnson, et al. 2015, Iyer, et al. 2017). A third option, when concentrated losses cannot be avoided, is to use ex-post compensation. Targeted policies can be used to help transform vulnerable industries into winners from the transition, for instance helping automakers switch to electric vehicles or fossil fuel companies diversify to renewable energy (Altenburg, et al. 2017, Hallegatte, Fay and Vogt-Schilb 2013). Tackling the political economy of emission-reduction strategies thus requires capacity to perform ex-ante assessments of the impact of reforms, to implement complementary policy packages to compensate those impacts, and to engage with relevant stakeholders to codesign or at least communicate the intent and consequences of those policy packages (Rentschler and Bazilian 2017). Countries with strong institutions capable of facilitating information sharing and social dialogue can be at an advantage to design and communicate such packages (ILO 2018, Hallegatte, Fay and Vogt-Schilb 2013, 2050 Pathways Platform 2017). Efforts to ensure a just transition are strategic because they can contribute to garnering community support for the pace of change that is needed to address climate change (Robins, Brunsting and Wood 2018). Increasing further their social and political acceptability, emission-reduction policies can be designed to be aligned with domestic development agendas—for

instance when a public transport system reduces global GHG emissions while also improving congestion and the health of local population (NCE 2016), or a shift to carbon taxes is used to reduce evasion and informality (Bento, Jacobsen and Liu 2018). See also paragraph 2.50 for more on making the transition inclusive and just.

2.18 **Other challenges for the political economy of climate change policy root in the public and political understanding of the problem**. Some challenges in the public sphere include difficulty for comprehending the scale and timing of the issue and irrational responses to the risk due to the uncertainty of climate change impacts (Stern 2015). The way the public processes information also likely contributes to these challenges. The scientific process seeks to eliminate personal biases, yet people find it difficult to discount the way they experience the world, and the internet has democratized information sharing (Achenbach 2015). Interested parties can take advantage of these challenges to (mis)shape public opinion. Working with governments to address misperceptions surrounding climate change will be an important step.

2.19 **Market and government failures hinder the implementation of emission-reduction measures.** Addressing climate change requires an appropriate policy and regulatory mix. GHG emissions are often influenced by non-climate policies. For instance, energy subsidies designed to improve access may incentivize consumption of fossil fuels and agricultural policies may incentivize deforestation. Rather than limit focus to implementing new climate policies, a detailed review and update of existing normative and regulatory frameworks may help countries move forward with a socially-acceptable transition to net zero emissions (OECD 2017).

2.20 **Even if anthropogenic GHG emissions were to cease now, the impacts of climate change will continue for several centuries** and the magnitude of the impacts and risk of irreversible changes will increase as global warming increases (IPCC 2014b).[4]

2.21 **The size, geography, and location of small island states makes them particularly vulnerable.** The development of islands is complicated by a number of factors: (i) the majority of the world's islands are resource-poor, have few marketable products, and have high transportation costs to external markets; (ii) production costs in islands are high because of the absence of economies of scale, and because most raw materials must be brought from the mainland; and (iii) islands usually face a shortage of trained human resources because the resident population size is usually small and training is costly (Watkins and Cruz 2007). The fragility of islands was officially recognized in 1992 at the United Nations Conference on Environment and Development. In 1994 Small Island Developing States endorsed the United Nations Program of Action on the Sustainable Development of Small Island Developing Nations (also known as the Barbados Program of Action), which identifies options for addressing these special needs. An ocean-based rather than land-based approach can help in sustainably developing ocean spaces for economic growth without compromising the ocean health and thus maintaining the potential to generate ocean wealth. The emergence of the "blue economy" concept at the 2012 United Nations Conference on Sustainable Development (also known as Rio+20) can help small coastal and island economies integrate land, coastal and marine development strategies, promote integrated regional value chains and progressively develop and participate in a host of dynamic coastal, marine and ocean-related industries, including land-based oceanic industries,

[4] Shifting biomes, soil carbon, ice sheets, ocean temperatures, and associated sea level rise have intrinsically long timescales, leading to changes that will last hundreds to thousands of years beyond the stabilization of surface temperature (IPCC 2014a).

aquaculture, mariculture, marine biotechnology, and marine renewable energy (Rustomjee 2016).

B. Institutions for climate action

2.22 **Effective legal, regulatory, and institutional frameworks underpin climate-resilient and low-carbon development.**[5] Climate change comes with uncertainty that poses challenges for long-term planning and generates a need for updated governance models that incorporate legal, regulatory, and institutional frameworks at various levels of government and across sectors. This includes appropriate mechanisms to stimulate innovation and commercialization, such as patent protection.

2.23 **Effective responses to climate change are coordinated across decision-making levels and sectors** (Meadowcroft 2011, 2050 Pathways Platform 2017). Subnational stakeholders are key to increasing national climate ambition (UNEP 2015). Sector specific and cross-cutting approaches geared toward climate-resilient and low-carbon development frequently involve large numbers of actors, interests, challenges, and opportunities, which can hinder progress (GGBP 2014). To confront this challenge, countries may use policies whose purpose is reducing emissions and improving resilience and in which each sector can address its specific problems and development challenges (i.e. sector policies that integrate climate change) (Meirovich 2014).

2.24 **A promising means of achieving such coordination is to integrate climate change considerations into national planning through the NDC and LTS processes and the SDG Agenda** (2050 Pathways Platform 2017). NDC mitigation and adaptation targets are aligned with at least 154 of the 169 indicators of the SDG framework (Northrop, et al. 2016). The NDCs should be aligned with long-term decarbonization pathways, particularly for long-lived infrastructure assets. Further capacity and engagement are needed to develop policies that foster clear and consistent pathways and guide investment decisions to avoid stranded assets and stranded jobs. The first global stock-take of progress against the Paris Agreement, in which countries review contributions with objective of increasing NDC ambition is scheduled for 2023.

2.25 **Including climate actions in public expenditure and budgets is a core challenge.** For policies to have the expected impact it is essential that they be integrated in national planning processes, have a clear budgetary allocation enabling their implementation, and demonstrate the government's commitment to incorporating these actions in the national development targets (ODI 2013). In addition, the increased frequency and intensity of extreme weather events has repercussions on public budgets that are direct (e.g. funding emergency reconstruction and rehabilitation) and indirect (e.g. drops in revenue from productivity and exports) and the budget balances of developing countries are less resilient to such events (Lis and Nickel 2009). However, climate

[5] According to the OECD, factors for the successful integration of climate resilience in development planning include: (i) political leadership and vision; (ii) development planning processes that consider climate resilience essential for coordinated actions at all levels of government; (iii) institutional structures that facilitate coordination and encourage the participation of all stakeholders; (iv) capacity building; (v) a strong evidence base to make the case for action and help establish priorities; (vi) access to finance combining national and international resources; (vii) development of mechanisms for monitoring, evaluating, learning, and adjusting processes; (viii) feedback between lessons learned and the design of new policies; and (ix) creation of coalitions bringing together various governmental and nongovernmental actors (OECD 2014).

change is yet to be incorporated into many sectors' planning processes, perhaps because the cost of delaying action is still misunderstood.

2.26 **National systems articulating disaster risk management and climate change adaptation are the core of a country's capacity to confront climate risks** (IPCC 2012). Frequently observed barriers to implementation of adaptation measures include the lack of long-term planning, a culture of crisis management rather than of prevention, limited autonomy over financial resources at the municipal level (IPCC 2014b), and uncertainty over the magnitude and impact of future climate change and the reaction and adaptation of ecosystems (Chambwera, et al. 2014, Patt and Schröter 2008).

2.27 **Tools for innovative risk management and decision making under deep uncertainty are increasingly used to analyze and respond to climate change impacts** (IPCC 2014b). Most climate change impacts are characterized by deep uncertainty surrounding their intensity and frequency (IPCC 2014b). Low-regret measures that provide benefits under current climate conditions and a range of future climate scenarios are starting points for addressing projected trends in exposure, vulnerability, and climate extremes (IPCC 2012). New methods (including decision making under deep uncertainty) are increasingly being used to help governments make decisions in the face of uncertain climate change impacts (Drouet, Bosetti and Tavoni 2015, Heal and Millner 2014, Kalra, et al. 2014, Kunreuther, et al. 2013).

2.28 **Increased public-sector capacity is needed to generate high quality data and analysis to inform robust and transparent decision making.** Countries need to consolidate (or establish) systems that drive an evidence-based policy process, particularly in the case of adaptation policy (Dixit, et al. 2012). Countries also need to build capacity for reporting climate actions using comparable measurements (Singh, Finnegan and Levin 2016). The Paris Agreement established an enhanced transparency framework for action and support in which countries will 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).

2.29 **The presence or absence of clear ground rules affect climate action in the private sector**. National and subnational policies should create an institutional environment that fosters private investment in low-carbon and climate-resilient projects and programs (Brown and Jacobs 2011). These include stable regulatory frameworks; incentives (e.g. subsidies, taxes, long-term financing, and promoting technological innovation);[6] a clear understanding of the relevant risks; availability of reliable information to make investment decisions; and identification of cost-effective opportunities. Policies should also be transparent and easily understood by the private sector.

C. Finance for climate action

2.30 **Financial flows need to be aligned with a pathway toward climate-resilient and low-carbon development.** This objective from the 2015 Paris Agreement sends a strong signal to public and private financial institutions and investors (Amerasinghe, et al. 2016). In 2009, developed countries committed to provide US$100 billion a year by 2020 for climate action in developing countries. In 2014, developed countries mobilized

[6] Government has a role in fostering sustainable innovation, including by funding relevant research and ensuring wide, international diffusion of technology through reduced trade barriers and effective enforcement of intellectual property rights, among others (OECD 2011).

US$62 billion of climate finance for developing countries (OECD and Climate Policy Initiative 2015). International development and multinational cooperation agencies play a pivotal role in mobilizing climate finance and MDBs, including the IDB, have established explicit climate finance goals. For the purposes of this document, the term "climate finance" is used to broadly refer to finance that intends to have benefits for climate change, regardless of the source of funds or level of concessionality.

2.31 **Investing in sustainable infrastructure is key for meeting objectives and commitments for climate-resilient and low-carbon development.** Since infrastructure assets are long-lasting and many are being built today—it is estimated that in the 2015–2030 period around US$90 trillion in new infrastructure investments will be needed (NCE 2016)—it is important that sustainability considerations be incorporated into those investment decisions (Mercer and IDB 2016, Pfeiffer, et al. 2018). Although sustainable infrastructure needs can increase upfront capital costs by roughly five percent, they can lead to lower operating costs over the life of the investment, while also reducing risks and negative externalities (Mercer and IDB 2016). To deliver this scale of investment, new sources of capital need to be mobilized, largely from private sources. To fulfill the Addis Ababa mandate, MDBs have been called upon to look beyond traditional loans and provide technical assistance, policy guidance, and financial instruments to effectively channel public and private resources toward the SDGs. This expanded mission stems from the realization that achieving the SDGs will require resources exponentially larger than what MDBs can provide. Given that MDB disbursements account for 3.2–3.8 percent of total current infrastructure spending, mobilizing additional resources is essential to fill the gap for sustainable infrastructure.

2.32 **Sustainable investments in developing countries face a variety of risks and barriers.** The risks associated with traditional infrastructure financing also apply to climate investments (Amin, Dimsdale and Jaramillo 2014, IFC 2011). Higher upfront capital costs favor investments in technologies with proven effectiveness, but that are also often associated with higher GHG emissions. The uncertainty surrounding mitigation and adaptation measures (e.g. new markets or technologies) and the short-term vision are significant barriers for climate action (Fay, Hallegatte, et al. 2015a, Höhne, et al. 2015, Ricke and Caldeira 2014, Stern 2006). Risks may be perceived as higher and inappropriate support measures may be put in place if policy-makers, project developers, and financiers do not fully understand the technologies (Amin, Dimsdale and Jaramillo 2014). Possible changes to policies and regulations, including international financing mechanisms, also contribute to investment risks (UNDP 2011).

2.33 **Public policy has a key role to play in addressing barriers.** Policies incentivize private sector investment by establishing sustainability standards, appropriate tax incentives, and effective risk sharing mechanisms between the public and private sectors. The Addis Ababa Action Agenda calls for policies and regulatory frameworks to be strengthened to better align private sector incentives with public goals, including incentivizing the private sector to adopt sustainable practices, and to foster long-term quality investment (United Nations 2015). Policy recommendations for designing smart sustainable incentive schemes include: (i) integration with the policy context; (ii) financial, operational, and policy additionality; (iii) targeted use of concessionality based on strong understanding of specific risks; (iv) transparency and predictability of incentives; and (v) deep and informed engagement of stakeholders (Amin, Dimsdale and Jaramillo 2014).

2.34 **Concessional climate finance can cover incremental costs and absorb risk; however, the architecture of climate finance is complex and resources are limited** (Annex, Figure A-2). Grants and concessional resources play a key role in addressing additional costs and risks associated with climate change actions. Strategic uses of limited public resources include reducing risk and providing project support to mobilize private capital (IFC 2016). Concessional public resources can be used to pilot new, potentially transformative, technologies and business models, as well as to scale-up their deployment. Principles for the effective use of concessional resources include sustainability (temporary use of concessional resources) and minimum level of concessionality needed to achieve the required outcomes. The proliferation of climate funds has led to inefficiency in the channeling and delivery of finance through duplicated efforts, varying rules and procedures, gaps in provisions (Amerasinghe, et al. 2016). Concessional climate finance is limited, and many climate funds face an uncertain future due to resource constraints and evolving mandates in contributor countries (Amerasinghe, et al. 2016). Historically most funds have engaged only in niche activities and only the larger funds (e.g. CIFs) have been able to engage lead ministries responsible for strategic investment planning and financial management decisions at country level (Nakhooda, et al. 2014). Taking more risk to support innovation and creating new incentives for shaping infrastructure and development finance choices are among the ways such funds could be even more effective (Nakhooda, et al. 2014). MDBs are well-positioned to assist countries in navigating the complex architecture of concessional climate finance.

2.35 **Innovative approaches are needed to mobilize private finance.** Blended finance affords an opportunity to move toward market-based financing in support of the SDGs and Paris Agreement if it is anchored to a development rationale, designed to increase the mobilization of commercial finance, tailored to the local context, focused on effective partnering, and monitored for transparency and results (OECD 2018). To achieve scale and narrow the SDG financing gap, blended finance must create investment-grade assets to crowd-in institutional investors and insurance companies (Convergence and Business and Sustainable Development Commission 2017). Increasing the sustainability of infrastructure can also lower investment risks and thereby attract more private sector capital. Over time, it would also lead to improved private-sector capability to design, build, and operate sustainable infrastructure and considering sustainability criteria in PPPs could increase private-sector investment by US$150 billion to US$255 billion over 15 years (Bielenberg, et al. 2016).

2.36 Blended finance solutions include risk mitigation for investors (first loss guarantees, local currency), debt (senior, subordinated or contingent loans, bonds), equity (funds, direct equity), and innovative forms of pricing and technical cooperation (performance-based incentives, investment grants, contingent grants). Bonds for sustainable development are used to structure financing packages that cater to different risk-profiles and crowd-in financing that would be otherwise unavailable. Guarantees can improve financing conditions for projects and help promote private sector investment by covering the risks that the private sector is not normally able to absorb or manage. The potential of guarantees to mobilize resources and catalyze private sector capital has not been fully utilized by donors, multilateral entities, and beneficiaries (IDB Group 2018).

2.37 **The challenges of leveraging private sector resources for sustainable infrastructure should not be underestimated**. Several key barriers reduce the likelihood of private investments in sustainable infrastructure: the absence of a clear

vision (e.g. national infrastructure strategy); the need for well-articulated pipelines of bankable projects; the lack of financing mechanisms to effectively mitigate risks and align financing with sustainability principles; and, unclear market signals due to a proliferation of standards and definitions of what constitutes sustainable infrastructure (IDB and IDB Invest 2018). Even with private financing, the public sector must continue to play a role in planning and regulating infrastructure. The necessary public and private coordination leads to unique and complex challenges

D. Knowledge and innovation for climate action

2.38 **The unique features of climate change create specific information needs.** Consistent and reliable climate information on the right scale for decision making is needed. It is key to improve understanding of the costs, benefits (economic, environmental, and social), opportunities, synergies, trade-offs, and limitations of the main adaptation and mitigation options, and their impact on sustainable development. Building understanding of the policy, fiscal, and structural reforms that are needed to align economic growth with measures for low-carbon and climate-resilient investments is also key (OECD 2017).

2.39 **Adaptation to climate change is difficult to disentangle from development because poverty and development gaps are the key drivers of vulnerability to climate change** (IPCC 2014b)**.** Much of the relevant adaptation literature lies in different strands of literature focused on specific development issues (e.g. health, nutrition, poverty eradication, access to basic infrastructure, conflict, institutions), which can make it difficult to see clearly the interdependence of these issues. The key is to understand what policies will help countries strive in a world shaped, inter alia, by climate change impacts.

2.40 **There are challenges to determining the effectiveness of climate adaptation programs.** There has been theoretical progress in monitoring and evaluation: M&E frameworks have been established for projects financed from international sources (CIF 2014) and universal metrics have been proposed to compare the effectiveness of adaptation actions at the project level (Stadelmann, et al. 2011). However, adaptation actions are context specific and there are usually practical difficulties in measuring them (Klein, Schipper and Dessai 2005). First, we cannot measure the actual outcomes on a predefined schedule (e.g. actions to improve robustness in the face of a 100-year event may not be tested for many years). Second, indicators that are appropriate in the context of a specific project are not often suitable for aggregation at the portfolio level. Thus, models are difficult to apply at the national (OECD 2015) or institutional level.

2.41 **Decision-making processes must factor the deep uncertainty of climate change impacts.** Better data about possible evolutions of climate conditions are needed, but these will never enable precise predictions. Decision makers around the world are increasingly using innovative analytical methods that facilitate decision making under uncertainty, particularly in planning processes (Bonzanigo, et al. 2015, Dittrich, Wreford and Moran 2017, Kalra, et al. 2014, IPCC 2014a, OECD 2015) (Bonzanigo, et al. 2015, Dittrich, Wreford and Moran 2017, Kalra, et al. 2014, IPCC 2014a, OECD 2015, Bonzanigo, et al. 2015). These methods are focused on helping a diverse range of stakeholders agree on decisions that would perform well under a variety of plausible futures, including under different climates, rather than deriving the best decision given a single objective and single view about the future.

2.42 **Monitoring progress toward full decarbonization requires sector indicators aligned with long-term decarbonization strategies**, such as “passengers transported by

mass-transit systems" or "hectares of land restored" (Höhne, et al. 2015, Vogt-Schilb and Hallegatte 2017, Bataille, et al. 2016, 2050 Pathways Platform 2017, Fay, Hallegatte, et al. 2015b, Iyer, et al. 2017), or indicators focused on regulatory and institutional approaches, such as Climatescope (Bloomberg New Energy Finance 2014) and Readiness for Investment in Sustainable Energy "RISE" (World Bank 2015). The common practice of only monitoring emission reductions compared to a baseline is not the right one. Even if it reduces emissions, short-term action is likely to be off-track if it misses sectors that are difficult to decarbonize because low-carbon alternatives are expensive and take time to deploy, such as public transportation (Bataille, et al. 2016, Vogt-Schilb, Hallegatte and Gouvello 2015, Vogt-Schilb and Hallegatte 2014, Iyer, et al. 2017). In that case, the economy risks getting locked into carbon-intensive development pathways, from which it is then unnecessarily costly to diverge. Work to develop indicators to track and monitor the implementation of the Paris Agreement at the country and sector level remains to be done.

2.43 **While the literature on climate mitigation tends to highlight the theoretical advantages of carbon pricing** (Stiglitz et al 2017, Pearce 1991)**, actual implementation and empirical confirmations of their value are yet to materialize at scale**. The Stiglitz and Stern commission recommends all countries implement prices of at least US$40–80/tCO$_2$ by 2020 and US$50–100/tCO$_2$ by 2030, noting that those would be consistent with the Paris Agreement only if backed by ambitious complementary policies at the sector level. The implementation of carbon prices has however remained limited and unambitious (World Bank, Ecofys, and Vivid Economics 2016). Existing carbon price schemes suffer from low price levels and wide exemptions and are sometimes impeded by subsidies, particularly for energy and agriculture. In 2018, British Colombia's carbon tax is limited to US$35/tCO$_2$, equivalent to less than US$0.08/liter of gasoline; the European trading system price has remained below €10/tCO$_2$, or the equivalent of €0.02/liter of gasoline between 2011 and 2017; during the same period, European governments spent €112 billion per year in fossil fuel subsidies (ODI 2017). In Mexico, the low US$3.50/tCO$_2$ carbon tax does not apply to natural gas. There is mixed empirical evidence on whether carbon taxes have reduced emissions, for instance in Scandinavian countries and British Columbia (Murray and Rivers 2015, Lin and Li 2011, Miller and Vela 2013). Evidence is scarce on the effectiveness of carbon prices as a policy instrument to drive progress on the five decarbonization fronts: (i) carbon-free electricity; (ii) energy efficiency and waste reduction; (iii) electrification of end uses and fuel switching; and (iv) expansion and sustainable management of natural carbon sinks.

2.44 **There is evidence that aligning sectoral policies and regulatory frameworks can deliver progress on decarbonization** (Fay, Hallegatte, et al. 2015a, OECD 2017, OECD 2015). The literature on these topics tends to be scattered; knowledge about specific issues such as renewable power (REN21 2017), clean transport systems (IEA 2017a, IEA 2017b), or low-carbon food systems (Vermeulen, Campbell and Ingram 2012) and empirical evidence on the effectiveness of interventions in each of those sectors tend to be treated separately. The gap between sector literatures and the climate mitigation literature may be closing as it is increasingly recognized in the climate mitigation literature that reducing emissions will require reviewing a wide range of policies.

2.45 **Technology and innovation are needed to create novel approaches to climate action.** Innovation is the transformation of new ideas into economic and social solutions (Navarro and Olivari 2016). Innovation can be the execution of a new way of doing things more efficiently (a more effective use of resources); a new or significantly improved product (good or service) or process; a new marketing practice; or a new

organizational method in business practices, workplace organization, or external relations (OECD and Eurostat 2005). Innovation can help decoupling economic growth from natural capital depletion (see paragraph 2.62). Green innovation[7] includes both the creation and commercialization of new frontier technologies and the diffusion and adoption of green technologies new to the firm (Dutz and Sharma 2012). Examples of relevant technologies include renewable energy, electric and hybrid vehicles, higher yield seeds, and improved early-warning systems (Dutz and Sharma 2012). An example of process innovation is using robust decision-making tools consistent with uncertain climate risk (see paragraph 2.27).

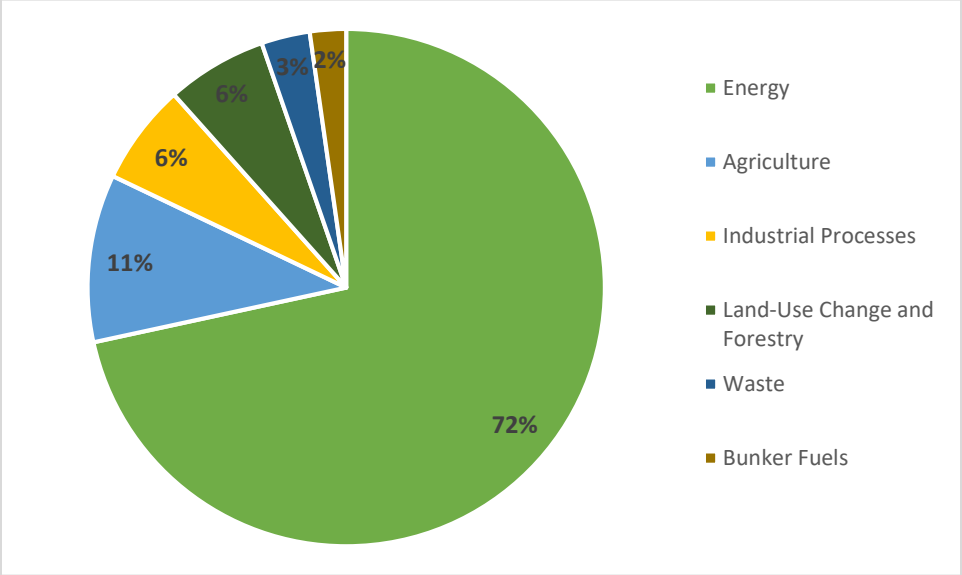
2.46 **Promoting dialogue between diverse actors can strengthen the nexus between science and decision-making** (2050 Pathways Platform 2017). There is a disconnect between researchers and decision-makers resulting from divergences over the objectives, needs, priorities, and scopes of these actors (Huggel, et al. 2015, Krauss 2015). This lack of coordination and communication also occurs between researchers in different disciplines (e.g. those specializing in adaptation and mitigation), leading to decision making based on limited analysis. The use of knowledge about climate actions is increased when it is accessible and there is a broader and more diverse agenda for collaboration (Krauss 2015). A comprehensive, multisector approach is needed to address the various dimensions of the issue.

E. Sector considerations for climate action

2.47 **The participation of key sectors is central to achieving climate-resilient and low-carbon development.** For the purposes of this SFD, key sectors were identified based on the significance of their contribution to GHG emissions and LAC countries' climate change agendas as described in the NDCs (Annex, Table A-1). The largest GHG emitting sectors globally are energy (including transportation), agriculture, industrial processes, and land-use change and forestry (Figure II-2). Factors influencing vulnerability have been incompletely considered to date, making quantitative assessments difficult (IPCC 2014a). Tackling climate change requires integrated solutions and relies on public and private sector collaboration. As such, Part E is organized around the following framing concepts: social considerations; climate risk and the financial system; sustainable infrastructure; and sustainable landscapes. While evidence for specific approaches within these framing concepts is presented below, the concepts themselves are somewhat innovative (or are being newly applied in the developing world) and evidence on how the approaches work collectively is still emerging. Climate change has also been mainstreamed into other SFDs and efforts have been made to align this document with the analyses presented there.

[7] Other terms used to define this concept (with slight differences) are: *ecological innovation, environmental innovation, and sustainable innovation.* For a review of the different definitions, see Schiederig, Tiertze, and Herstatt, 2011.

Figure IIII-2: World GHG Emissions by Sector, 2014 ($MtCO_2e$)



Source: (World Resources Institute 2018)[8]

1. Delivering an inclusive and just transition: social considerations

2.48 **Poverty is a critical driver of vulnerability to climate change impacts, and climate change impacts and extreme weather events push people into poverty**. Inclusive development and poverty reduction policies build resilience to climate change impacts, and climate adaptation and mitigation policies can reduce future poverty. Social protection programs, in particular conditional and unconditional cash transfers, substantially reduce vulnerability to climate change impacts; well-designed *adaptive* or *shock-responsive* programs that scale-up automatically in the aftermaths of climate shocks can be particularly effective and are increasingly being used (Beazley, Solórzano and Sossouvi 2017, Hallegatte, Vogt-Schilb, et al., Unbreakable: building the resilience of the poor in the face of natural disasters 2017, Hallegatte, Bangalore, et al. 2016). Climate change adaptation policies can be specifically designed to promote development and reduce inequality, for instance by targeting agricultural extension programs to poor communities or providing underserved populations with basic infrastructure (CGIAR 2013, Hallegatte, Bangalore, et al. 2016).

2.49 **Climate change impacts human health.** Climate change may lead to increases in the prevalence of water- and vector-borne tropical diseases,[9] to the appearance of diseases in areas where they were previously not endemic, to increases in the incidence of cardiovascular and respiratory diseases, food crises, droughts, malnutrition and child growth stunting (Hallegatte, Bangalore, et al. 2016). Improving local health systems and the ability to countries to answer to those impacts is thus part of an adaptation strategy (Hallegatte, Bangalore, et al. 2016). Air quality and health co-benefits provide additional motivation for decarbonizing as they are mainly local

[8] Land use and forestry contains total emissions and removals for forest land (CO_2, CH_4, N_2O), cropland (CO_2), grassland (CO_2), burning–biomass (CO_2, CH_4, N_2O). Of non-CO_2 gases, agriculture contains methane (CH_4) and nitrous oxide (N_2O), produced by aerobic and anaerobic decomposition processes in crop and livestock production and management activities.

[9] Higher temperatures maintained during longer periods in summer combined with high concentrations of nutrients in water bodies will increase the risk of water and mosquito borne diseases (Hallegatte, Bangalore, et al. 2016, Watts, et al. 2015).

and near-term (West, et al. 2013). Household fuel combustion for cooking and heating is a significant source of GHGs and short-lived climate pollutants and household air pollution is a major environmental risk factor to health, especially for women and girls (WHO 2016).

2.50 **Emission-reduction policies can be designed to promote a just transition that improves populations' immediate social conditions, encourages job creation, and fosters economic growth** (OECD 2017, NCE 2015, Fay, Hallegatte, et al. 2015a, Newell and Mulvaney 2013). The impact of emission-reduction policies on inequality, poverty, and marginalized populations is important for both their social and political acceptability and alignment with the SDGs (Altenburg, et al. 2017, Hallegatte, Fay and Vogt-Schilb 2013, Vogt-Schilb and Hallegatte 2017). Deliberate and careful policy choices, such as compensating energy price hikes with higher cash transfers (Sdralevich, et al. 2014), can be made to design climate policy packages in a pro-poor fashion (Fay, Hallegatte, et al. 2015a, Feng, et al. 2018, Renner 2018). The few existing assessments tend to conclude that the global impact of the transition to a zero-carbon economy on jobs will be positive (ILO 2018, Vogt-Schilb and Hallegatte 2017), with more green jobs created than brown jobs destroyed; however, the impact on brown jobs can make the political economy of the transition more difficult. To increase access to new economic opportunities associated with the climate-resilient and low-carbon transition, governments will need to focus on policies for innovation, skills training, and education, including vocational. Key to achieving social benefits is to explicitly embrace those objectives in and adopt inclusive processes to deliver them, at all stages of project: upstream legislation, regulations, planning, designing, commissioning, maintenance, and decommissioning (IDB and IDB Invest 2018). Countries with pre-existing generic social protection schemes (such as universal pensions, unemployment and health insurance, cash transfers and safety nets programs, or public training programs) may be better prepared to automatically compensate the negative impacts of emission-reduction policies on consumers and workers, and thus face fewer political economy challenges in the transition to zero emissions (ILO 2018, Hallegatte, Fay and Vogt-Schilb 2013, Fullerton, et al. 2011).

2. Managing climate risk to the financial system

2.51 **Climate change and climate policies entail systemic risks for financial stability through effects on asset values, price volatility, fluctuations in the availability of inputs, and trade sanctions** (Caldecott and McDaniels 2014, Caldecott, Harnett, et al. 2016). For example, infrastructure projects—given the expectation of their use in the long term—may in practice be irreversible investments, becoming unusable (or stranded) assets if they use technologies that generate high GHG emissions, or if they do not incorporate climate resilience features (Smith School 2015). This type of risk is frequently underestimated, resulting in overexposure of financial and economic systems. A solution is to link development strategies with sustainable infrastructure that considers climate risk and favors climate-resilient and low-carbon options (Bhattacharya, Oppenheim and Stern 2015).

2.52 **Recognizing these risks, the Financial Stability Board (FSB) reviews how the financial sector can take climate change into account.** The FSB launched a Task Force on Climate-related Financial Disclosure (TCFD) to improve understanding of climate-related risks in the valuation of financial assets. The task force issued its first set of recommendations in 2017 on integrating climate-related risks into companies' risk management practices (both financial and non-financial) and into their regular disclosures to investors, regulators, and financial markets. The TCFD recommended

disclosure of: (i) the organization's governance around climate-related risks and opportunities; (ii) the actual and potential impacts of climate-related risks and opportunities on the organization's businesses, strategy, and financial planning where such information is material; (iii) how the organization identifies, assesses, and manages climate-related risks; and (iv) the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material.

3. Lowering emissions and building resilience: sustainable infrastructure

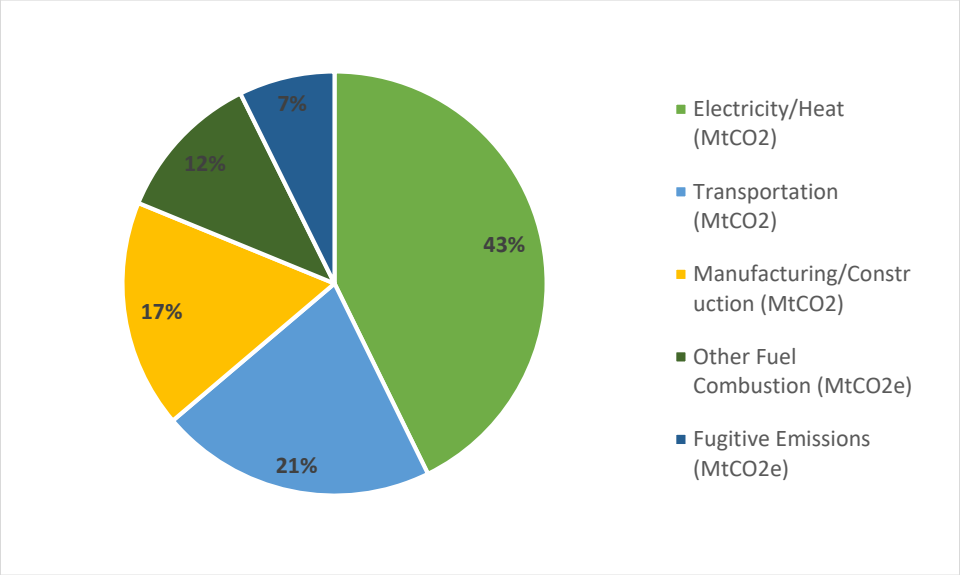
2.53 **Sustainable infrastructure can drive growth.** Investment in sustainable infrastructure can help generate employment, boost international trade, industrial growth, and competitiveness while reducing inequalities within and among countries (NCE 2015). Infrastructure choices that are being made now will either support or make impossible the achievement of the Paris Agreement and the SDGs, given infrastructure's longevity of 50–100 years and more (Pfeiffer, et al. 2018) and the window for making the right choices is uncomfortably narrow (OECD 2017). The IDB defines sustainable infrastructure as infrastructure projects that are planned, designed, constructed, operated, and decommissioned in a manner to ensure economic and financial, social,[10] environmental (including climate resilience), and institutional sustainability over the entire life cycle of the project (IDB and IDB Invest 2018).

2.54 **To limit the rise in global temperature to 2°C, net GHG emissions from energy systems should reach zero by 2050–2070** (IEA 2017c, Audoly, et al. 2017). Electricity, heat, and transportation account for nearly three-quarters of global energy emissions (Figure II-3). Manufacturing and construction also contribute significantly. The use of less carbon-intensive materials (e.g. wood instead of cement) could reduce emissions in that regard. Cities are responsible for significant and growing total GHG emissions, however, per capita emissions can be comparatively low in cities that are efficient and well-planned (World Bank 2010).[11]

[10] For example, lack of transparency in the stages of project assessment, evaluation of alternatives, and permitting lead to biased and incoherent decisions, which erode trust and encourage opposition of the community (Watkins, Mueller, et al. 2017).

[11] Examples include Hong Kong, Paris, Sao Paulo, Tokyo, Dhaka, and London (World Bank 2010).

Figure II-3: Global GHG Emissions by Energy Subsector, 2014



Source: (World Resources Institute 2018)

2.55 **With the right long-term investments, a transition to 100 percent renewable-based electricity generation is viable** (Vogt-Schilb and Hallegatte 2017). The falling cost of renewable energy technologies (REN21 2017) means that renewable electricity is now often the cheapest option and has further widened the range of options for progress on a low-carbon growth path. Some renewable energy technologies, such as geothermal, can provide baseload generation, and are easy to integrate into existing networks, but the technologies with the highest potential and the lowest costs, namely, wind and solar, are variable, which makes it more challenging to integrate them in electricity systems. Therefore, the transition toward 100 percent renewable electricity systems requires significant changes in the way these systems operate. The grid of the 20th century, based on a combination of baseload, intermediate, and peak generation technologies, will likely give way to a grid with a significant penetration of variable generation technologies, coupled with a set of flexibility measures. Flexibility measures include not only flexible generation technologies such as hydropower, but also innovative technologies such as battery storage, demand management (e.g. through smart grid technologies), and stronger interconnections to compensate inter-regional resource availability. To achieve this transition toward a 100 percent renewable grid in the medium term, new market rules and management models will be required. The transition also has financial implications. Unlike fossil-fuel facilities, which have lower initial capital costs and higher long-term operating costs, renewable energy facilities have much higher capital costs, and often negligible operating costs. Although natural gas has lower emissions than coal or oil, it too will have to be phased out if the world is to limit warming as indicated in the Paris Agreement. Natural gas will also face increasing competition from renewables and continued investments risk becoming stranded assets (Cantzler, et al. 2017, Pfeiffer et al. 2018). Important steps in the transition toward 100 percent renewable electricity systems include identifying and removing normative and regulatory barriers to the decarbonization of energy, directly supporting the uptake of modern renewable technologies with policies such as public auctions for renewable energy (IEA 2017c, REN21 2017), and creating markets by setting incentives for commercial banks, for

accreditation, certification, and inspection agencies, and for services companies (ECLAC 2014).

2.56 **The decarbonization of energy systems also requires addressing the energy needs for transportation and for heating and cooling in buildings and in industry.** The decarbonization of these applications can be achieved through the direct use of renewable energy (e.g. low enthalpy geothermal resources for district heating, solar heating, or sustainably produced biofuels) or through the electrification of the applications (e.g. electric vehicles for public and private transportation). Clean technology buses are already deployed at scale in the USA, Europe and China (Pozniak 2017), with approximately 173,000 hybrid or electric buses operating in the world as of 2015 (ZeEUS 2016). The technologies are now mature and alternative business models have been successfully implemented. Adoption of electric vehicles is affected by existing norms and regulation, fiscal and financial incentives, the number of charging stations, and the presence of a local electric vehicle manufacturing industry (Sierzchula, et al. 2014). For electric vehicles to effectively reduce emissions, efforts to decarbonize the electricity generated to power them must continue in parallel. Some transport applications such as air travel will be more challenging to decarbonize, given the unfeasibility of electrification and the obstacles to replacing fossil fuels with biofuels (Scott et al., 2010; OECD and UNEP, 2011).

2.57 **Renewable energy also has a relevant role to play to provide electricity to isolated rural communities through off-grid systems.** 2.8 billion people in the world still rely on solid biomass fuels for cooking, with damaging health impacts and emissions of GHG and black carbon. A number of clean cooking solutions (including liquefied petroleum gas) are available that both ensure compliance with WHO air quality standards and reduce emissions (Troncoso and da Silva 2017).

2.58 **Energy efficiency also has an important role to play in the decarbonization of energy systems.** Increasing energy efficiency has multiple climate and development benefits. Energy efficiency requires a combination of measures: removing energy subsidies and instead taxing energy use or GHG emissions (at a minimum, remaining subsidies should be time-bound and targeted to low-income groups or less developed regions); improving the governance of institutions promoting energy efficiency initiatives; introducing performance standards in all sectors; promoting energy efficiency markets; developing financial services; and creating consumer information and education campaigns (IEA 2015). Energy codes and standards play a vital role in energy efficiency by setting minimum requirements for energy-efficient design and construction (Iwaro and Mwasha 2010). Tailoring financial products makes it possible to reduce the perceived and actual risk in financial institutions, and help the industry standardize the language and metrics allowing the performance of the technologies associated with energy efficiency to be communicated, and so make financial resources available in the market (IEA-RETD 2015). Given the perceived risks and financing barriers concerning the effectiveness of many energy efficiency technologies, energy performance contracting is a promising measure in energy management (OECD 2012).

2.59 **Transit-oriented urban development and modal shift to public transportation and non-motorized transportation have a key role to play in the decarbonization of urban transportation** (Transportation SFD). Greater use of cleaner and more efficient public transportation and of non-motorized transportation could save more than US$100 trillion in capital and operating costs between now and 2050 and reduce emissions by 1.7 gigatons of CO_2 per year, equivalent to a 40 percent reduction in

passenger transportation emissions worldwide (Replogle and Fulton 2014). This suggests that an effective way of reducing GHG emissions from transportation is to design cities that allow people to choose public transportation, walk, or cycle, instead of driving cars. Public green spaces associated with transit-oriented development also help to increase resilience of the urban environment. Effective models to integrate land-use and mobility policies are based on transit-oriented development, densification, and compact growth (REN21 2017). The interaction between mobility policies and land-use planning has significant potential for reducing vulnerability, improving the provision of public services and infrastructure, and ultimately increasing mitigation potential (University of Cambridge 2014).

2.60 **The rapid pace of technological change and innovative business models bring uncertainty to how specific sectors will respond to climate change.** Examples include the potential for decreased mobility needs as connectivity improves, the sharing economy (e.g. renting personal vacation homes, ride-sharing), increased battery capacity, and improved predictions of extreme weather events.

2.61 **Improving water treatment plans and waste management can reduce emissions.** Improved water treatment plants can reduce energy consumption by integrating renewable energy sources and methane recovery. Several factors influence waste composition (e.g. level of economic development, cultural norms, geographical location, and energy sources) and more urbanized and wealthier populations consume more inorganic materials relative to organic (Hoornweg and Bhada-Tata 2012). Improved sanitation can effectively remove excess nutrients (nitrogen and phosphorus) from the water and help communities, river, and marine ecosystems reduce their vulnerability to climate change.

2.62 **The circular economy is increasingly recognized as a key opportunity for sustainability.** The circular economy seeks to decouple economic development from the consumption of limited resources using three principles: (i) preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows; (ii) optimize resource yields by circulating products, components, and materials at the highest utility at all times in both technical and biological cycles; and (iii) foster system effectiveness by revealing and designing out negative externalities (Annex, Figure A-1) (Ellen MacArthur Foundation 2015). By avoiding waste, making businesses more efficient, and creating new employment opportunities, the circular economy could be worth US$4.5 trillion through 2030 (WEF and Accenture 2017). Innovation is important for driving sustainable economic growth (OECD 2011).

2.63 **Sustainable infrastructure projects should be sited and designed to ensure resilience to climate and natural disaster risks** (IDB and IDB Invest 2018). Identifying the impacts of climate change and considering them in infrastructure planning, design, construction, operation, and maintenance are an essential part of increasing resilience (World Bank 2017). Considering climate change impacts in the construction or reconstruction of infrastructure reduces its vulnerability and extends its useful life, with additional costs that are generally lower than the cost of repair or reconstruction (ADB 2013).

2.64 **Climate change will affect governments' ability to plan and deliver basic services, particularly in urban areas** (UN Habitat 2011, Hogan 2003). Urban planners need to take climate change into account, including solutions that reduce exposure to climate impacts, mitigate risks, reduce interruptions of critical infrastructure

services, and preserve the assets of the most vulnerable population segments (Santamouris and Cartalis 2015).

2.65 **The decarbonization of energy systems needs to consider the impacts of climate change.** The energy sector is vulnerable to the impacts of climate change in two important ways. First, power generation sources are usually dependent on climate patterns; the link is more acute for hydropower (through changing water availability), but also relevant for coal, nuclear, wind, solar, and biomass power. As use of renewable energy sources increase, climate models for the coming decades should be considered. Second, given the vulnerability of electricity transmission and distribution systems to extreme weather events, in some locations renewable energy-based distributed generation systems with battery storage may combine the benefits of zero emissions and resilience. The cost of adapting new and retrofitting existing grids can be reduced by adopting existing technology from other geographical and climatic conditions (IPCC 2014b).

2.66 **The transportation sector, particularly the road network, is exposed and vulnerable to the impacts of natural disasters, and climate change is expected to exacerbate future risks, threatening existing and future infrastructure.** Transportation infrastructure exhibits significant vulnerabilities to extreme weather—including coastal storms, landslides, inland flooding, and extreme temperatures. This in turn can damage or even destroy road, rail, port, and airport infrastructure. Damaged transportation assets represent a sizable portion of economic losses from natural disasters, and connectivity is a crucial factor in the capability of a population and an economy to cope with and recover from the damages caused by hazards.

2.67 **Resilient transportation interventions and policies can significantly reduce future losses in assets and well-being**. In many countries, spending on transport infrastructure maintenance can prevent damage caused by frequent floods and storms, and thereby reduce user costs and repair needs. Appropriate transport asset management systems can save resources spent in rehabilitation and dedicate these to maintenance activities. Upgrading construction standards for critical bridges and culverts can reduce the impact from less frequent but higher impact events. This can sometimes be done at low cost thanks to new materials and designs. Transport service disruptions can also be reduced by improving the resilience of supply chains with stocks and telecommuting, leading to positive impacts in the economy and social well-being.

2.68 **Blue spot analysis is an innovative tool to prioritize interventions to improve road network resilience** (Espinet Alegre, et al. 2018, Axelsen and Larsen 2014). It is useful here to distinguish between (i) the resiliency of the road infrastructure (e.g. road design); and (ii) the resiliency of the road network (robust decision making under uncertainty, identification and prioritization of intervention). Blue spot analysis has been used to help governments and decision makers prioritize and compare alternative interventions in the road network to build the network's resilience to deeply uncertain natural hazards while at the same time promoting the country's other development objectives. For example, a World Bank project in Mozambique prioritized road interventions[12] based on flood risk and economic development potential; the selected interventions cost less and returned substantial benefits, mostly in the form of avoided

[12] The process entailed: (i) mapping the road network using a mobile application; (ii) developing a road network model to assess the criticality of road assets; (iii) using hazard maps to assess flood risks by district and rank suitable interventions based on risk and criticality; and (iv) stress-testing potential interventions under several climate scenarios to ensure service delivery could withstand future climate change impacts.

damage to the infrastructure due to flood events (World Bank 2017). In particular, these assessments highlight links in the transportation network that are most susceptible to natural hazards and whose disruption would cause the most significant impacts. This information can then be applied to determine suggested cost-effective portfolios of interventions to reduce vulnerabilities.

2.69 **Climate change will affect water resources, including for hydroelectricity.** Changes to the frequency, amount, and timing of precipitation and the rapid retreat of tropical glaciers will cause instability in hydroelectricity generating capacity and will affect the quality and availability of water resources for human consumption and food production. Adaptation measures are needed to guarantee the energy supply and respond to anticipated reductions in water availability and quality (IPCC 2014b, Van Vliet, et al. 2016). Climate change will directly impact the availability and quality of freshwater resources worldwide (Schewe, et al. 2014). The water supply in coastal and island regions is particularly at risk due to changes in precipitation patterns and sea level rise.

2.70 **An innovative approach that uses integrated planning tools for decision making under deep uncertainty is needed to increase climate-resilience of infrastructure.** It is important to take measures that recognize the nexus between water, energy, and food (Bellfield 2015). For example, producing biofuels can require a lot of water (Miralles-Wilhelm and Muñoz-Castillo 2018) and the use of biofuels to reduce emissions in the energy sector could exacerbate water crises. An integrated strategy should be devised for land and water resource management that considers existing adaptation and risk management plans. Watershed management plans offer an opportunity to connect these tools and improve resilience at basin level (Merritt, et al. 2015, Tompkins and Adger 2004, Vynne, Adams and Gregg 2012). Although planning at the river basin scale is challenging, it has clear advantages for addressing climate change issues in the water and sanitation sector. Such measures are best incorporated when defining master plans, which can then prioritize specific infrastructure investments for water consumption, agriculture, and flooding control.

4. Sustainable landscapes

2.71 **A sustainable landscapes approach is needed to align social, environmental, and economic objectives.** The sustainable landscapes approach is a holistic approach to the management of territories where combinations of natural and managed ecosystems, such as forests or wetlands and marine and coastal systems are managed in an integrated fashion with human-created ecosystems like agroecosystems and urban ecosystems. The purpose is to attain performance at the broader landscape level so that the natural capital conservation goals and the livelihoods, resiliency, and productivity work together to ensure the adequate provision of services to stakeholders. Since landscapes are commonly mosaics of heterogenous social-ecological systems occurring in a determined geographical area, the needs and demands of multiple stakeholders usually overlap, requiring landscape-wide management decisions that incorporate coordinated and interdisciplinary solutions that factor in the interdependence of ecological, social and economic processes (Opdam 2018).

2.72 **Ecosystem services provide resiliency benefits.** Natural capital is inherently important to provide adaptation solutions—filtering water, preventing landslides, mitigating floods, protecting coasts and improving air quality—as well as acting as

natural carbon sinks.[13] Hybrid approaches (combining grey and green infrastructure) can provide cost-effective hazard protection solutions (e.g. wetlands restoration combined with small levees for coastal flood protection, bioswales, rain gardens, green roofs, street trees installed in sidewalk tree pits) (Depietri and McPhearson 2017).

2.73 **There are opportunities to reduce emissions and raise productivity through actions in land use and land-use change.** Forests provide critical climate regulating services, primarily through their role in carbon sequestration. Whether managed or unmanaged, forests are a vital part of the carbon cycle. They absorb, store, and release carbon dioxide in a dynamic process of growth, decay, disturbance, and renewal. New biomass from forest growth and forestland expansion stores carbon in standing trees and in long-lived wood products like construction lumber. The IPCC (2014) suggested that reducing deforestation, sustainable forest management and afforestation are the most cost-effective sequestration options. Reforestation, avoided forest conversion, and natural forest management all have been shown to be cost-effective mitigation opportunities, although the potential varies from country to country (Griscom, et al. 2017). The deforestation problem roots in the global consumption of certain commodities. For instance, beef and soybean production are recognized as the two main drivers of deforestation in the Amazon. Proven interventions to make supply chains more sustainable and protecting forests include limiting road network expansion or carefully choosing routes of new roads, protecting forests from agricultural expansion, enforcing protection laws, supporting continued management by indigenous peoples, payments for ecosystem services, moratoriums on agriculture or livestock expansion, and labels that certify the sustainable sourcing of products (Laurance, et al. 2015, Damania, et al. 2018, Busch and Ferretti-Gallon 2017).

2.74 **Climate change and unsustainable infrastructure practices are reducing biodiversity.**[14] Part of making infrastructure sustainable is preserving, restoring, and integrating it with natural environment. Sustainable infrastructure also supports the sustainable and efficient use of natural resources, including energy, water, and materials, and limits pollution. The approach depends on national circumstances and overall performance should be gauged relative to what could have been built or developed instead (IDB Group 2018b). Global warming is also creating conditions for enhanced invasiveness of certain native and exotic species, and at the same time limiting the ability of other species to adapt to changes in their habitats (IPCC 2007, Millennium Ecosystem Assessment 2005, UNEP 2014).

2.75 **The tourism sector, when effectively planned and managed, can help to conserve biodiversity and protect the environment.** Biodiversity represents a comparative advantage for tourist destinations (Freytag and Vietze 2009) and its loss implies a reduced ability to attract tourists and generate tourism spending. Climate change could impact infrastructure and services, threaten natural and cultural assets (e.g. biodiversity, heritage sites), and increase risks to visitors (Caldecott, Harnett, et al.

[13] Forests, agroforests, and other ecosystems provide numerous services: (i) *regulating services* (climate, hazard, and noise regulation; pollution control; air, soil, and water quality; disease/pest regulation and pollination); (ii) *supporting services* (including primary production; decomposition; soil formation and nutrient cycling; water cycling; ecological interactions and evolutionary processes); (iii) *provisioning services* (including food; fiber; water; energy, and biodiversity); and (iv) *cultural services* (including recreation; tourism; spiritual and religious values (Smith et al. 2014).

[14] E.g., the rapid urbanization of coastal areas in LAC leading to pollution from nutrient run-offs from city wastewater and marine litter from inadequate waste management infrastructure (UNEP 2016).

2016). Nature tourism is important for biodiversity, capable of generating substantial resources that can be used for both development and conservation (Balmford, et al. 2009, Buckley 2011, Gunter, Ceddia and Tröster 2017).

2.76 **Agricultural practices need to be transformed to ensure food security and minimize GHG emissions.** World population growth projections indicate that almost two billion more people will be living in developing countries by 2050. Agricultural output will need to be raised by 60 percent to meet new demand (FAO 2013). Dissemination of state-of-the-art technologies and practices to developing countries and climate-smart agriculture (CSA)[15] have the potential to boost food production while increasing adaptive capacity and contributing to climate change mitigation (Chambwera, et al. 2014, McCarthy, Lipper and Branca 2011).

2.77 **Adaptation practices and technologies have improved over time, but vulnerable farming communities' access to them remains a challenge.** The use of climate change adaptation strategies can increase agricultural productivity, but the decision to use them depends on access to information, credit, and agricultural extension services (Di Falco et al. 2011). The decision to use new technologies or practices to adapt to climate change could also be affected by uncertainty and certain technologies are only appropriate for larger producers. Some of the key actions to tackle and adapt to climate change in arid zones aim to increase water use efficiency and reduce demand (Thomas 2008). The use of seeds and crop varieties that are resistant to drought, heat or certain pests is also important. In the case of coffee production, the priority is to develop high quality varieties adapted to high temperatures (Ovalle-Rivera, et al. 2015) and to conduct research to identify alternative crops (Jones and Thornton 2003). Adaptation practices for livestock include managing with available resources, shifting to breeds that are better suited to the prevailing climate, and improving credit access (Porter, et al. 2014). A variety of risk tools also exist for climate adaptation in agriculture, including access to inputs, diversification of income sources, use of forecasts, and climate insurance (Warner, et al. 2013, Baethgen 2010). Nevertheless, the cost and complexity and customers' low willingness or ability to pay place certain limitations on the use of insurance (Warner, et al. 2013). Insurance could also provide a perverse incentive if it limits policy holders' willingness to implement actions to effectively reduce their vulnerability.[16] Thus insurance schemes are more appropriate alongside other actions to reduce vulnerability (Repetto 2008).

2.78 **Emissions from livestock can be reduced, but the political economy of dietary changes toward less meat is challenging.** Livestock is a significant source of emissions worldwide. A global transition to diets with less meat would have substantial benefits for human health, while also contributing significantly to climate change mitigation (Stehfest, et al. 2009). However, the general public is often not aware of the health and climate benefits of eating less meat and may be reluctant to operate dietary changes (De Boer, De Witt and Aiking 2016). Coercive policies such as taxes on the carbon content of food can be politically difficult to implement as increasing the price

[15] According to the FAO, CSA "aims to enhance the capacity of the agricultural systems to support food security, incorporating the need for adaptation and the potential for mitigation into sustainable agriculture development strategies. CSA proposes more integrated approaches to the closely linked challenges of food security, development and climate change adaptation/mitigation, to enable countries to identify options with maximum benefits and those where trade-offs need management. CSA recognizes that the implementation of options will be shaped by specific country contexts and capacities, as well as enabled by access to better information, aligned policies, coordinated institutional arrangements and flexible incentives and financing mechanisms" (FAO 2018).

[16] E.g., if crop producers in regions under increasing water stress take out insurance for protection from total loss instead of investing in technology for irrigation efficiency or switching crops.

of meat could have negative monetary impacts on vulnerable consumers (García-Muros, et al. 2017, Säll and Gren 2015). Information campaigns and compensatory policies for vulnerable households can play an important role. The most challenging issue for a just transition away from beef may be that it directly affects the livelihood of beef producers, but this issue has received less attention so far (Röös, et al. 2017). An avenue for future research could be to adapt lessons learned from the stranded assets (McGlade and Ekins 2015) and stranded jobs (ILO 2018), literatures that have focused on the impact of phasing down fossil fuel production. Improving forage quality and the efficiency of dietary nutrient use, various manure management practices, improved animal health and animal productivity are effective means of decreasing GHG emissions per unit of animal product and interactions among individual components of livestock production systems must also be considered (Hristov, et al. 2013).

2.79 **Agroforestry systems maintain livelihoods and prevent poverty, while also helping to reduce GHGs.** Agroforestry systems provide multiple ecological benefits (Deheuvels, et al. 2014, Rapidel, et al. 2015) and have been effective at improving productivity and incomes, as well as reversing soil degradation (Liniger, et al. 2011, Rousseau, et al. 2012). Agroforestry is a strategy for reducing risk of harvest loss (Current et al., 1995; Deheuvels, 2011) from pests and diseases (Gidoin, et al. 2014, Ngo Bieng, et al. 2013), (Ngo Bieng et al., 2017, 2013). It also favors populations of pollinators (Cordoba et al., 2013). Agroforestry further has potential for carbon storage in biomass and soils agroforestry. Thus, it is valued as a climate change mitigation and adaptation strategy (Verchot et al., 2007, Lasco et al., 2014).

2.80 **Oceans and coastal and marine ecosystems play a role in sequestering CO_2.** Oceans have absorbed roughly 30 percent of anthropogenic CO_2 (IPCC 2014a). Mangrove forests, seagrass beds, and salt marshes are more efficient than terrestrial forests at sequestering carbon (Mcleod, et al. 2011). Climate change and carbon emissions have contributed to changes in water temperature, currents, acidification, and other ocean conditions, affecting the ability of these systems to perform as carbon sinks.

2.81 **Marine ecosystems and fishery productivity are being threatened by climate change and ocean acidification**. This is in addition to the stress fish populations face from pollution, habitat degradation, overfishing and harmful practices (FAO 2016). There has been an increase of pH of about 30 percent since the beginning of the industrial era, which affects not only marine life but also the human population that is directly or indirectly dependent on the goods and services delivered by the ocean ecosystem (Hosain and Rahman 2017). Marine aquaculture represents an important part of island and other coastal economies and, exacerbated by climate change, ocean acidification could harm chances of attaining a blue economy system.

III. Climate Change Challenges in Latin America and the Caribbean that the IDB Seeks to Address

A. Climate change context in Latin America and the Caribbean

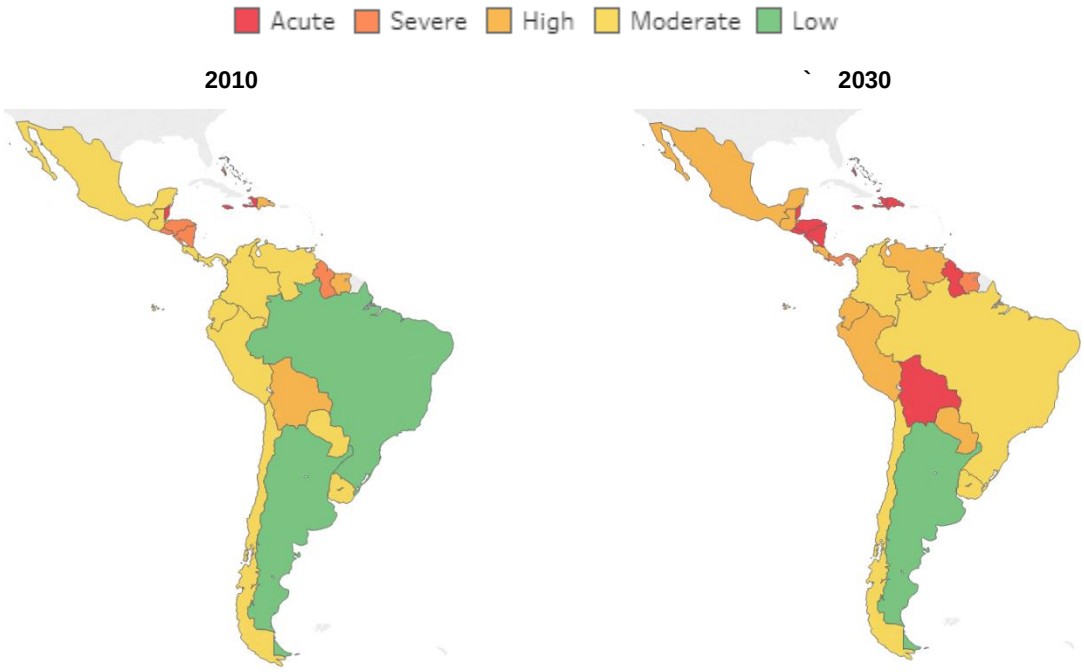
3.1 **Climate change threatens social and economic outcomes in LAC.** The key climate change effects in LAC general rise in average temperatures (0.7°C to 1°C increase since 1970, except in Chile which has lost 1°C); changes in precipitation patterns (southeastern South America has gained 0.6mm per day between 1950 and 2008, while central-southern Chile has lost 1mm per day at the same time); increased frequency and intensity of extreme events including flash floods and landslides;

changing discharge patterns in the Amazon River and western Andes (for instance seven out of nine watersheds in Cordillera Blanca, Peru, experience decreasing discharge during the dry season); rising sea levels (of 2 to 7 mm per year since the 1950s); acidification and increased coral bleaching in the western Caribbean; and retreat of glaciers (for instance in Mérida Venezuela (300 to 500m), cordillera Blanca in Peru (100 to 150m), and cordillera real in Bolivia (200m over the 20th century) and glacier extinction over 5000m (IPCC 2014b) (Annex, Figure A-3 and Figure A-4). These effects, and most importantly their continuation in the future, will lead to mostly negative expected or observed impacts in LAC: decreased productivity; damage to infrastructure, coastal areas, and ecosystems; increased disease; reduced availability of water (IPCC 2014b). However, the impacts in some specific locations are positive, including increased agricultural production for certain crops (Magrin, et al. 2014). The Germanwatch Index on global climate risk (CRI) estimates the economic and socioeconomic impacts of extreme weather events and associated. Honduras, Haiti, Nicaragua, and the Dominican Republic fell within the top ten most affected countries over the 1997–2016 period (Annex, Table A-2). A conservative estimate of regional GDP costs ranges from US$85 billion to US$110 billion annually by 2050 (Vergara, Rios, et al. 2013) (Annex, Table A-3 for a list of impacts and their associated costs). According to preliminary estimates, overall losses from the 2017 hurricanes Harvey, Irma, and Maria reached around US$215 billion (Faust and Bove 2017).

3.2 **Regional indicators suggest high vulnerability and differences in the ability to respond to climate impacts.** While measuring vulnerability to climate change is complex, a few (imperfect) indicators are used globally. The climate vulnerability indicator developed by the Development Assistance Research Associates (DARA) is based on 34 indicators of economic, human, and ecological effects of climate change. This index suggests that most countries in the region are affected by climate change, that they will become more vulnerable between now and 2030, and that the projected economic costs are substantial (Figure III-1 and Annex, Table A-4). The index already classifies Belize, Haiti, and Jamaica as acutely vulnerable due to climate change, and by 2030, another seven[17] of the IDB's 26 borrowing member countries are expected to be acutely vulnerable. The University of Notre Dame Global Adaptation Index (ND-GAIN) summarizes countries' vulnerability to climate change in combination with their readiness to improve resilience. ND-GAIN estimates that, overall, LAC countries have progressed in their climate change readiness since 1995 (Figure III-2). Progress comes mainly from the indicator for social readiness, which is proxied with income inequality, level of education, penetration of ICT, and appetite for innovation as measured by patent applications. Economic readiness has also improved in the region; NG-GAIN measures it with the World Bank doing business indicator, which is a rough indicator of the flexibility of businesses to adapt to any changes—including from climate change impacts.

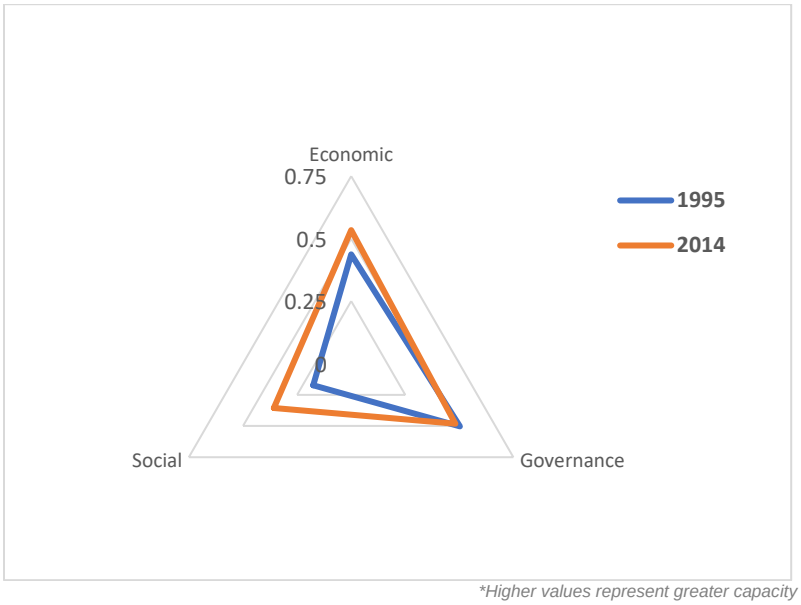
[17] Bahamas, Bolivia, Dominican Republic, El Salvador, Guyana, Honduras, and Nicaragua.

Figure III-1: DARA Vulnerability Level Due to Climate Change



Source: (DARA data 2012)

Figure III-2: ND-GAIN Readiness in LAC Countries



**Higher values represent greater capacity*

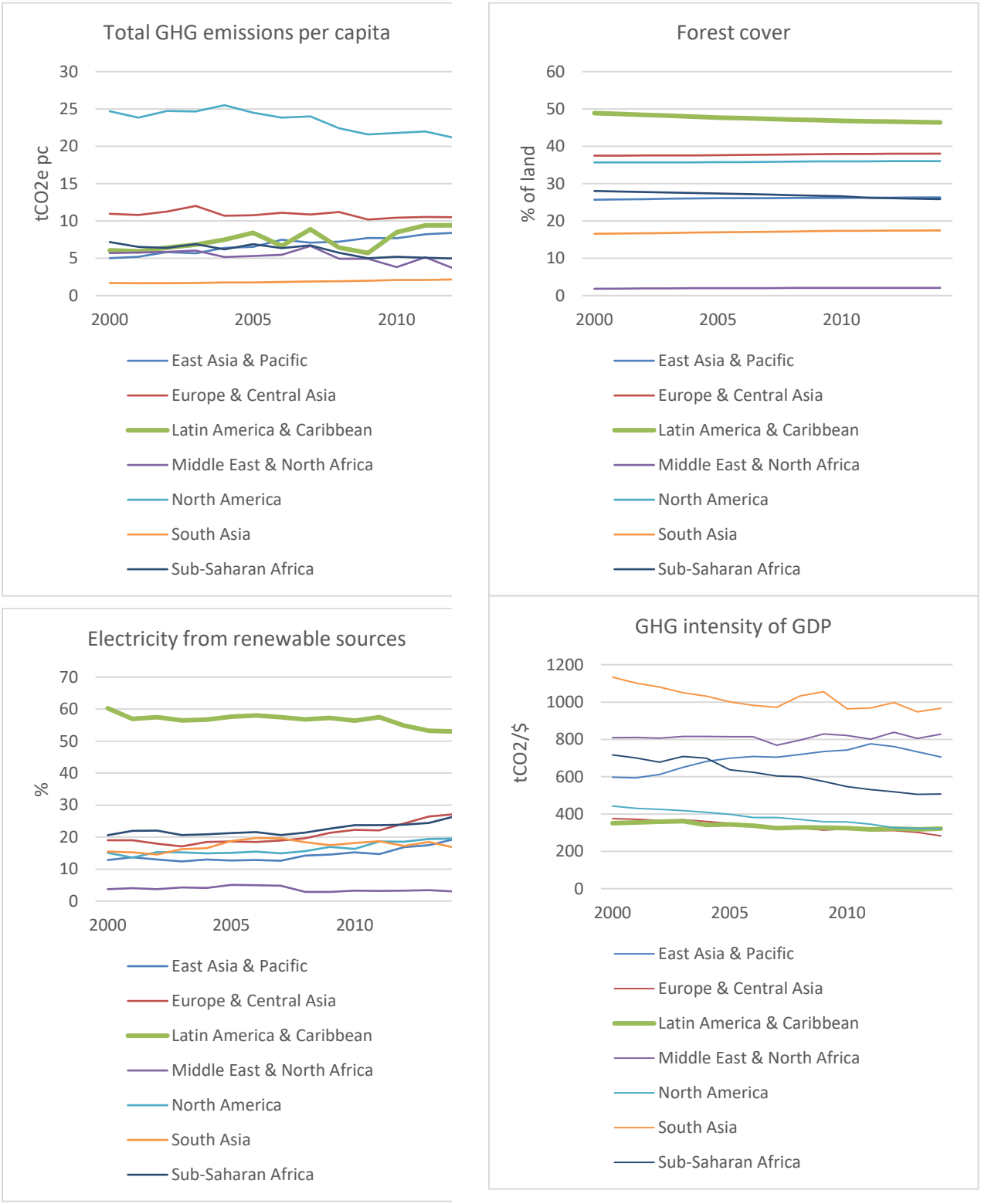
Source: (University of Notre Dame Global Adaptation Index 2015)

3.3 **The effects of climate change across the Caribbean Sea are already evident.** These effects include an increase in sea surface temperature,[18] greater frequency of anomalous hotspots, and an increase in the frequency of category 4 and 5 hurricanes, among others (Oxenford and Monnerau 2017). Considering global warming, sea level rise, and human induced activities, many island nations are facing serious problems with environmental sustainability and water quantity and quality (Wen and Chambers 2014), as well as increased risk of coastal erosion, floods, and storm surges. Climate shocks could cripple island economies, particularly with the dependence on tourism as the mainstay of these economies.

3.4 **To fulfill international climate change objectives and commitments, the region needs to transition to net zero emissions before the end of the century.** In recent decades, emissions per capita in the region have increased from about 6 tCO_2e per capita per year in 2000 to 9.4 tCO_2e in 2012, third to the poorest regions, Sub-Saharan Africa and South Asia. For comparison, the North American region (USA and Canada only) dominate at around 21 tCO_2e per capita per year, and the value of 1.7 tCO_2e per capita per year is used as the global benchmark to be reached in 2050 to stabilize climate change at around 2°C. This highlights the challenge for both the region and the world. Regional averages mask heterogeneity in the level of emissions and progress over time. Analyzing some of the pillars of decarbonization for which data is readily available, the region is leading on both forest cover and reliance on renewable electricity; but while the other regions have made progress on those indicators, the situation in LAC is worsening. LAC and sub-Saharan Africa are the only regions where forest cover has decreased between 2000 and 2013 according to World Bank data. Here again, the situation is country-specific: El Salvador, Honduras, and Paraguay have lost 20–30 percent of forest land cover, while the Dominican Republic and Uruguay have improved land cover by 30 percent. On renewable electricity, some countries such as Trinidad and Tobago have virtually none, while in Costa Rica, Paraguay, and Uruguay more than 90 percent of electricity is renewable. On efficiency, the region also starts from a leading position, and it is slowly decreasing GHG emissions per unit of GDP, suggesting it is possible to achieve economic growth in LAC while reducing emissions; however, reductions in the carbon content of growth have been slower than in other regions of the world. The Dominican Republic, Panama, and Suriname have made the most progress on efficiency, more than halving emissions per unit of GDP, while in Haiti has increased 77 percent and the Bahamas 30 percent (Figure III-3).

[18] The Caribbean Sea has warmed by approximately 1.5°C over the last century (Oxenford and Monnerau 2017, Palanisamy, et al. 2012), and is expected to warm further by an average of 1.4°C by the years 2081-2100 compared to 1986-2005 levels (Oxenford and Monnerau 2017, Nurse and Charlery 2016).

Figure III-3: LAC vs. Global Emission Indicators



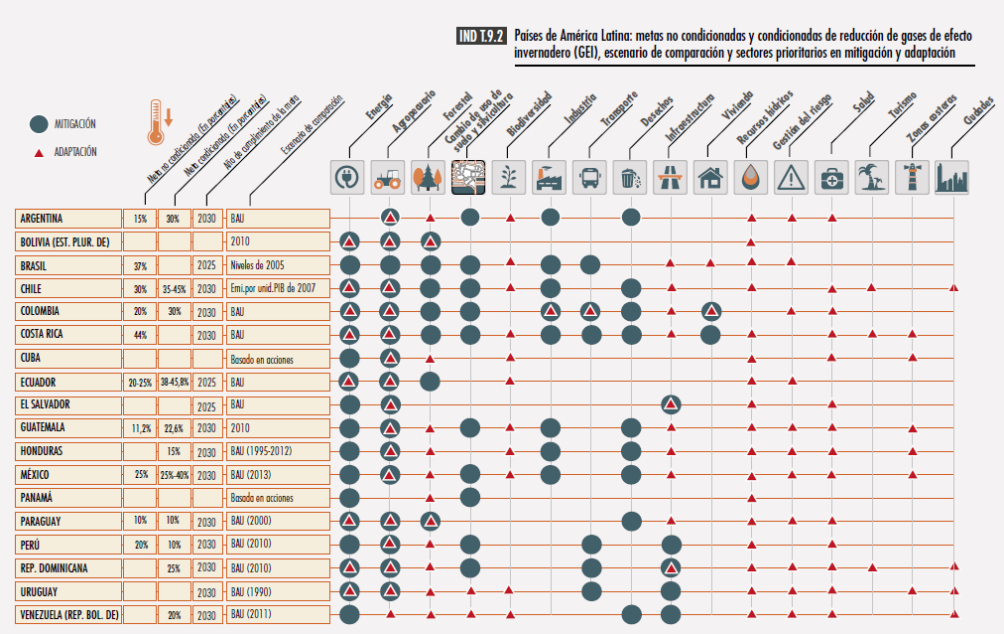
3.5 The remainder of this section is organized around four main challenges to progress toward climate-resilient and low-carbon development: (i) supporting institutions; (ii) increasing access to and the effective use of climate finance; (iii) improving the availability of and access to knowledge; and (iv) mainstreaming climate change considerations into sectors. Addressing each challenge will require continued extensive coordination between the IDB, MIF, and IDB Invest.

B. Support institutions on climate action

3.6 **The region actively participates in the global climate change dialogue.** As of May 2018, all 26 of the IDB's borrowing member countries have signed the Paris Agreement, 25 have submitted NDCs (UNFCCC 2018), and Mexico has an LTS. An analysis of LAC NDCs[19] shows prioritized emission reductions in a number of sectors and adaptation as a key component of proposed actions (UNDP 2016). Globally, NDCs fall short of reaching Paris Agreement objectives (see paragraph 2.12), including NDCs in the region. There are wide variations in countries' size, level of development, and vulnerability to climate change mean (Callaghan 2016) and tailored solutions will be needed to address countries' varying needs (Figure III-4). Of the six countries in the region that were assessed by Climate Action Tracker, just one—Costa Rica—was rated as compatible with the 2°C temperature goal, while the other five were rated as insufficient or highly insufficient (Climate Action Tracker 2018).[20] This first iteration of NDCs was characterized by uncertainty (of the international negotiations and guidelines), leading to heterogenous quality and room for continued learning. Continued support will be needed for countries in the region to effectively implement the Paris Agreement through robust and ambitious NDCs and LTSs—in particular to strengthen ownership of them across the government and to effectively align them with sub-national and national development priorities and policies. Coordination among donors will be important going forward—the NDC Partnership is one means of bringing together countries and institutions working to support climate goals. The IDB is financing the development of the LEDS LAC[21] publication, which will focus on the region's progress in developing policies, strategies, and actions for compliance of the commitments established in their NDCs.

[19] The analysis was conducted on Intended Nationally Determined Contributions, or INDCs in this case.
[20] If all government targets were in these ranges, warming would reach over 2°C and up to 4°C.
[21] Low Emission Resilient Development Strategies platform for LAC.

Figure III-4: GHG reduction targets in LAC



Source: (ECLAC 2017)

3.7 **LAC has made gradual progress on climate change legislation.** Six countries (Brazil, Guatemala, Honduras, Mexico, Paraguay, and Peru) have climate change legislative frameworks with varying levels of comprehensiveness and approaches, including carbon taxes and emissions abatement targets, and the creation of interagency mechanisms. Further to these dedicated acts, most countries in the region have already or are starting to incorporate climate change within other legislation, with 23 of the IDB's borrowing member countries having at least one piece of approved legislation related to climate change.[22] Thus, most countries have a legal foundation on which to build and future efforts can focus on strengthening existing laws and filling gaps (Nachmany, et al. 2017). Even with this legal foundation, countries face the challenge of implementation.

3.8 **The region has also made some progress on energy subsidy reform** (Di Bella, et al. 2015) **and taken timid steps toward carbon pricing** (World Bank, Ecofys, and Vivid Economics 2016), led by Mexico, Colombia, and Chile. Lessons learned from subsidy reform point to the value of designing and communicating compensation packages for poor and vulnerable households. Good practices on implementing carbon prices remain to be analyzed, as does the impact of the reforms on carbon emissions or the five fronts of decarbonization actions identified earlier (paragraph 2.13).

3.9 **Climate regulations in most countries in the region have been prepared mainly by the environment ministries, but ministries of finance are at the center of domestic decision making and are key to climate action** (Mercer and IDB 2017). The explicit incorporation of climate change into long-term budget frameworks—ideally, informed by a robust LTS—can hasten mainstreaming of

[22] Based on Grantham Institute data, which includes climate and climate-related laws, as well as laws and policies promoting low-carbon transitions, which reflects the relevance of climate policy in areas including energy, transport, land use, and climate resilience (Nachmany, et al. 2017).

climate change across programs, more effective and efficient public spending, improvements to short- and long-term planning, and substantially increase accountability. Countries in the region are starting to link climate change mitigation and adaptation to their development planning and national budgeting processes (UNDP 2016).

3.10 **Jurisdiction over climate change matters is scattered.** The design and implementation of climate actions requires the involvement of multiple ministries, including environment, finance, and planning. Considering this complexity, most countries in LAC have created coordination mechanisms to facilitate cross-ministerial participation. However, these mechanisms often have difficulty obtaining adequate operating budgets (Aguilar and Recio 2013) and do not ensure adequate stakeholder engagement.[23]

3.11 **Subnational planning processes need more support.** Local level action is key and takes place in the context of broader national efforts. National and regional governments should ensure that their policy frameworks are well-aligned to empower local action (OECD 2014). Subnational climate action can also be hindered by severe institutional capacity shortcomings and fiscal space limitations (Giraud 2017). Comparative analysis of sub-national climate action and interaction across levels of governance is insufficiently developed to allow generalization and explanation of different approaches to climate policy (Somanathan, et al. 2014). However, the growing trend for decentralized decision making to subnational entities in LAC does make it harder to mobilize private capital at scale (Serebrisky, Suárez-Alemán, et al. 2015).

C. Increase access to and effective use of finance for climate action

3.12 **Existing flows of finance for climate action are insufficient to cover the region's needs.** As with at the global level, the transition toward climate-resilient and low-carbon development in LAC will require considerable additional resources; one estimate indicates the region needs to invest an additional US$200 billion–US$300 billion per year to implement the Paris Agreement (Fay, Andres, et al. 2017). Of total climate finance resources available worldwide an annual average of US$26 billion was invested in Latin America in 2015–2016 (approximately six percent of the global climate finance in the same period), compared to US$23 billion in 2013-2014 (7 percent of global amounts) (Buchner, Stadelmann, et al. 2014, Buchner, Oliver, et al. 2017).

3.13 **The infrastructure investment gap in LAC is significant.** The region requires additional infrastructure investment of 2.0–2.5 percent of GDP or US$120–US$150 billion a year (Serebrisky, Suárez-Alemán, et al. 2015). Infrastructure services, such as the supply of drinking water and electricity, the disposal and treatment of waste water, the mobility of people and goods, and the provision of information and communication technologies, are the backbone for economic development, competitiveness and inclusive growth in LAC (Bhattacharya, Meltzer, et al. 2016, Calderón and Servén 2014, NCE 2015, Serebrisky 2014, Serebrisky, Suárez-Alemán, et al. 2015). One study estimated the cost between 2010 and 2050 for LAC to adapt to an approximately 2°C warmer world by 2050 to be between US$14billion and US$21 billion per year, largely for infrastructure (World Bank 2010).

[23] For example, in some cases, UNFCCC focal points made sector-specific commitments in NDCs without engaging all relevant stakeholders, risking the ownership of the commitments.

3.14 **The region's barriers to investment in climate action mirror those at the global level.** These include higher upfront costs, uncertainty and limited understanding of recently developed technologies, and risks of changes to policies and regulations. Stronger policy frameworks that signal less risk to private investors are needed (Buchner, Oliver, et al. 2017). Four countries (Brazil, Mexico, Chile, and Uruguay) ranked in the top ten in the 2017 Climatescope, a detailed, country-by-country quantitative assessment of clean energy market conditions and opportunities (Annex, Table A-5 includes the complete list of IDB borrowing member countries' scores).

3.15 **Complementing international climate finance, public sector funding and financing arrangements in the region** include: (i) specific funds for climate change actions (National Climate Change Fund and the Amazon Fund in Brazil[24], and the Adaptation Fund in Colombia); (ii) mechanisms to attract investments in renewable energy (e.g. most power purchase agreements in Brazil are financed by BNDES, tax exemptions partially fund the procurement of renewable technology in Uruguay, and a risk-mitigation mechanism for geothermal energy exploratory studies in Nicaragua helps attract private finance); and (iv) credit lines to support climate change projects (BNDES in Brazil and NAFIN in Mexico).

3.16 **More financing instruments and mechanisms are needed.** The magnitude of the additional resources needed to reduce the impacts of climate change and the peculiarities of climate investments mean that to scale up climate investment in the region, new financing sources and models are critical, including from the private sector.[25] Access to concessional climate finance is key for innovative projects. Developing project pipelines is a key priority since, when coupled with uncertain policy frameworks, scant project pipelines "result in inadequate deal flow that can prove insufficient in drawing investors and reducing transaction costs to mobilize financial resources at scale" (Mercer and IDB 2017).

3.17 The IDB Group adheres to the Development Finance Institutions' Principles on Blended Concessional Finance for Private Sector Projects. This common framework aims at ensuring a harmonized, efficient and catalytic use of concessional resources, while avoiding market distortions and crowding out the private sector. The five principles are: (i) additionality; (ii) minimum concessionality; (iii) crowding-in; (iv) commercial sustainability; and (v) governance.

D. Improve the availability of and access to knowledge and innovation for climate action

3.18 **More LAC-specific climate change research is needed.** Existing knowledge on how climate change impacts different sub regions and sectors in LAC is fragmented (Reyer, et al. 2017). There is a need for analysis of the causes of climate change vulnerability in LAC sector studies. Research and IPCC discussion are dominated by North America, Europe, and, to a lesser, extent Asia. The region's academia has limited capacity to investigate long-term decarbonization strategies independently from external experts. It is necessary to plug gaps in the availability of local

[24] The Amazon Fund has demonstrated the potential of a nationally-driven approach and the use of performance-based payments, but also illuminated some challenges. It has shown that developing country-based institutions can meet high fiduciary standards and provide substantial transparency on fund operations. However, there are costs to solid administration of funds, including difficulties for smaller organizations to access the resources (Forstater, Nakhooda and Watson 2013).

[25] In 2017, IDB Group climate cofinance totaled US$871M, with roughly one-third generated by the IDB and the remainder by IDB Invest as reported in the 2017 Joint MDB Report on Climate Finance.

information and in the available information analysis, and to communicate the findings to decision makers (OECD 2014). A priority is to improve locally initiated, locally informed, and locally conducted research, which will fill information gaps and can enhance the region's ownership of the agenda. Developing and strengthening partnerships with academic, intergovernmental, civil society, and private sector organizations can generate and disseminate the knowledge needed for the region to transition toward climate-resilient and low-carbon development.

3.19 **Accounting for the risk and uncertainty associated with climate change impacts requires adopting existing and new approaches, including robust decision making.** Infrastructure investments in LAC seldom benefit from risk assessment and mitigation analysis. Standard probabilistic risk assessments can be resource-intensive and quantified hazard maps expensive to produce. The region needs to improve local data and the capacity to use it for decision making. In addition, climate change impacts mean that the risk of extreme weather events cannot be computed from historical records. One promising trend is the development and piloting of robust decision-making approaches to deal with (i) deep uncertainties such as those created by climate change impacts; and/or (ii) data gaps inherent to developing countries (Bonzanigo, et al. 2015, Dittrich, Wreford and Moran 2017).

3.20 **Further information is needed about the effectiveness of climate change interventions in LAC.** There are constraints on the planning and implementation of adaptation measures in Latin America related to the lack of impact and vulnerability studies, climate information, comprehensive and multidisciplinary studies, research on adaptive capacity, and local/indigenous knowledge and access to technological resources (Magrin, et al. 2014, IPCC 2007).

3.21 **Roadmaps are useful for supporting countries in identifying short-term actions that are consistent with long-term technology adoption.** Innovative solutions are not always easily understood by planners and regulators, including in LAC. Technical cooperation can be used to create roadmaps to inform decisions—for instance with GEF resources, RG-T2384 has funded a technology roadmap on energy-efficient building of residential and commercial buildings in the Dominican Republic and a technology roadmap for renewable energy applications for solar heating and cooling, and biomass in Costa Rica.

3.22 **Improved accounting of GHG emissions[26] is an important element of making informed decisions for strategically decarbonizing development in LAC.** At present, countries use a range of approaches to express mitigation targets in their NDCs, which presents "challenges in understanding, comparing, and aggregating Party efforts"; improved accounting would allow Parties "to track individual progress toward their own mitigation-related NDC targets, understand others' NDC targets and their progress toward them, and assess collective progress toward the long-term mitigation goal" (Hood and Soo 2017). Further work is needed in LAC to

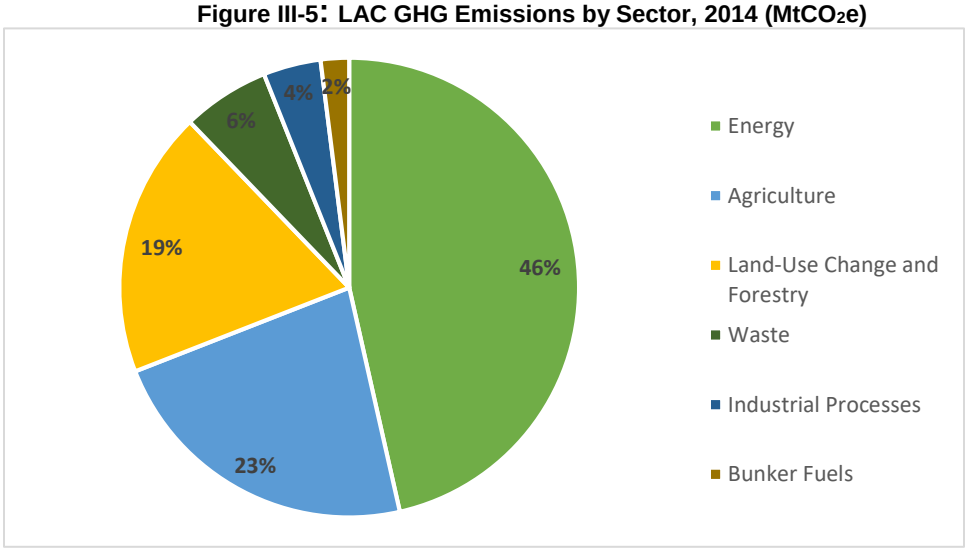
[26] The Environment and Safeguards Compliance Policy commits the IDB to calculate gross emissions from projects it finances that generate significant amounts of GHG emissions (those estimated to exceed 25 kilotons CO_2e). The Bank also calculates net or "avoided" emissions (reductions below business as usual) for selected projects. Currently, the focus is on projects in seven sectors—energy, industry, agriculture, water and sanitation, transport, urban development, and tourism—that dominate the portfolio's GHG footprint. The IDB is working to improve its GHG accounting by establishing a methodology and guidance materials for reporting on the contribution of IDB projects in key sectors.

improve accounting and enable a long-term perspective toward avoiding carbon lock-ins, particularly for infrastructure.

E. Mainstream climate change considerations into sectors

3.23 LAC is vulnerable to sea level rise, an increase in intensity and frequency of weather-related natural hazards, water and vector-borne diseases, and changing precipitation and temperature patterns that jeopardize health, productivity, and food-producing crops (IPCC 2014b). These impacts threaten poverty and inequality reduction and sustainable growth in the region (Hallegatte, Bangalore, et al. 2016). Similar to global emissions, the largest GHG emitting sectors in the region are energy (includes transportation), agriculture, and land-use change and forestry (Figure III-5). However, in 2014, the significance of contributions from energy was lower in the region, at 46 percent, compared to 72 percent globally. In LAC, agriculture represents 23 percent of GHG emissions and land-use change and forestry 19 percent, whereas the global distribution in those sectors is 11 percent and 6 percent, respectively. It is worth noting that countries in the region vary significantly (e.g. in Chile the energy sector represents more than 80 percent of emissions, while agriculture represents less than ten percent, in contrast to Haiti where agriculture exceeds energy at nearly 44 percent versus 43 percent respectively (World Resources Institute 2018). The remainder of Section E discusses the multi-sector areas from Part II in the LAC context.

Figure III-5: LAC GHG Emissions by Sector, 2014 ($MtCO_2e$)



Source: (World Resources Institute 2018)

1. Delivering an inclusive and just transition: social considerations

3.24 **The region's prospects for improving social inclusion and reducing inequality may be undermined by the consequences of climate change.** Natural disasters have been shown to result in increases in poverty rates and malnourishment (Beazley, Solórzano and Sossouvi 2017, Hallegatte, Vogt-Schilb, et al. 2017)**.** Climate change impacts on natural disasters could thus reverse progress made on poverty reduction (Hallegatte, Vogt-Schilb, et al. 2017). Options to tackle these challenges include pro-poor disaster risk reduction policies designed to consider deep uncertainty on future hazards; policies that promote inclusive growth and development not directly related to climate change, such as inclusive agricultural

expansion; and inclusive expansion of infrastructure. Adaptive social protection schemes that expand the amounts disbursed or the number of beneficiaries after a natural disaster hits have been shown to be effective in the region, including in Ecuador, Haiti, and Peru (Beazley, Solórzano and Sossouvi 2017). Key good practices include: (i) advanced assembly of registries of potential beneficiaries (broader than current beneficiaries) that include benefit delivery means (such as bank account numbers); and (ii) preparing a financial contingency plan that ensures that there will be no administrative and financial bottlenecks for disaster relief (Hallegatte, Vogt-Schilb, et al. 2017, Beazley, Solórzano and Sossouvi 2017).

3.25 **The main health threats associated with climate change in Latin America are malaria, dengue fever, cholera, and heat stress** (Githeko and Woodward 2003, Hallegatte, Bangalore, et al. 2016). This will drive up costs for health services. For example, it is estimated that treating additional cases of malaria and diarrhea will cost US$1 billion per year by 2050 (Annex, Table A-3). In the Colombian highlands, the year-to-year prevalence of Malaria has been linked to weather fluctuation with increased temperatures leading to increased cases and wider geographic coverage of the disease (Siraj, et al. 2014). Using preventive systems and disease transmission and exposure response mechanisms and implementing environmental pollution controls (with the co-benefit of reducing GHG emissions) can reduce these threats (Hallegatte, Bangalore, et al. 2016, Magrin, et al. 2014).

3.26 **Emission reduction policies need to consider their impact on poor and vulnerable people to be politically palatable.** Explicit attention should be paid to the possible negative effects of policies on poor and vulnerable households (e.g. increases to energy and food prices and disruptions to labor markets). For example, a fraction of revenues from fossil fuel subsidy reform or energy taxes can be used to fund an expansion of the social protection system (Vogt-Schilb, Marchán, et al. 2017). In El Salvador, liquefied petroleum gas (LPG) subsidies where replaced with targeted cash transfers to households that help them buy energy. In Mexico, the cash transfer program *Oportunidades* has component designed to fight energy poverty, which automatically compensated, at least in part, the gradual increase of the LPG prices (Toft, Beaton and Lontoh 2016). Helping households adapt is also a recognized factor of success; Ecuador's subsidy fuel subsidy removal was complemented with targeted subsidies to electric cookstoves to help households switch (Rentschler and Bazilian 2017). With respect to job markets, solutions may include retraining workers from stranded industries and training new workers in the skills needed for the decarbonized economy of the future. Analytical assessments of the potential negative impacts of emission-reduction policies in LAC, and how to manage them, are still scarce and limited to topics such as the impact of energy pricing reforms on consumers (Feng, et al. 2018, Di Bella, et al. 2015) or the impact of payment for ecosystem services on farmers (Hallegatte, Bangalore, et al. 2016). More country-level analysis is needed on the policy options to manage the negative impacts of other policies (for instance policies that promote transport electrification, renewable energy, or dietary changes) on consumers, workers, regional communities and professional groups.

2. Managing climate risk to the financial system

3.27 **Climate-related stranded assets are an important risk for the region, given its fossil fuel resources.** Climate-related stranded assets are not yet featuring prominently on the radar of financial institutions in the region; an exception is pension funds, which have been receptive to the risk of climate change-related

stranded assets impacting their portfolios, considering their long-term mandates (Caldecott, Harnett, et al. 2016).

3.28 **Interest in the region is growing for managing climate-related risks in the financial sector.** Both financial institutions and finance authorities are increasingly aware of the potential impact of climate change on their financial indicators. However, policy instruments at the system level and institutional risk management tools at the firm level are yet to be fully developed in LAC, largely due to the lack of understanding of climate-related risks and widely agreed upon standards. Internationally recommended frameworks[27] are seen as potentially providing a basis to further develop risk management mechanisms at both the macro and firm level. Analysis of financial regulations and risk management practices in LAC that aim to define, assess, and regulate climate-related risks and the impact of climate change confirmed the incipiency of the topic in the region, but also highlighted the progress of industry-led actions even in the absence of policy and regulatory signals (Frisari, Nakano and Cárdenas forthcoming). IDB Invest is disseminating the work of the TCFD and promoting sustainable financing through collaboration with bank associations, individual commercial banks, and markets, expanding knowledge and evidence for better business.

3. Lowering emissions and building resilience: sustainable infrastructure

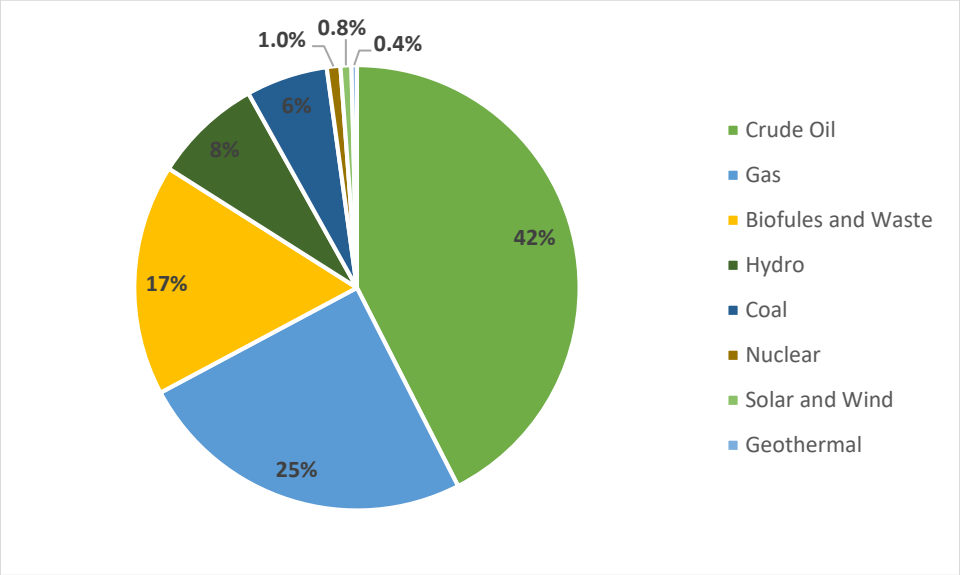
3.29 **The region can use its hydropower assets to facilitate the decarbonization of its electricity grids.** Hydropower plants can be used as a flexibility mechanism to enable a higher penetration of variable generation technologies such as wind and solar. A change in the operation of hydropower has been one of the measures taken by Uruguay in its effort to increase the penetration of renewable energy in the electricity system. The other measures have been the strengthening of its regional interconnections, and hourly demand management systems (Clean Energy Solutions Center 2015, Ecofys 2015, ESMAP 2015, IEA 2015, Towards 2030 2015). By strengthening its electricity interconnections, the region can maximize the flexibility contribution of hydropower, as well as the use of its geothermal, solar and wind resource-rich areas (Paredes 2017, REN21 2017).

3.30 **Fossil fuel subsidies are hindering the decarbonization of energy in LAC.** See Figure III-6 for the share of primary energy supply sources. Depending on the source and the time scale considered, energy subsidies in the region were estimated between 1.6 (2008—2014) and 1.8 (2011—2015) percent of GDP (Marchán and Espinasa 2017, Di Bella, et al. 2015). This represents about one third of the fiscal deficit of the region in 2014, estimated at 5.1 percent of GDP (IMF 2018). Reforming energy subsidies in LAC would reduce the sector's emissions by approximately 13 percent (IMF 2013). Political economy challenges rooted in the social consequences of energy price hikes can in principle be managed diverting only a fraction of the fiscal proceedings of subsidy removal; in LAC, only about 23% of the spending on subsidies reaches the two poorest quintiles of the population (Feng, et al. 2018). Experience in the Dominican Republic shows that it is possible to substitute universal gas and electricity consumption subsidies with subsidies targeting the most disadvantaged social groups. In the Dominican case, the program was built on the national subsidy system, accompanying other social

[27] E.g., the Financial Stability Board´s Task Force on Climate Related Financial Disclosure (TCFD) and the pledge of the recently launched Central Bank and Financial Supervisors Network for Greening the Financial System (NGFS).

initiatives focused on health and education (World Bank 2013). Targeted energy subsidies may be useful to enable the transition from the use of solid biomass fuels to clean cooking technologies (Troncoso and da Silva 2017).

Figure III-6: LAC Primary Energy Supply Sources, 2014

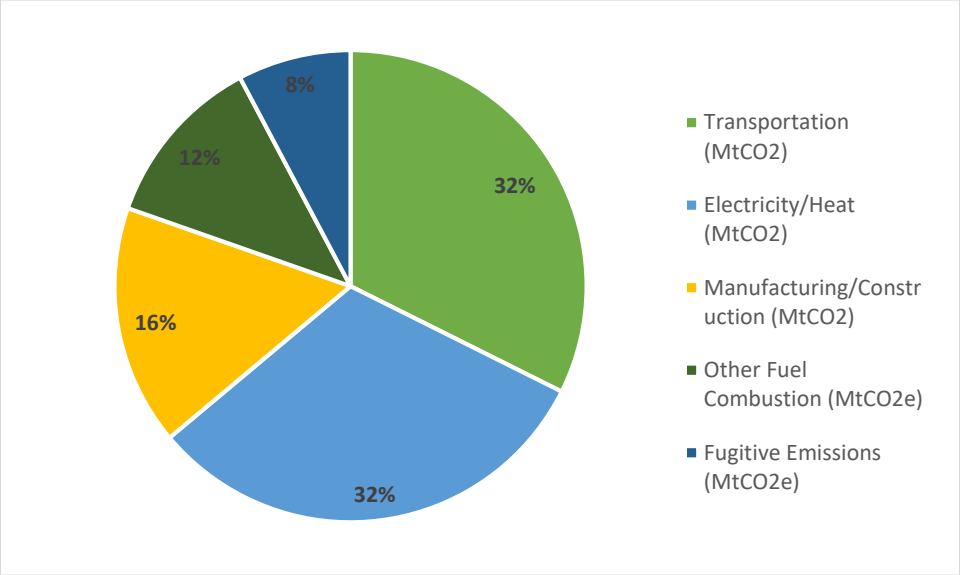


Source: (IDB calculations, based on IEA data and other sources 2018).

3.31 **The energy investment environment is improving in LAC**. However, structural challenges remain for the private sector. The region has some of the top performers in renewable energy investment, but some countries still have market structures that hinder competition by limiting the entry for additional players, innovative business models, and new technologies that could improve energy infrastructure. Sustainable energy investors require regulatory environments that are stable and predictable, with a long-term vision of the sector to reduce risks and foster proper financing mechanisms. Availability and affordability of new technologies are changing the marketplace faster than market regulation, creating investment opportunities. More investment in sustainable energy in the region requires more competition and regulation that is compatible with technological change, and with the lifespan of sustainable energy infrastructure.

3.32 **Transportation is an important source of emissions in LAC** (Figure III-7) **and is the fastest growing source of emissions.** From 2000 to 2012, transport-related GHG emissions in the region grew by nearly 49 percent, a trend that is expected to continue, driven by a fast rate of urbanization, some of the world's highest motorization rates, and a rapid expansion of freight transport (Vergara, Fenhann and Schletz, Zero Carbon Latin America - A Pathway for Net Decarbonisation of the Regional Economy by Mid-Century: Vision paper 2015). Public transportation must be considered in the context of urban development and accessibility. In general, transportation systems have been developed in isolation from urban planning processes, creating major disincentives to the use of public transportation, generating congestion and pollution externalities (Transportation SFD). Public transportation and urban development policies could reduce GHG emissions by 30 percent in LAC, improve air quality and reduce respiratory diseases, and the absenteeism they cause (OECD/ITF 2015).

Figure III-7: LAC GHG Emissions by Energy Subsector, 2014



Source: (World Resources Institute 2018)

3.33 **Electrification is important for decarbonization and electric vehicles could provide an opportunity in the face of growing motorization.** While car ownership in the region (170 cars per 1000 inhabitants) is still relatively low,[28] the LAC region has the highest motorization rate in the world at 4.5 percent per year (Vergara, Fenhann and Schletz, Zero Carbon Latin America - A Pathway for Net Decarbonisation of the Regional Economy by Mid-Century: Vision paper 2015). Low-cost policy options for the region to further the adoption of electric vehicles include: (i) electrical infrastructure requirements and clear regulations for parking in new developments; (ii) harmonization of standards; (iii) time-of-use electricity pricing to incentivize charging during off-peak periods; (iv) initiatives to increase the social awareness of electric vehicle technologies; (v) support private capital investments and R&D activities to expand or create value-added industries in the electric vehicle and battery markets; and (vi) increasingly stringent local pollution and emissions standards for cars (Gómez-Gélvez, et al. 2016).[29] Mass production prospects are furthering research that is rapidly lowering battery costs and increasing energy density (IEA 2017d). As indicated in the Transportation SFD, regulatory reforms (in the form of financial and nonfinancial incentives) could impact the market penetration: (i) designating exclusive parking spaces for electric vehicles, with charging stations; (ii) regulating or harmonizing standards for charging devices; (iii) promoting initiatives (such as electric taxi pilot projects) to build awareness; (iv) introducing dynamic pricing for charging vehicles, fostering optimum power use; and (v) introducing regulations to expand charging stations to shopping malls and other public spaces (Gómez-Gélvez, et al. 2016). Bus rapid transit systems are already a key mode of transportation throughout the region, including in Bogotá, Curitiba, Quito, Lima, and Mexico City (Vergara, Fenhann and Schletz, Zero Carbon Latin America - A Pathway for Net Decarbonisation of the Regional Economy by Mid-Century: Vision paper 2015).

[28] Compared, for example, to the US rate of 700 cars per 1,000 inhabitants (IEA 2017).
[29] Analysis based on Mexico, Argentina, Brazil, Chile, Colombia, and Peru.

3.34 **The region has shown progress in efforts to make cities more sustainable** (Magrin, et al. 2014). The paradigm shift toward more compact urban growth, with well-connected infrastructure and effective management, could raise productivity in urban areas, resulting in social and environmental benefits, including benefits for public health (Global Commission on the Economy and Climate 2014). LAC has seen steady growth in the number of green buildings and sustainability professionals, with Brazil and Mexico consistently among the top 10 countries for green building in the world (Mueller 2017).

3.35 **An integrated approach is needed for waste management.** Efficiently capturing methane from landfills for electricity generation remains an underexploited opportunity in LAC. The region also needs to design and implement incentives for reducing solid waste and increasing recycling as part of an effective strategy (Water and Sanitation SFD), including the application of circular economy principles.

3.36 **Natural hazards and climate change impacts pose a major risk to cities in the region**. As with other regions, cities in LAC are also hotspots of vulnerability to floods, heat waves, and other hazards that climate change is expected to aggravate (Hardoy and Romero 2011). About 80% of the disaster impacts in the region are felt in cities, affecting the poorest populations hardest (ELLA 2013). Settlements in areas prone to disasters, in conjunction with the use of inappropriate building materials and lack of access to water, electricity, sanitation, and other basic services make the urban poor particularly vulnerable (Baker 2012). Urban poverty and inequality are likely to be exacerbated by the impacts of climate change (Lampis 2013). A 2013 study estimated that the average annual economic loss due to storms in Trinidad and Tobago was US$55.73 million and concluded that these losses will increase to US$65.46 million because of climate change (IDB 2013).

3.37 **A multidisciplinary approach to climate change is particularly important in the urban context.** Complex interactions between population dynamics, social processes, and natural hazards increase LAC cities' vulnerability to disaster risk (ELLA 2013). By incorporating Disaster Risk Management into urban planning, governments can promote equitable urbanization processes that reduce vulnerability and contribute to sustainable development goals. In Colombia, DRM is included in land planning and supported by legislation and specific regulations; Bogota has progressed most in implementing the national DRM strategy, having produced micro-zoning maps that identify 'at risk' areas of land and vulnerable families (ELLA 2013).[30]

3.38 **Progress has been seen in infrastructure adaptation planning in LAC.** For example, in the 2020-2030 action plan for key infrastructure adaptation actions in Mexico and in national infrastructure adaptation strategies (Uruguay, Ecuador, Colombia, and Nicaragua), which consider the impact of climate change when deciding on the location of works, the promotion of innovation and development/use of new technologies to boost resilience, monitoring and availability of meteorological and hydrological information, and efficient storage and use of water (Alencastro 2014).

[30] Measuring the impact of DRM interventions is challenging due to the lack of a counterfactual and needing to wait for a major disaster to happen to gauge if the DRM strategies worked as planned; efforts at measuring results often focus on whether specific initiatives or aspects considered to be good DRM practice have been implemented (ELLA 2013).

3.39 **Countries in the region lack clear information about the quality, maintenance status, and exposure of the existing road network.** The region's cities need to develop transportation infrastructure based on standards that reduce vulnerability to the impact of climate change. Weaknesses in the design, location, and construction of roads, containment walls, and dykes, among other things, magnify the destructive power of natural hazards. It is estimated that approximately 6,700 kilometers of roads in Latin America would be damaged by a one-meter rise in sea level (ECLAC 2011) and that in the Caribbean Community (CARICOM) member countries would lose 570 kilometers of roads and 28 percent of the airports would be damaged (Simpson, et al. 2010).

3.40 **Connectivity disruption is an important consideration.** Damaged transport assets represent a sizable portion of economic losses from natural disasters. Damage to transport infrastructure can affect accessibility to essential services such as schools and hospitals, and create business interruptions for the tourism, fishery, or agriculture sectors, exacerbating long-term economic losses. In Belize for instance, the value of the road network represents 142 percent of the country's GDP, while power plants represent 14 percent of GDP and water supply and sanitation 25 percent. As a result, roads constitute 79 percent of infrastructure value (including energy, water, and roads). Hurricane Mitch, which affected Nicaragua in 1988, caused heavy and long-lasting rainfall, which caused landslides and floods, seriously damaging the country's road infrastructure. The road network of Nicaragua, in 1998 was 18,447 kilometers—of them more than 3,000 kilometers and more than 100 bridges were damaged or destroyed.

3.41 **The energy sector in LAC needs to be made more resilient, particularly given the region's reliance on hydropower** (Fay, Andres, et al. 2017)**.** For example, in 2015, reservoirs for São Paolo's hydroelectric system dropped below 3 percent of capacity, triggering blackouts throughout the region (Poindexter 2015) and an estimated US$50 billion of investments of are needed for Brazil to ensure reliable electricity supply by 2035 due to the projected unreliability of hydroelectricity (de Lucena, Schaeffer and Szklo 2010). Robust decision-making techniques have been proposed to help plan for hydropower under the threat of uncertain climate change impacts (Ray, et al. 2018); these techniques have been used successfully to prioritize water supply investments in Peru (Bonzanigo, et al. 2015).

3.42 **Unsustainable water resource management practices**[31] **in LAC threaten to magnify anticipated impacts of climate change, resulting in water insecurity.** Resource planning and risk assessments need to consider that the means and extremes of precipitation, evapotranspiration, and rates of discharge of rivers are being altered (Milly, et al. 2008). Since the 1970s, droughts have become more frequent, especially in the tropics and sub-tropics and heavy precipitation events are expected to become more frequent in almost all regions of the world in the 21st century (IPCC 2007). Climate change is causing Andean glaciers to retreat, altering the water cycle (IPCC 2014b).

3.43 **Countries in LAC are preparing to respond to these impacts, however, there are remaining challenges in the region that need to be considered as part of an effective long-term water resource adaptation plan or strategy.** These challenges include: (i) supply, distribution, and sustainability of water sources;

[31] E.g., lack of water rights policies, lack of effective water governance, and lack of efficient technology for irrigation.

(ii) contamination and degradation of water quality; (iii) infrastructure for the efficient management of water resources; and (iv) water governance and institutional capacity strengthening (Miralles-Wilhelm 2014). In addition, improved data to understand the anticipated impacts of climate change on local hydrology and better channels to communicate climate-related information are needed. Investments in water and sanitation infrastructure need to consider a longer time horizon using the best available science and statistical techniques.

3.44 **An integrated approach to manage water resources is key to effectively respond to the challenges posed by climate change at the watershed level.** The livelihoods and wellbeing of local communities are at stake if vulnerability and risks to climate-related threats are not reduced. Integrated water resource management is well-established in LAC, yet fragmentation of water policymaking still leads to coordination challenges between central agencies and sub-national actors (e.g., in Peru there are 13 central agencies involved in water policymaking and 10 in water regulation) (Denier, et al. 2015).

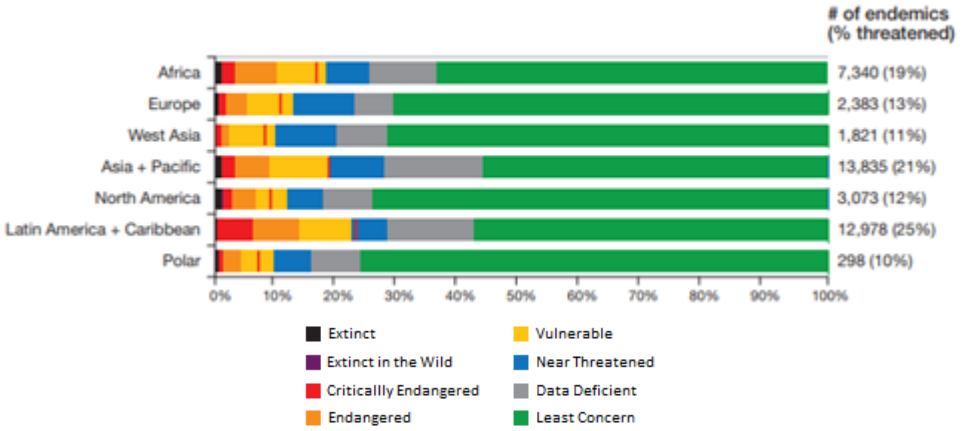
4. Sustainable landscapes

3.45 **Sustainable landscapes are gaining prominence in LAC.** Integrated landscape management is being applied across LAC to address a variety of challenges and use of the approach has accelerated in the past decade (Estrada-Carmonaa, et al. 2014). Intersectoral collaborative processes have proven important for developing sustainable and ecosystem-based strategies for landscape management (Opdam 2018). Several studies on the interface between landscape ecology and social sciences found that concepts like *green infrastructure* and *landscape level ecosystem services* can facilitate the convergence of actors toward a common goal and stimulate collaborative landscape management (Opdam 2018).

3.46 **The region possesses a wealth of biodiversity, but it is being threatened.** LAC is the most biologically diverse region on the planet—almost half of the world's tropical forests are in the region, 33 percent of the world's mammals, 35 percent of reptile species, 41 percent of birds, and 50 percent of all amphibians (UNEP 2018). Ecosystem services[32] provide inputs into key sectors in LAC economies, but conventional economic approaches are depleting the region's natural asset base and the associated ecosystem services (Bovarnick, Alpizar and Schnell 2010). An example is the Peruvian anchoveta, where unsustainable catch limits led to over-investment in fishing fleets, depletion of the stock, and higher costs per ton caught (Bovarnick, Alpizar and Schnell 2010). More broadly, the IUCN Red List Index shows an increase between 2008 and 2012 of species in LAC moving toward extinction, despite efforts to improve the conservation status of threatened species (UNEP-WCMC 2016) (Figure III-8 shows the current breakdown by region).

[32] Water, soil fertility, pollination, pest control, growth and reproduction of food species, climate regulation, waste assimilation, and many other functions.

Figure III-8: Proportion of Species in each Red List Category



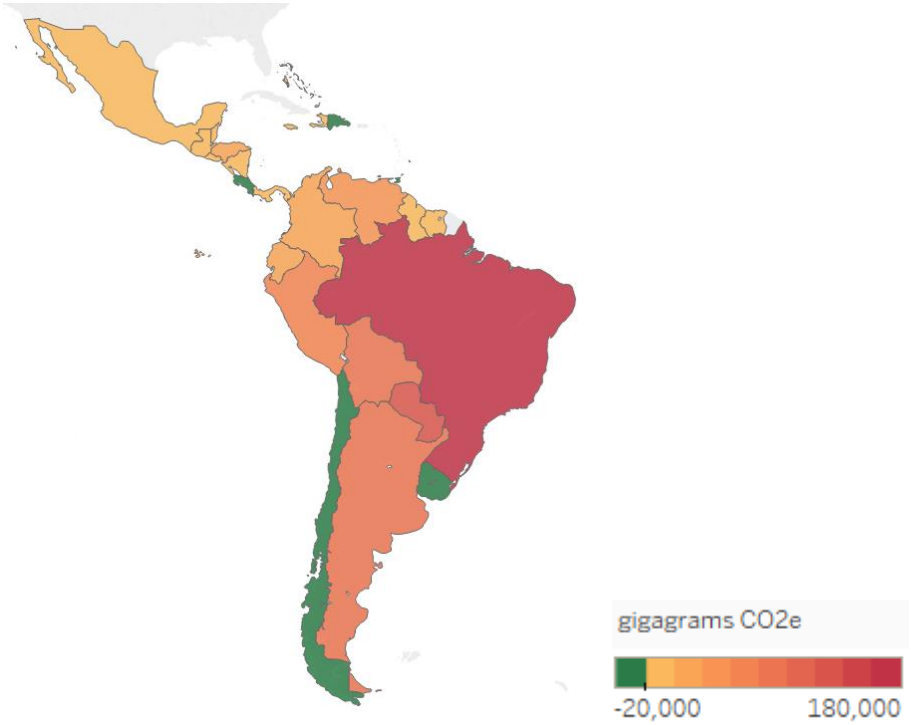
Source: (UNEP-WCMC 2016)

3.47 **Climate change is compromising the integrity of natural ecosystems, ecosystem services, and biodiversity in large areas of LAC** (Magrin, et al. 2014). The gradual and sustained rise in surface temperatures in the Caribbean Sea has increased the number of coral bleaching events, resulting in loss of biodiversity, with important economic impacts (e.g. for fishing, tourism, and biochemical production (Vergara, Rios, et al. 2013). It is possible that species in the Amazon will gradually become extinct, which may affect regional and global water and carbon cycles (Vergara and Scholz 2011). Recent analysis of the historical evolution of the biomass dynamics of the Amazon rainforest over the past three decades point to climate variability as a potential driver of an observed decline in the rates of increase in above ground biomass in the Amazon, hence reducing the Amazon's potential to act as a carbon sink (Brienen, et al. 2015).

3.48 **Forestry and agroforestry play an important role in the region.** The annual net CO_2 emissions or removals from forests, estimated as the net carbon stock gains or losses in living biomass (both aboveground and belowground), vary in LAC. Countries with the highest CO_2 emissions from conversion of forestland to other land uses in LAC are Brazil and Paraguay (Figure III-9). *Reducing Emissions from Deforestation and Forest Degradation, while promoting Conservation, Sustainable Forest Management, and the Enhancement of Forest Carbon Stocks* (REDD+) made significant progress initially, indicating governments are interested in supporting forest conservation and sustainable management (Sanhueza and Antonissen 2014), but, faced with implementation issues, momentum has stalled in recent years (Fletcher, et al. 2016). There have been significant shifts in Amazon deforestation patterns from 2001–2014[33], suggesting that the protected area networks have had limited success (Kalamandeen, et al. 2018). Agroforestry is employed on between 200 and 357 million hectares in Latin America and has developed significantly in certain sectors and countries (Somarriba, et al. 2012).

[33] (i) loss hotspots are moving away from southern Brazil to Peru and Bolivia; (ii) the number of new large forest clearings (>50 ha) has declined by 46 percent, while the number of new small clearings (<1 ha) has increased by 34 percent; and (iii) small-scale low-density forest loss expanded markedly in geographical extent (Kalamandeen, et al. 2018).

Figure III-9: 2010-2015 average annual net CO2 emissions or removals from forests in LAC

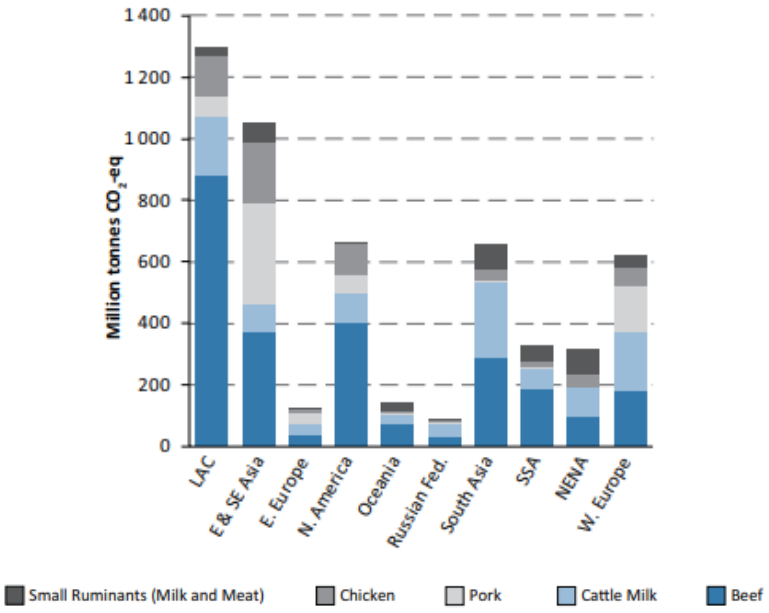


Source: (FAOSTAT 2016)

3.49 Water related ecosystems (e.g. wetlands and forests shade streams) store and reduce runoff, recharge aquifers, digest organic waste, and halt erosion. Degradation of these natural systems affects water treatment costs, given that the quality and availability of the water supply depends heavily on the quality of the surrounding land. One of the most cost-effective tools for retaining the natural state ecosystems is protected areas, particularly for water (Dudley and Stolton 2003, USAID 2017). Investing in nature to conserve and restore the forests and natural grasslands that enhance water quality and quantity is an important strategy for increasing the water security of millions of people living in LAC cities.

3.50 **Climate change will have a major impact on agricultural productivity.** Changes to precipitation patterns, temperature changes, and more frequent and intense weather events (including droughts and floods) will affect crop yields (Magrin, et al. 2014). Climate change may also affect crop and livestock production through the spread of pests and diseases and increased loss of soil nutrients from heavy rains (ECLAC, FAO, and ALADI 2016). Reduced yields and higher prices could intensify malnutrition (Nelson, et al. 2009) and increase poverty (Ahmed, Diffenbaugh and Hertel 2009). LAC is the world's leading exporter of beef (FAO 2017), mostly from Argentina, Brazil, Mexico, Paraguay, and Uruguay. It also has the highest level of GHG emissions from livestock in the world, driven by its production of specialized beef (Gerber, et al. 2013) (Figure III-10). While it is established that efficiency improvements in the management of cattle can have benefits in terms of economic yields, nutritional outcomes and environmental impacts; the social impacts and political economy challenges for the region that would arise from a global dietary change away from beef have seldom been investigated. This is a potential area for future analysis.

Figure III-10: GHG Emissions from Livestock



Source: (Gerber, et al. 2013), GLEAM

3.51 **The rural population's dependence on farming activities increases its vulnerability to climate change impacts.** Particularly in LAC, there is a strong need for further research in the agricultural sector to adapt to climate change (Nelson, et al. 2009). Smallholdings play a fundamental role in food security, particularly for a large portion of the population vulnerable to climate change impacts (Altieri, Funes-Monzote and Petersen 2012). Climate change impacts on agriculture yields could increase extreme poverty in rural Mexico by 11 percentage points, while inequality could worsen, reflected in an increase of 20 percent in the Gini coefficient (López-Feldman 2014).

3.52 **Some effective adaptation practices exist in the region, using new technology and traditional methods.** Examples include the Climate Risk Adaptation and Insurance Project in the Caribbean[34], which offers climate-indexed insurance, early-warning systems, and risk reduction information to financial institutions and low-income individuals with a strong focus on the agriculture sector (Warner, et al. 2013) and agricultural insurance to cover price variations and climate impacts by private banks in Brazil (SICREDI). The MIF's PROADAPT Building Climate Resilient Farmers in the Brazilian Sertão project is developing climate-smart agriculture solutions in the northeastern semiarid region of Brazil to reduce farm failure among farmers facing acute climate risk. It has created a tool for smallholder farmers to integrate several levels of climate resilience, including short-term actions to increase productive efficiency, medium-term actions to reduce production fluctuations, and long-term actions to buffer climate shock through the restoration of ecosystem services. The application of the tool has led to production increases of up to 30 percent for individual farmers, mainly by minimizing fluctuations and improving quality, and it allows for continuous scoring and monitoring of climate risk

[34] The Munich Climate Insurance Initiative (MCII) leads the Climate Risk Adaptation and Insurance in the Caribbean project. The project is implemented by MCII with its partners, Caribbean Catastrophe Risk Insurance Facility (CCRIF), MicroEnsure, and Munich Re.

at the farm level. Ancestral practices and knowledge are also potentially effective adaptation measures (Valdivia, et al. 2010, Altieri 2004). A case in point is that of pre-Hispanic terraces widely used in the Andes. These have proven to be effective at controlling erosion and soil loss on sloping ground (Posthumus and Stroosnijder 2009, Chow, Rees and Daigle 1999, Altieri 1999) but run a high risk of being abandoned (Inbar and Llerena 2000) and can have high maintenance and restoration costs (Denevan 1995).

3.53 **The tourism sector in LAC faces challenges related to climate change.** Of concern is the potential for climate change impacts to affect demand for tourism in small Caribbean island nations, whose economies tend to be heavily reliant on tourist income and related service industries, and to risk stranding tourism assets (Caldecott, Harnett, et al. 2016). One study estimates that with a 1-meter sea level rise, of 900 major coastal resort properties in 19 CARICOM countries, 29 percent would be partially or fully inundated, up to 60 percent would be at risk to erosion damage, and a much larger number would experience significant loses of beach assets (Scott, Simpson and Sima 2012). Impacts will vary and examining risks to individual island nations and resorts—for example coral bleaching and reduced beaches—could be particularly important to help guide governments and investors in determining future resilience (Caldecott, Harnett, et al. 2016). At the same time, tourism in LAC can contribute to environmental protection, in turn protecting ecosystem services that enhance resilience to climate change. For example, in Peru's Cordillera Huayhuash region, growth in international tourism since the 1990s has led to new forms of conservation, with the creation of private parks and alternative economic opportunities that integrate campesino communities (Bury 2008).

IV. Lessons Learned from the IDB's Experience in Climate Change

A. Organizational management of climate change at the IDB

4.1 The IDB has progressively strengthened climate change actions in the region, as reflected in its evolving organizational structure. In 2006, the IDB launched the Sustainable Energy and Climate Change Initiative (SECCI). In 2010, the Bank created a specialized climate change unit that later evolved into a division, with staff and budget dedicated to promoting the adoption of climate change actions in public and private sector operations. This evolution culminated in 2016 with the creation of the Climate Change and Sustainable Development Sector (GN-2845-1). Additionally, a workforce planning exercise for the Climate Change Division was undertaken in 2017 to align its human resources to the priority areas identified in its medium-term (to 2020) roadmap.

4.2 In addition, high-level commitment to climate action is reflected in the decision of the IDB's Board of Governors to endorse the "goal of increasing the financing of climate change related projects in LAC to 30 percent of the IDB's and IIC's combined total approvals of loans, guarantees, investment grants, technical cooperation, and equity operations by December 31, 2020, subject to demand from borrowing countries and clients and access to external sources of concessional financing" (AB-3067). Subsequently, Management approved the IDB Group Climate Change Action Plan for achieving the 30 percent climate finance goal and systematically mainstreaming climate change into operations.

B. Reports from the Office of Evaluation and Oversight (OVE)

4.3 The Office of Evaluation and Oversight (OVE) has conducted three evaluations that are relevant for identifying lessons learned from the IDB's climate actions in recent years.

4.4 In 2012, as part of the *Mid-term Evaluation of the IDB-9 Commitments*, OVE prepared a background paper (RE-430-3) considering the *IDB Integrated Strategy for Climate Change Adaptation and Mitigation, and Sustainable and Renewable Energy*. According to OVE, the strategy and associated action plan present a good, in-depth analysis of the challenges that need to be addressed in the region with respect to climate change. However, OVE points out that the strategy fails to prioritize sectors and has not managed to strengthen the Bank's capacity to use technical cooperation grants to help countries prepare new investment operations and undertake the necessary institutional capacity building. Nor has it been possible to combine these interventions with loans based on more conventional investment projects and policies. A final evaluation was completed in 2018, *IDB's Ninth Capital Increase: Implementation and Outcomes* (RE-515-4), which acknowledges current climate finance tracking as more robust than the previous all-or-nothing approach.

4.5 In 2014, OVE further evaluated the Bank's climate change interventions and institutional arrangements in *Climate Change at the IDB: Building Resilience and Reducing Emissions* (RE-459-1). The evaluation highlighted progress on climate change mitigation in various Bank sectors and identified work in progress on forest protection/management and strengthening ties between public sector energy policy frameworks and private sector renewable energy operations. With respect to adaptation, the evaluation acknowledged the support to managing natural disaster risks that are exacerbated by climate change and that the portfolio is largely consistent with countries' levels of vulnerability. Nevertheless, OVE made four recommendations, which CCS has substantially adopted and implemented: (i) strengthen the mainstreaming of CC concerns in IDB by maintaining a highly qualified CC group whose mandate and incentives are to provide cutting-edge technical knowledge and support to divisions in all three operational Vice-Presidencies—VPS, VPC, and VPP; (ii) deepen IDB's engagement in policy dialogue and operational support to address climate adaptation challenges in relevant sectors; (iii) markedly strengthen the coordination between the Bank's public sector and private sector windows and scale up efforts to mobilize external resources to leverage the Bank's work; and (iv) deepen the Bank's ability and incentive to track its activities and results related to CC mitigation and adaptation.

4.6 In its *Evaluation of Special Programs Financed by Ordinary Capital* (RE-476-3), OVE reviewed the portfolio of 139 technical cooperation projects financed with SECCI funds. OVE found that this fund had helped to generate knowledge, to strengthen internal capacity, and, ultimately, to bolster the IDB's work on climate change. The analysis emphasized that these operations have been extremely valuable to borrowing member countries and have helped to enhance the IDB's technical capabilities in this field. OVE also indicated that internal capacity building and knowledge work have enabled an increase in the number of adaptation and mitigation investments and in the amount of international climate resources that are leveraged.

C. Results of the Development Effectiveness Matrix

4.7 A review of the sovereign-guaranteed operations approved between 2013 and 2017 that made use of climate finance showed that they have been consistently the evaluable and had good vertical logic at entry.

D. Lessons learned from IDB climate change projects

4.8 Lessons from the previous SFD remain valid and have been updated based on recent climate change interventions, as set out below. Interventions in progress or recently completed were considered, including loans, technical cooperation operations, and operations financed with international climate funds. The information was compiled with support from the Knowledge and Learning Division (KIC/KLD) through semi-structured interviews with project team leaders and subsequently updated with based on documentary analysis[35] of relevant operations that were approved after the previous SFD was prepared.[36]

1. Supporting institutions

4.9 Important considerations for operations geared toward policy reform are:[37]

a. **Involving the finance ministry and using a multisector approach.** Climate change has been typically addressed by environment ministries but transforming the agenda toward climate-resilient and low-carbon development largely depends on the support of finance ministries, as well as ministries of other key sectors, such as transportation and energy. Co-benefits from responses to climate change are best achieved through interagency coordination, which can ensure integrated planning, public policy consistency, and the incorporation of cross-disciplinary expertise. Interventions that encouraged coordination and dialogue between various donors and key stakeholders (national and subnational public sector, private sector, academia, and civil society), helped to ensure better use of available resources.

b. **Strengthening governance structures, resource management, and risk management.** The use of Programmatic Loans Based on Policy Reforms (PBPs) are useful for the gradual implementation of regulatory reforms, given the time required to consolidate adjustments in the legal, institutional, and regulatory framework, and can ultimately facilitate better coordination between institutions and leverage of results. A well-defined schedule and clearly assigned responsibilities are recommended to avoid delays. Supporting the design and implementation of policy measures is furthered by the development and use of standardized management tools, methodologies for economic evaluation, sizing of costs and impacts, and consideration of linkages with other sectors. Where possible, the participation of the public in the decision-making

[35] Review of Project Completion Reports (PCRs), monitoring reports (PMRs), loan proposals, and other relevant documentation.

[36] CCS is conducting an internal review of projects funded through the Climate Investment Funds, with a view to developing an external publication on lessons learned in implementation of climate projects since the inception of the CIFs in 2008. IDB is also benefiting from funding provided under the CIF Evaluation and Learning initiative to conduct two evaluations on: (i) development of adaptive capacity in Bolivia; and (ii) assessment of tools and methods used in project and program design to deliver transformational change.

[37] Based on experience from these operations: BO-L1104, DR-L1050, ES-L1071, GY-L1039, HO-L1070, NI-L1074, PE-L1080, PE-L1108, PE-L1121, PE-L1127, PN-L1070, PN-L1074, and SU-L1022.

process for regulatory frameworks and climate change policies has also been helpful. Operational experience has also shown that reducing vulnerability to natural hazards requires improved governance of disaster risk management and closing the financing gap for emergency assistance, rehabilitation, and reconstruction.

c. **Strengthening capacities.** The sectoral approach to climate change requires strengthening the capacities of the respective ministries and institutions (i.e. it is essential that their staff have climate change expertise, so they can identify opportunities).[38]

2. Accessing and effectively using finance for climate action

4.10 The lessons learned regarding access to and use of finance for climate action are set out below:[39]

a. **Concessional resources enable investment in modern technologies.** Concessional resources and/or technical assistance are key ways to compensate for the uncertainty, increased risk, or higher upfront costs associated with investments in innovative, clean technologies and to include activities that help ensure the resilience of the investments. The IDB's work has recently focused on developing innovative instruments to mobilize private investment at scale. For example, the Bank's experience in Cerro Pabellón, Chile (one of the 70 approved IDBG operations with concessional resources from the Climate Investment Funds) shows that the use of convertible loans or grants may be a promising instrument to address the upfront risk of geothermal exploration.

b. **Technical assistance can also be used to generate and share knowledge that supports development of national strategies, programming, and capacities.** Climate interventions should consider incorporating knowledge development and exchange components focused on: sharing best practice about planning, regulation and policy; promoting replication of new models for financial instruments; identifying and promoting technological and other innovations to address climate change; and accessing multilateral and bilateral funds. The accumulated experience demonstrates the importance of supporting the generation and transmission of knowledge on climate issues, in particular linked to the financial sector, while there is still a lack of information about the risks and returns of many climate investments.

c. **Innovative financing mechanisms are essential to promote climate action.** The IDB Group leverages ample knowledge of development financing, experience structuring transactions, a solid financial rating, public-private approaches, and capacity to convene relevant actors, including commercial investors and governments. As an example of financial innovation, the operation Capital Markets Solution for Energy Efficiency Financing (ME-L1150) unlocks long-term financing from institutional investors by bundling and pooling

[38] Key capacities include: preparing, interpreting, and using climate information; estimating economic, social, and environmental impacts of climate change; identifying possible climate actions; establishing strategies and priorities based on interdisciplinary analysis; knowledge of available sources of finance; and application procedures for access to funds and support for the submission of proposals.

[39] Draws upon CH-L1102, CH-M1053, CO-L1096, CO-L1124, ES-L1050, GU-T1262, ME-L1055, ME-L1121, ME-L1145, and ME-L1150, among others.

small-scale energy efficiency projects. As an external validator, the IDB can play a significant role in recommending innovative approaches.

d. **All relevant stakeholders need to be involved.** Experience from the implementation of Climate Investment Funds has highlighted the importance of effective stakeholder engagement to the successful delivery of programs. Considering a multidimensional approach to guarantee the sustainability of the intervention means linking the efforts of various stakeholders, and a full diagnostic assessment defining the type of mechanism or financial instrument to use, the implementing agencies or institutions, and the selection of beneficiaries. This will ensure that the design of the intervention integrates the participants' needs and interests. Another example is the Latin America Water Funds Partnership,[40] which showed water funds must engage water utilities to mainstream water conservation practices into the utilities' business model.

e. **Despite their complexity, PPPs are an important means of financing sustainable development.** Recent experience with PPPs has highlighted the importance of initiating socialization campaigns early; structuring efficient PPP contracts and tender documents to facilitate the bankability of projects; implementing climate change specifications during the planning process; and reinforcing the organizational discipline that is necessary to achieve public and private goals.

3. Building climate change knowledge and mainstreaming climate change into sectors

4.11 Lessons relating to knowledge and sectors are addressed jointly since their close connection has generated operations that focusing on them simultaneously. The following considerations are important for the design and implementation of knowledge and sector interventions:[41]

a. **The peculiarities of climate change need to be recognized.** Technical cooperation operations involving the generation of new knowledge or the testing of technology can take longer to implement due to: (i) inherent high levels of uncertainty, lack of information, and limited experience with the proposed measure; (ii) legal aspects concerning intellectual property; and (iii) multisector and interagency work. Reaching consensus calls for active dialogue between all project participants.

b. **Upstreaming climate change in the project cycle**. IDB has strengthened capacities for upstreaming climate change through the strategic dialogues with the Governments and annual programming exercises. The CCS division systematically supports the inclusion of climate considerations in the country development challenges diagnostic (CDC) and the IDBG country strategies. The division has also raised awareness about the MDBs climate finance methodology and its application in all operations of the IDBG as a response to the Bahamas Resolution mandate to increase the IDBG climate finance to 30%

[40] Launched in 2011 with The Nature Conservancy, FEMSA Foundation, and the GEF to create and strengthen water funds across the region to implement mechanisms that offer downstream users the incentives to proactively engage in conservation and climate adaptation practices. Based on the lessons learned and opportunities identified in program, the IDB is planning a second phase.

[41] Based on experience from the following operations: BO-G1001, BO-L1104, PE-G10001, PE-T1297, PE-T1340, RG-G1006, RG-T1655, RG-T1657, and RG-T1901.

by 2020. The division systematically supports the identification of opportunities to include climate considerations early in the project cycle (at the ERM level), and thought scanning the pipeline of all bank operations to identify opportunities to ensure resilience or reduce GHG emissions.

c. **Creating knowledge and capacity within the Bank.** With the Knowledge, Innovation and Communication Sector (KIC/KIC) support, CCS has built the capacities of project teams to identify climate change opportunities in projects, identify available climate funds, and apply the climate finance tracking methodology at project level (more than 600 specialists were trained in 2017). Further in-depth workshop and knowledge materials are being prepared on cutting-edge climate change topics such as blue spot analysis, climate risk methodology for urban areas, decision making under deep uncertainty, as well as on-line courses for new employees and a massive open online course on disaster risk analysis for investments in critical infrastructure projects.

d. **Involving stakeholders to ensure the knowledge is applied.** Through internal and external grant funds (SECCI, NDC Pipeline Accelerator Fund, GCF Readiness, CIFs, etc.), the IDB has financed knowledge generation on climate change for the region. Some of the lessons learned from the design and execution of this kind of project include: (i) design the operation taking specific local contexts into consideration; (ii) include a dissemination component to encourage sharing experiences;[42] and (iii) obtain validation by key stakeholders.

e. **Determining the effectiveness of climate actions.** Operations for improving approaches for monitoring and evaluating climate actions are being strengthened. The IDB has financed the development of tools and procedures to determine the effectiveness of climate actions, which results in a better understanding of climate risks and their costs. The use of international climate finance also increases focus on monitoring and evaluation of the activities to determine their effectiveness, contributing to lessons learned and an evidence base for further interventions. Some of the lessons learned include: (i) take local context into account, including socioeconomic and environmental factors; (ii) take the opportunity to train local technicians for monitoring; (iii) an ample time series and appropriate technology are required for results to be reliable (and useful in decision-making processes); and (iv) solid institutional arrangements, reinforced through sustainable financing agreements, can continue capturing, processing, and analyzing information. At the same time, there are limitations to quantifying results from many actions that are key to climate change.

f. **Safeguarding against higher emissions.** The IDB's Environment and Safeguards Compliance Policy commits the Bank to calculate gross emissions from projects that generate significant amounts of GHG emissions. The Bank can bring about technological change or a change in a country's development path by applying guidelines such as those prepared by the Environmental Safeguards Unit (VPS/ESG).

[42] Key lessons learned from the design and implementation of PPCR projects include the importance of translating climate change information into the local language for the target population and using diverse media to reach wider audiences (CIF 2017).

4.12 Additionally, the following factors have been found to be essential for interventions to take a cross-cutting approach:

a. **A comprehensive approach at various levels of government.** Progress on increasing climate resilience and/or reducing GHG emissions requires the participation of national and subnational governments, and the clear participation and guidance of the central government's planning ministries, to ensure coordination with development plans. To improve the outcomes of climate interventions, the coordination of various sector areas needs to be promoted (e.g. agriculture, environment, public works, energy, and finance). It is worth noting that this coordination should be at the level of sector strategies and policies, geared toward formulating a regulatory framework that helps tackle climate change through concrete actions. Implementing policies that establish incentives for climate-resilient low-carbon development, together with programs of low emission technological change and cost-effective adaptation measures is recommended. From operational experience in the region, it is possible to conclude that specific interventions to contribute to climate change mitigation and adaptation need to be executed by each sector and different levels of government, maintaining integrated coordination with other sectors through the framework of a national climate change strategy and action plans at the departmental or municipal level.

b. **Climate change interventions frequently have special considerations that, in some cases, can translate into longer times for project design and execution.** First, interventions implementing novel approaches such as the energy-food-water nexus or cutting-edge technology require extra time for their implementation. This is often linked to technical aspects that have traditionally barely been addressed (such as inter-agency and inter-ministerial coordination, intellectual property issues, establishment or update of legal or financial frameworks). Second, the approval times and eligibility criteria for international funds are different from the IDB's internal processes. Project team leaders wishing to use these resources need to consider the requirements and be ready adapt to different processes and timelines to achieve better coordination with clients.

c. **Early lessons are emerging from the IDB's pilot methodology to assess climate and disaster risk in relevant medium and high-risk projects.** Rooted in the existing Natural Disaster Risk Management Policy (OP-704) and Guidelines,[43] this methodology will strengthen the current screening process, and provide guidance for conducting climate and disaster risk assessments in relevant operations, using both qualitative and quantitative approaches. This approach is being piloted in IDB projects and is expected to be submitted for broader consultation by the end of 2018. A learning by doing approach is being used, which has made it possible to already identify challenges for ensuring that the assessments add value to projects, such as the importance of completing hazard and climate change information with project criticality and project

[43] The guidelines apply to all natural hazards, including the hydro-meteorological hazards –windstorms, floods and droughts– that are associated with both the existing climate variability and the expected change in long-term climate conditions. Of note for risk assessments, climate change is expected to change some countries' disaster risk (their probable losses) by changing the characteristics of the hydro-meteorological hazards.

characteristics and the importance of having qualitative approaches such as mode of failures analysis, in addition to quantitative methods for risk analysis.

E. The IDB's comparative advantages in the region

4.13 The IDB will prioritize climate change actions based on the region's needs and the IDB's comparative advantages as described below.

4.14 **The IDB has a multidisciplinary team engaged in climate action.** The Climate Change Division (CSD/CCS) supports climate change knowledge and financing at the IDB, working with sectors to mainstream climate change considerations, supporting institutions, and assisting member countries with improved access to climate finance. The division continually seeks innovative approaches and opportunities for synergies with IDB Invest to support its engagement with the private sector. CSD/CCS is also well-connected with global experts and participates and contributes to relevant global processes (e.g. various G20 groups) thereby gaining access to cutting-edge global knowledge. Taken together, this approach allows for enhanced coordination and for climate resilience and emissions abatement opportunities to be considered at the earliest stages of interventions.

4.15 **The IDB is the leading MDB for climate finance in LAC and is an important facilitator of access to international climate finance.** The IDB Group mobilizes substantial resources to contribute to both climate change mitigation and adaptation in the region. US$14 billion in climate finance was approved in the 2012-2017 period, among which US$1.5 billion was accessed through external sources (Table B). The IDB has facilitated access to a variety of international climate funds for its member countries, through technical support for the formulation of proposals and the design and execution of projects. The IDB was accredited by the Green Climate Fund in 2015 and signed the Accreditation Master Agreement in 2017.

Table B: Top International Funds Accessed for IDB Group Climate Finance

Fund	Climate Finance Mobilized 2012–2017 (US$ Million) As of December 2017*
Climate Investment Funds (CIF)	486
China Cofinancing Fund for LAC	445
Canadian Climate Fund for the Private Sector in the Americas (C2F)	269
Green Climate Fund (GCF)	257
Global Environment Facility (GEF)	147
Korea Infrastructure Development Co-Financing Facility (KIF)	54
Nordic Development Fund (NDF)	49
DEFRA Cofinancing Account	37
Cofinancing Special Grants	20
Multidonor SECCI Fund	20
European Commission Framework Account	19
Haiti Reconstruction Fund	18
Forest Carbon Partnership Facility	17
Guyana REDD+ Investment Fund	11

Fund	Climate Finance Mobilized 2012–2017 (US$ Million) As of December 2017*
European Commission Amended and Restated Framework Agreement	9.78
Fund of the Petroleum Exporting Countries Organization	9.47
Parallel cofinancing from JICA	6.76
Global Agriculture and Food Security Program Trust Fund (GAFSP)	6.46
Emerging and Sustainable Cities	5.82
Multi-donor Aquafund	5.11
Canada Cooperation Framework	4.33
USAID	4.28
European Commission's LAIF Grant to CC and W&S	3.76
Knowledge Partnership Korea Fund for Technology and Innovation	3.69
NDF - Nordic Development Bank	3.09
Grants Funds by the government of Japan	2.98
Multidonor Disaster Prevention Trust Fund	2.00
Spanish General Cooperation Fund	1.74
Climate Smart Agriculture Fund (CSAF)	1.60
NDC Pipeline Accelerator Multidonor Trust Fund	1.28
Institutional Capacity Strengthening Thematic Fund	1.26
Japan Special Fund	0.97
Spanish Trust Fund for the Entrepreneurship Program	0.90
AgroLAC 2025 Multidonor Trust Fund	0.85
Haiti Technical Assistance Trust Fund	0.77
Swiss Technical Cooperation Fund for Consulting Services and Training Activities	0.75
Public Capacity Building Korea Fund for Economic Development	0.50
Multidonor Regional Integration Fund	0.50
Low Carbon agriculture for avoided deforestation and poverty reduction	0.34
Regional Fund for Agricultural Technology	0.25

Source: CCS.
* Figures correspond to Board approvals, except for the GCF. For the GCF, US$22 million has been approved by the IDB; the remainder has been approved only by the GCF Board.

4.16 **The IDB also has the convening power to disseminate good practices and generate policy dialogue.** The IDB is also able to act as an "honest broker" between national and private sector entities; to share lessons and disseminate good practices between member countries; and to build policy dialogue. The Regional Policy Dialogue serves as a key mechanism to promote knowledge sharing between high-level government officials from LAC and experts in key development areas. The climate change network has been instrumental to foster dialogue and raise awareness among priority sectors and finance ministers on climate change-related issues. Some of the topics covered by the network include: (i) best

practices for climate-resilient coastal development; (ii) existing international financing for climate change initiatives, including national policy for low carbon development; (iii) best practices in the areas of water management, forest resources and energy efficiency; and (iv) urban planning, including housing, transport, and environmental and risk management.

4.17 **Significant participation of the private sector with broad thematic and regional coverage.** The private sector received 35 percent of climate finance provided by or channeled through the IDB Group in 2016 (MDBs 2017). This highlights the sector's capacity and commitment to advancing relevant activities. IDB Invest has experience developing and implementing a wide range of regional and national climate solutions, including sustainable credit lines, capital markets instruments to support the issuance of sustainable bonds, blended finance for mitigation and adaptation projects, guarantees to financial institutions to implement energy efficiency technologies, incentives to carry out climate actions (e.g. through interest rates, grace periods, longer repayment periods), and technical assistance programs to help develop the ability to adapt to climate change (ProAdapt). Tools have also been developed to support decision making, such as regulatory framework quality indexes for private investment (Climatescope) and promotion of good practices (e.g. *Infrascope* and *Envision*).

4.18 **Internationally recognized technical quality.** The quality of IDB-supported climate interventions has been recognized on numerous occasions: the UNFCCC "Momentum for Change" award for the innovative and transformative character of its programs;[44] the "QUALIESCO" award for innovation in energy efficiency projects with guaranteed energy savings;[45] the "Infrastructure 360" award for technical assistance for a concentrated solar energy project;[46] mention—in the technical documents of the UNFCCC's loss and damages working group—for the contingent lines the IDB prepared for Central America as examples for other international organizations to follow;[47] and a mention in the journal *Science*.[48] Additionally, the program to strengthen climate modeling capabilities, jointly led by the IDB and the University of Nebraska,[49] is being replicated in other countries.[50]

V. Goal, Principles, Dimensions of Success, and Lines of Action to Guide the IDB's Operational Activities and Research

A. Goal and principles for the IDB's work in climate change

5.1 The goal for IDB's work in climate change is to promote climate-resilient and low-carbon development in LAC. The following principles will guide the IDB's future work in climate change:

a. **Alignment with sustainable development objectives and country objectives.** The IDB's interventions will be oriented toward poverty reduction

[44] For the ECOCASA (ME-L1121, ME-T1201, and ME-T1202) and EcoMicro (RG-M1205) programs, and the Emerging and Sustainable Cities Initiative.
[45] For a project promoting energy efficiency in commercial buildings (BR-X1018).
[46] For the Cerro Dominador Concentrated Solar Plant project (CH-T1122).
[47] Decision FCCC/SB/2014/4 refers to contingent facility operations (DR-L1045).
[48] Discussed a project to adapt coffee cultivation to climate change (RG-T1655).
[49] RG-T1574, approved in 2008, which lasted for approximately five years.
[50] RG-T2612. Bolivia, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Jamaica, Panama, Peru, Mexico, and Nicaragua have sent climate modelers to the trainings.

and equity enhancement, taking a long-term view consistent with climate-resilient and low-carbon development. Climate finance will be directed toward development interventions that fit within countries' own climate change agendas, as described in the NDCs, LTSs, SDGs, and related national strategies, plans, and legal frameworks.

b. **Upstream incorporation of climate change considerations.** To strategically direct resources toward areas of critical concern for LAC, climate change considerations will be mainstreamed into the institutional strategy, relevant SFDs, and IDB Group country strategies. Climate opportunities and challenges will also be identified early in the project cycle.

c. **Integrated solutions across sectors.** Responding to climate change impacts involves various sectors and levels of government; multisector interventions across VPS divisions and a closer coordination with IDB Invest and MIF will be promoted.

d. **Capacity strengthening.** Bearing in mind that addressing climate issues requires specific technical and institutional knowledge, support will be provided to national and subnational actors to strengthen capacity.

e. **Promotion of public-private coordination.** Recognizing the importance of the private sector in the region and its potential role as a catalyst of change and innovation toward sustainable growth, efforts will be made to optimize private sector participation, independently or in cooperation with the public sector.[51]

f. **Innovation for climate-resilient and low-carbon development.** New technologies, institutional arrangements, financial instruments, and business models need to be promoted. The IDB Group will continuously innovate across sectors to support the transition to climate-resilient and low-carbon economies.

B. Dimensions of success, lines of action, and activities

5.2 While the region has made progress in how it considers climate change, the evidence presented shows it is necessary to consolidate and strengthen this process. During the period that this SFD is in effect, the IDB will prioritize four dimensions of success (framed as the desired outcomes): (i) countries have institutions and markets that are supporting objectives and commitments toward climate-resilient and low-carbon development; (ii) countries improve their access to climate finance and effectiveness of its use; (iii) countries apply tailored knowledge to effectively support a just transition toward a climate-resilient and low-carbon economy; and (iv) countries make progress on mainstreaming climate considerations across sectors. These dimensions were identified taking into consideration the region's needs (discussed in Part III) and the IDB's comparative advantages, and updated to reflect new global commitments, particularly the Paris Agreement. These dimensions of success are supported through lines of action as presented below. This organization is for presentation purposes and it should be noted that actions in one dimension often contribute to the other dimensions, given the complementarity between them.

[51] The newly established Public-Private Partnerships (PPP) coordination mechanism supports IDB Group Country Representatives on all PPP technical assistance and related requests received from borrowing member countries.

1. Dimension of Success 1: Countries have institutions and markets that are supporting objectives and commitments, including those set out within the Paris Agreement, toward climate-resilient and low-carbon development

5.3 Supporting country capacity to implement their objectives and commitments under the Paris Agreement will be essential to its success. The IDB is well positioned to assist countries in mainstreaming climate change considerations into their operations. The NDC Invest platform emphasizes working hand in hand with these ministries across the full spectrum of their mandates, from identifying climate finance needs to setting standards and best practices. The IDB also coordinates with other donors as a member of the NDC Partnership. The following lines of action are proposed in order to achieve the objective of this dimension of success:

5.4 **Line of Action 1.** Help countries design, strengthen, and implement their NDCs and LTSs. The following activities are proposed toward implementing this line of action:

5.5 **Activities:**

a. Support efforts to strengthen existing legal, regulatory, and institutional framework geared toward promoting the formulation and execution of plans, strategies, actions, and funding for climate-resilient and low-carbon development.

b. Assess progress to guide post-2020 climate change goals for the IDB Group. The current 30 percent climate finance goal and the associated Climate Change Action Plan set out IDB Group actions leading to 2020. The role of MDBs will continue to be important beyond 2020 to assist countries with long-term decarbonization pathways.

c. Strengthen lead agencies' and multisector commissions' on climate change access to robust and transparent evidence and enhance planning, prioritization, coordination, policy, and dialogue activities. This includes supporting the identification, design and communication of feasible investment portfolios to implement those targets.

d. Assist countries to strengthen the systems and mechanisms to carry out transparent monitoring, reporting, and verification of actions according to their national objectives, commitments, and and priorities.[52]

e. Strengthen the technical capabilities of the main stakeholders at both the national and subnational levels and the public and private sectors to incorporate climate change in development actions and investments.

5.6 **Line of Action 2.** Promote a multisector approach to tackling climate change. The following activities are proposed toward implementing this line of action:

[52] Paris Agreement Article 4,13: Parties shall account for their nationally determined contributions. In accounting for anthropogenic emissions and removals corresponding to their nationally determined contributions, Parties shall promote environmental integrity, transparency, accuracy, completeness, comparability and consistency, and ensure the avoidance of double counting, in accordance with guidance adopted by the Conference of the Parties serving as the meeting of the Parties to this Agreement.

5.7 **Activities:**

a. Provide technical assistance to develop financial solutions to overcome barriers to scale up private sector investments for low-carbon, climate-resilient, innovative, and transformational investments.

b. Facilitate dialogue between countries (including beyond the region) and across sectors geared toward sharing experiences on climate change mainstreaming in national and sub-national development.

c. Support the configuration and operation of coordination and interagency dialogue arrangements between the national and subnational levels, and linkages between the public and private sectors, in coordination with IDB Invest, including developing a catalogue of financial instruments in LAC capital markets for sustainable infrastructure investments.

d. Foster dialogue and share experiences between countries to scale up successful projects.

2. Dimension of Success 2: Countries improve their access to finance for climate action and use it effectively

5.8 Existing climate finance is insufficient to meet the region's needs—resources from various sources need to be mobilized. Accelerating, encouraging, and enabling innovation is critical for an effective, long-term global response to climate change and promoting economic growth and sustainable development. The following lines of action are proposed in order to achieve the objective of this dimension of success:

5.9 **Line of Action 1.** Assist countries to leverage concessional resources to finance climate actions. The following activities are proposed toward implementing this line of action:

5.10 **Activities:**

a. Provide technical guidance to help LAC governments and private sector actors navigate the complex climate finance architecture and attract concessional financing to the region from international climate funds.

b. Apply the Development Finance Institutions Principles on Blended Concessional Finance for Private Sector Projects.

c. Design and implement innovative programs and projects that have the potential to be transformational but require concessional climate funds to be viable.

d. Assist with the implementation and reporting requirements of climate funds.

e. Promote development, transfer, testing, and adoption of technologies and innovative approaches for climate actions, though technical assistance and other means, with the understanding that innovation entails risk.

5.11 **Line of Action 2.** Assist countries to mobilize private sector resources to finance climate actions. Support the public and private sectors in the use of innovative financial instruments and mechanisms that take the characteristics of climate investments into account. The following activities are proposed toward implementing this line of action:

5.12 **Activities:**

a. Support countries to make financial flows consistent with climate-resilient and low-carbon development, as called for in the Paris Agreement, by building capacity for developing pipelines of bankable projects.

b. Support policy reforms to overcome market barriers and increase incentives for investments in GHG emissions reduction and climate resilience.

c. Establish incentives for private sector participation in climate action, including setting up Public-Private partnerships and using international resources.

d. Design and execute interventions promoting innovative financing mechanisms, incentives, and instruments for investments in mitigation and adaptation (including identification, design, pilot trials, and implementation to scale).

e. Capacity building for key actors in the financial sector to improve understanding of climate actions, focusing on the need for specific financing mechanisms and education on climate risks and mitigation and adaptation opportunities.

3. Dimension of Success 3: Countries apply tailored knowledge to effectively support a just transition toward a climate-resilient and low-carbon economy

5.13 The availability of and access to climate change knowledge and the capacity to visualize, analyze, interpret, and use that information to take specific action are vital. Tracking the results and understanding the effectiveness—through both qualitative and quantitative means—of climate actions and their impact on broader development and social considerations makes an important contribution to climate change knowledge. The following lines of action are proposed in order to achieve the objective of this dimension of success:

5.14 **Line of Action 1.** Improve the availability and use of climate information and data for robust and transparent decision making. The following activities are proposed toward implementing this line of action:

5.15 **Activities:**

a. Support the collection, analysis, interpretation, and use of climate data in the planning, design, development, monitoring, and evaluation of development projects and programs in the region.

b. Strengthen capacities at the national and subnational levels and in the private sector for the generation, interpretation, and use of climate information.

c. Design analytical tools and methodologies to assist decision makers, including the private sector—within and outside the Bank.

5.16 **Line of Action 2.** Implement approaches aimed at monitoring and evaluating climate actions. The following activities are proposed toward implementing this line of action:

5.17 **Activities:**

a. Strengthen capacities for the development, validation, and implementation of methodologies, tools, and procedures to determine the effectiveness of climate actions in social, economic, and environmental terms.

b. Develop studies, dissemination activities, and training—including policy dialogue—to improve current knowledge about climate risk, challenges and effectiveness of mitigation and adaptation options, climate resilience and adaptive capacity, co-benefits of development associated with climate actions, and the promotion of a just transition toward a climate-resilient and low-carbon economy.

c. Provide technical assistance for the development, validation, and implementation of plans to monitor and evaluate climate actions.

d. Compile, analyze, and disseminate evidence on the results of climate interventions.

4. Dimension of Success 4: Countries make progress on mainstreaming climate considerations across sectors

5.18 It is critical to tackle the challenge of climate change in a comprehensive and multisector way throughout the project cycle, making use of innovative approaches. To assist countries in mainstreaming climate change across sectors, the IDB must also continue efforts to mainstream climate change within the organization. This internal approach was detailed in the Climate Change Action Plan. Sector specific actions are considered in the respective SFDs (Annex, Table A-6 for a summary). The following line of action is proposed in order to achieve the objective of this dimension of success:

5.19 **Line of Action.** Mainstream climate action. The following activities are proposed toward implementing this line of action:

5.20 **Activities:**

a. Assist countries in climate change mainstreaming efforts by providing analytical inputs to all CDCs and country strategies, as well as to the strategic dialogue with governments, in accordance with the current Country Strategy Guidelines (GN-2468-9).

b. Scan the IDB pipeline to flag, as early as possible, opportunities to include climate considerations.

c. Help countries to consider the physical and transitional climate risks of their investments with the IDB by screening all relevant projects for climate risks and characterizing levels of risk for subsequent assessment in line with the IDB's existing Disaster Risk Management Policy and Guidelines (OP-704).

d. Apply the sustainable infrastructure and sustainable landscapes concepts, among others, to foster countries' multi-sector approach to climate change.

e. Support sustainable procurement practices in IDB-funded projects following the voluntary recommendations in the Green Procurement Manual.

f. Improve internal knowledge of the climate finance tracking methodology toward the IDB Group's 30 percent climate finance goal by continuing the implementation of tailor-made trainings, providing advisory service to project teams and issuing sectorial guidelines on the application of the MDB methodology.

5.21 **The dimensions of success and associated lines of action presented above overlap in complex ways.** Considering the demand-driven nature of IDB financing,

the approach taken in this SFD emphasizes the central role of countries to develop and implement national strategies. To achieve the desired outcomes, countries must have institutions in place that can attract and manage diverse financing options to build local knowledge and capacity and support an integrated approach through cross-sector projects.

ANNEX. TABLES AND FIGURES

Table A-1: Sectors Identified in IDB Borrowing Member Country NDCs
Source: IDB staff analysis based on NDCs as of March 2018

Adaptation Sectors	Number of countries including sector in NDC
Agriculture and Food Security	24
Water	22
Health	20
Infrastructure and Urban Development	16
Disaster Risk Management	13
Forests	12
Energy	12
Biodiversity and Ecosystems	11
Tourism	11
Coastal Zones and Marine Resources	8

Mitigation Sectors	Number of countries including sector in NDC
Energy	25
Forests	20
Transportation	20
Waste	16
Agriculture and Livestock	15
Industrial Processes and Products	14

Figure A-1: Circular Economy
Source: (Ellen MacArthur Foundation 2015)

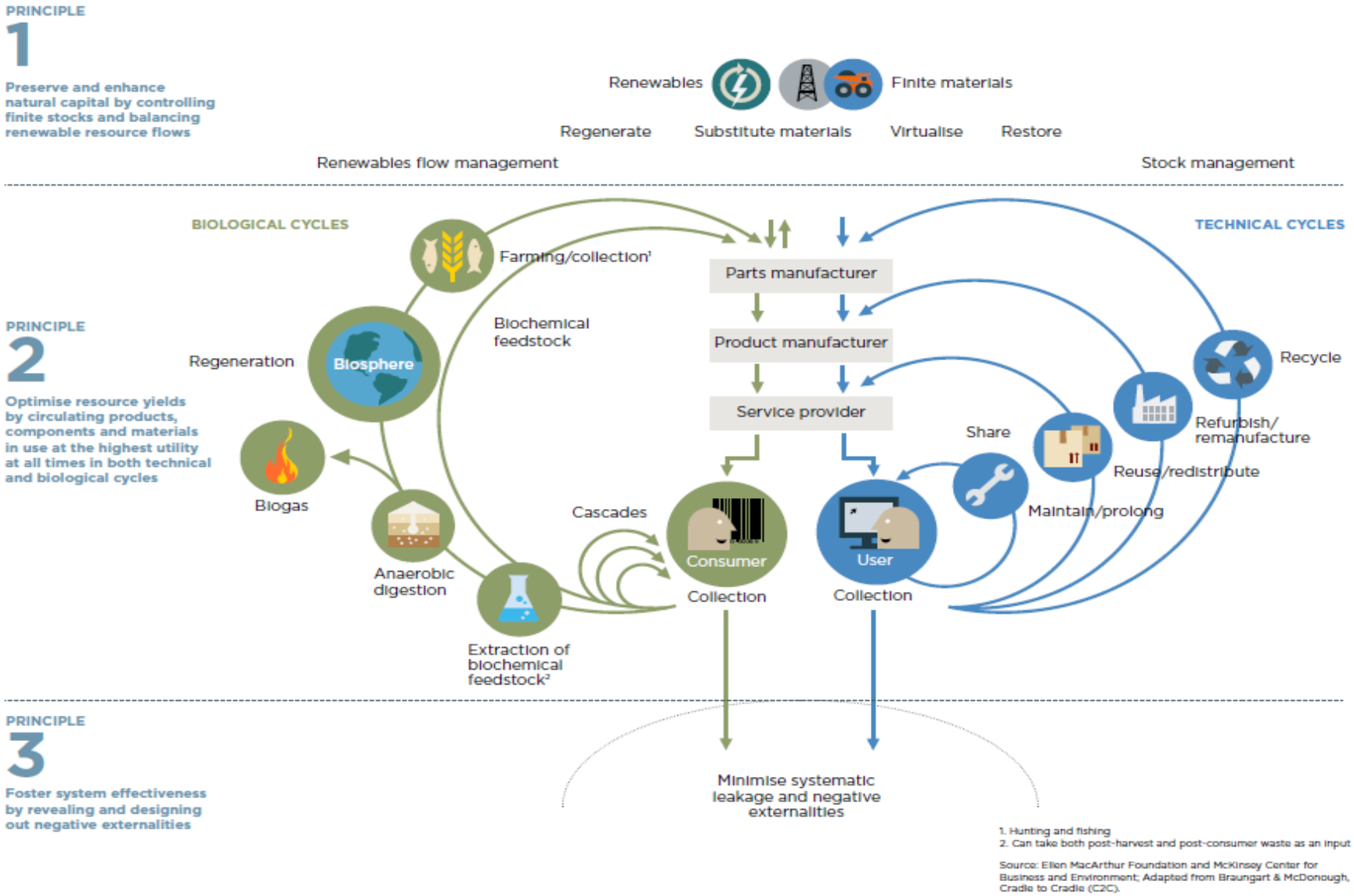


Figure A-2: Global Architecture of Climate Finance
Source: WRI

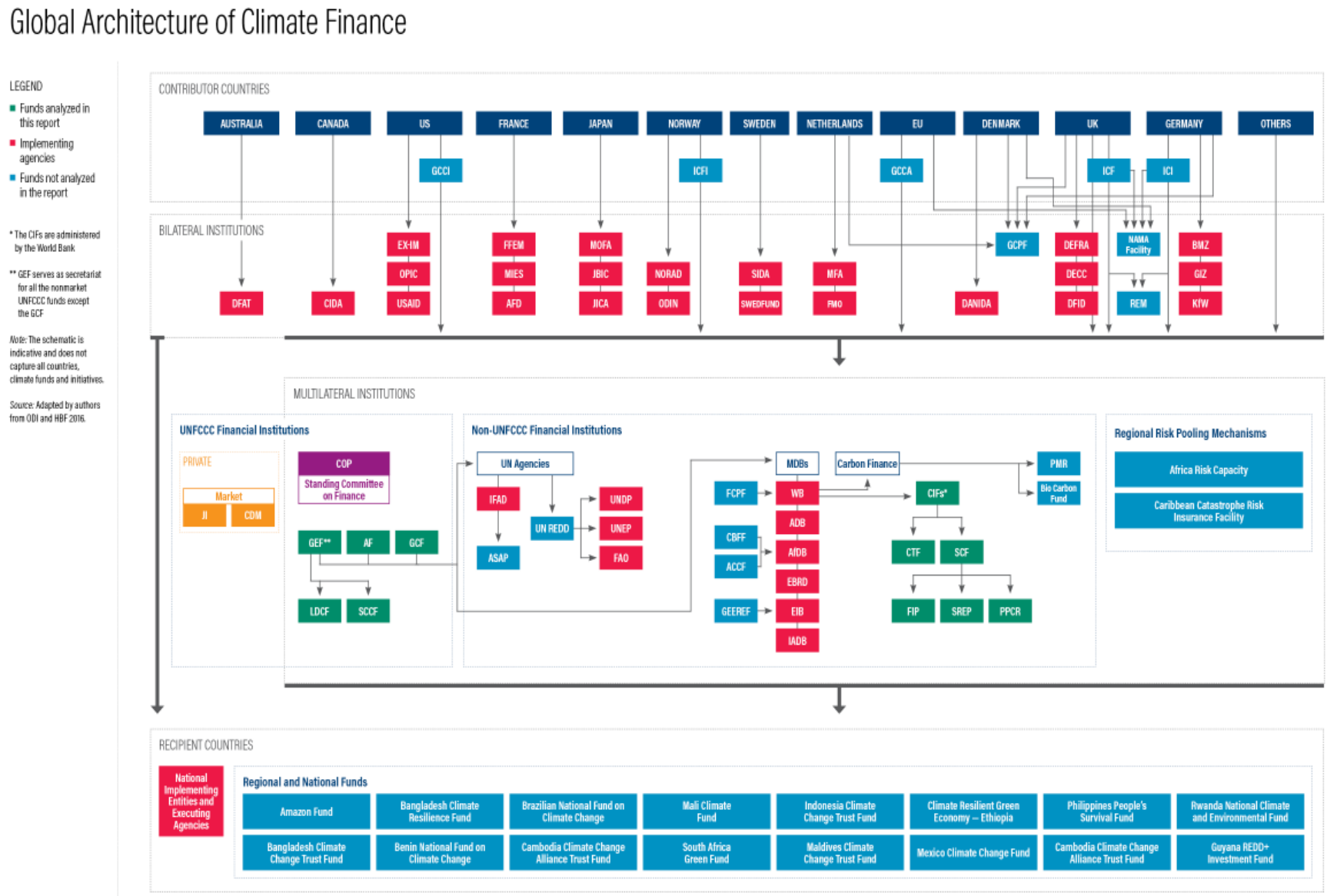


Table A-2: Global Climate Risk Index (CRI) 1997-2016 for IDB Borrowing Member Countries
Source: Germanwatch Global Climate Risk Index 2018 (Eckstein, Künzel and Schäfer 2017)

Country	CRI (Worldwide Ranking)	CRI Score	Fatalities (annual average)	Fatalities per 100,000 inhabitants (annual average)	Losses per unit of GDP (%)
Argentina	87	82.83	27.45	0.070	0.1241
Barbados	156	142.67	0.05	0.018	0.0968
Belize	21	46.67	2.35	0.779	3.1578
Bolivia	25	45.67	42.20	0.450	0.4060
Brazil	90	84.67	148.35	0.079	0.0618
Chile	94	89.67	85	0.056	0.1373
Colombia	49	59.50	107.05	0.245	0.1305
Costa Rica	101	95	96	0.143	0.0940
Dominican Republic	10	34	210.90	2.318	0.2615
Ecuador	55	65.33	41.35	0.292	0.1378
El Salvador	16	38.67	32.45	0.535	0.6965
Guatemala	11	34.33	97.60	0.717	0.4432
Guyana	111	100.17	0.30	0.040	0.8128
Haiti	2	13.50	280.40	2.956	2.7296
Honduras	1	12.17	301.65	4.277	1.9683
Jamaica	54	63.67	4.35	0.162	0.7528
Mexico	47	59.17	142.10	0.130	0.1810
Nicaragua	4	19.33	162.45	2.962	1.1265
Panama	95	89.83	9.65	0.280	0.0750
Paraguay	46	58.33	8.65	0.146	0.7049
Peru	66	70.50	108.20	0.388	0.0690
Suriname	174	167.67	0.15	0.030	0.0017
The Bahamas	17	40.33	2.80	0.849	2.7403
Trinidad and Tobago	167	155.00	0.55	0.042	0.0067
Uruguay	85	79.83	6.60	0.195	0.1593
Venezuela	59	67.17	59.90	0.222	0.1008

Table A-3: Estimated Annual Damages from Key Physical Impacts by 2050
Source: (Vergara, Rios, et al. 2013)

Impact	Region	2005 US$ billions
Loss of net export income: wheat, soya, corn, and rice	LAC	26–44
Sea level rise (1m)	LAC	22
Coral bleaching	Caribbean	8–11
Intensification and increased frequency of extreme weather events	CARICOM	5
Health (increased incidence of diarrhea and malaria)	LAC	1
Amazon jungle die-back	Latin America	4–8
Glacier retreat	Peru	1
Hydropower generation	Brazil	18
Estimated total[53]		***85–110***
Percent LAC GDP		***1.8–2.4%***

[53] Conservative range with significant limitations.

Table A-4: DARA Vulnerability Level Due to Climate Change
[Levels in decreasing order of vulnerability: acute, severe, high, moderate, and low]
Source: (DARA data 2012)

Country	Level of Vulnerability 2010	Level of Vulnerability 2030
Argentina	Low	Low
Bahamas	Severe	Acute
Barbados	Moderate	High
Belize	Acute	Acute
Bolivia	High	Acute
Brazil	Low	Moderate
Chile	Moderate	Moderate
Colombia	Moderate	Moderate
Costa Rica	Moderate	High
Dominican Republic	High	Acute
Ecuador	Moderate	High
El Salvador	Severe	Acute
Guatemala	Moderate	High
Guyana	Severe	Acute
Haiti	Acute	Acute
Honduras	Severe	Acute
Jamaica	Acute	Acute
Mexico	Moderate	High
Nicaragua	Severe	Acute
Panama	Moderate	Severe
Paraguay	Moderate	High
Peru	Moderate	High
Suriname	High	Severe
Trinidad and Tobago	Moderate	Moderate
Uruguay	Moderate	Moderate
Venezuela	Moderate	High

Figure A-3: Summary of Climate Change Effects
Source: (IPCC 2014a)

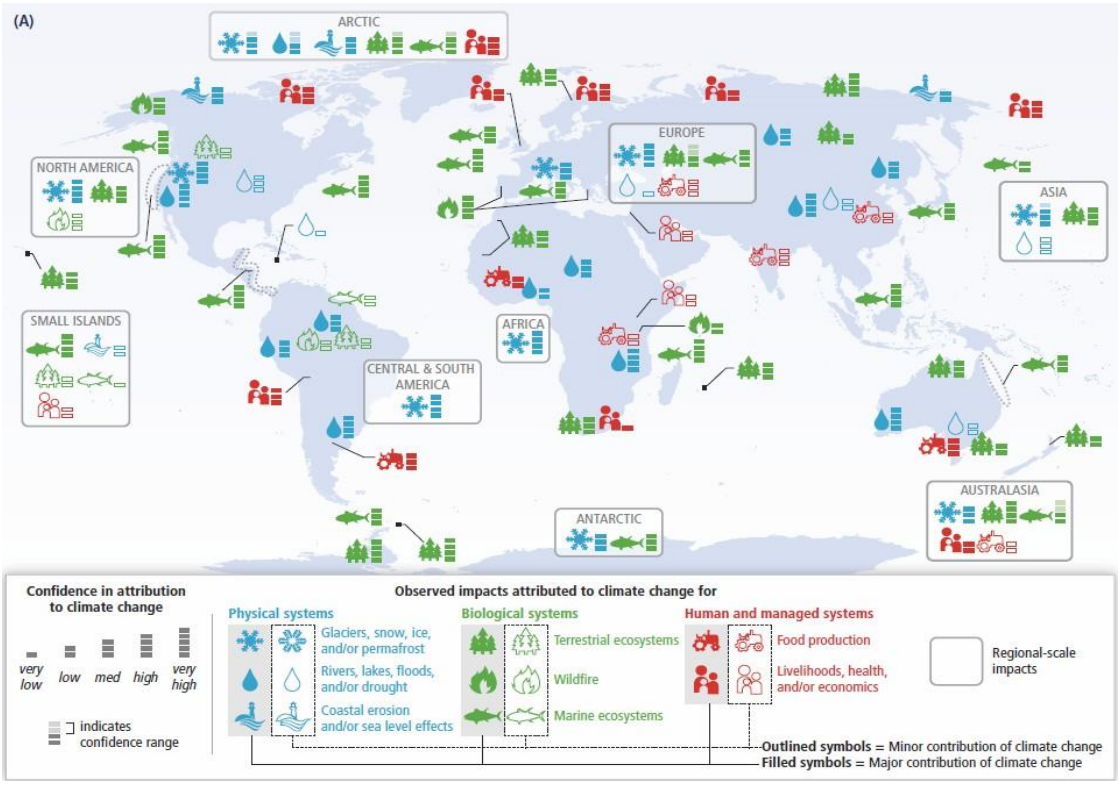


Figure A-4: Summary of Climate Change Effects in Latin American Sub regions
Source: (Magrin, et al. 2014)

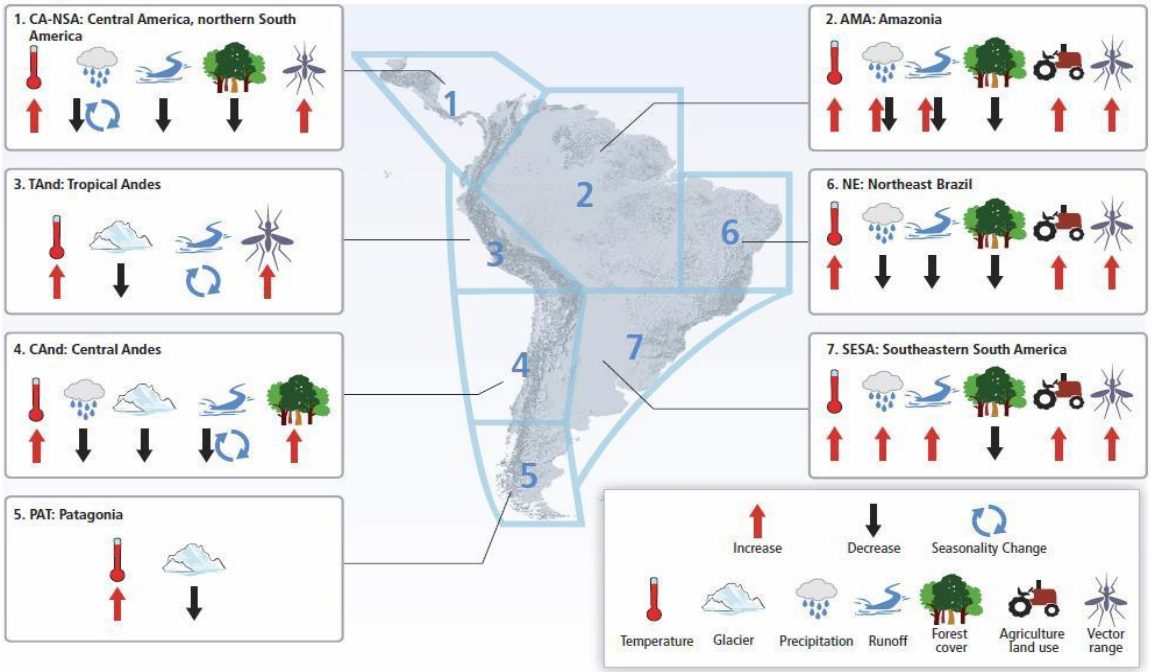


Table A-5: 2017 Climatescope in LAC
Source: (Climatescope 2018)

Country	Global Rank (of 71 developing countries)
Argentina	20
Bahamas	62
Barbados	27
Belize	50
Bolivia	42
Brazil	2
Chile	7
Colombia	26
Costa Rica	18
Dominican Republic	49
Ecuador	43
El Salvador	38
Guatemala	28
Guyana	66
Haiti	52
Honduras	14
Jamaica	46
Mexico	4
Nicaragua	37
Panama	33
Paraguay	70
Peru	25
Suriname	69
Trinidad and Tobago	64
Uruguay	9
Venezuela	68

Table A-6: Climate Change Addressed in the SFDs

SFD (Year approved)	**International Evidence** (Section II)	**Main Challenges** (Section III)	**Principles, Dimensions of Success and Lines of Action** (Section V)
OP-2001 **Agriculture and Natural Resources Management** (2016)	• Access to irrigation raises income and household consumption and provides risk-reduction mechanisms by lessening seasonal variability and vulnerability to climate events. • A variety of environmentally sustainable agricultural practices and technologies (e.g., agroforestry, soil and water conservation, improved pasture management) have the potential to improve production while potentially helping mitigate the impacts of climate change and/or better enabling farmers to adapt to these impacts (McCarthy, 2014). • Farmers face a series of risks that exacerbate the vulnerability of their output, such as the impacts of natural disasters, climate change, price volatility, and diseases and pests, making their income highly volatile. • Market instruments exist for managing the risks of the impact of climate change, natural disasters, and food prices (e.g., price variability).	• Agriculture and natural resources are highly vulnerable to climate change and natural disasters • The incidence of natural disasters in the region has doubled over the last 30 years, with a total of 416 events over the last decade (World Bank, 2013). Latin America and the Caribbean lost crops and livestock worth US$11 billion through natural disasters, the losses corresponding to almost 3% of the projected value of production in the period. • It is likely that the increase in vulnerability to climate change will have adverse effects on agriculture and natural resources such as water resources, and marine/coastal and fishery resources.	• Achieve an agricultural sector with high productivity that manages climate impacts.
OP-2003 **Integration and Trade** (2016)			• Among activities: design of trade and climate change programs
OP-2004 **Urban Development and Housing** (2016)	• The need to foster a sustainable urbanization is reflected in the development of agreements to enhance environmental sustainability. At the international level, these notably include the Paris Agreement, negotiated at the most recent United Nations Climate Change Conference. • The 2016 Toluca Declaration identifies eight key issues for urban and territorial planning: urban governance, adequate housing, water and sanitation, sustainable mobility, land	• Cities account for most households vulnerable to extreme climate events • The high vulnerability of cities in LAC contrasts to their low level of per-capita emissions, which is still well below the level of cities in more developed countries • The population and the infrastructure of the cities in the region are particularly vulnerable to heat, floods,	• Among principles: Consider how interventions act to boost the resilience and minimize the contribution of urban areas to climate change. • Among dimensions and actions: improve the quality, efficiency, resilience to climate change, and environmental and financial sustainability of entities providing urban public services, city

SFD (Year approved)	**International Evidence** (Section II)	**Main Challenges** (Section III)	**Principles, Dimensions of Success and Lines of Action** (Section V)
	management, environment, climate change, and resilience. • The issues of sustainability, resilience, and mitigation in the face of geophysical and climate disasters have given rise to various cooperation networks among cities. • Most municipalities lack the resources needed to finance the cost of implementing adaptation and mitigation strategies. • There are bonds issued by private investors willing to finance climate change adaptation in urban areas, such as the Institutional Investors Group on Climate Change (IIGCC) (OECD, 2012). • Urban parks help to reduce the use of private vehicles as a part of strategies to combat climate change.	droughts, and extreme climate events such as earthquakes, storms, and tsunamis. • The rise in average temperatures puts water sources at risk, particularly in Central American and Andean cities. • Cities in the region are also highly vulnerable to natural disasters, which take a very high human and economic toll. • Addressing environmental vulnerability and enhancing the sustainability of cities require coordinated efforts by the various levels of government and sectors of society. • The high rate of urbanization and primacy in LAC can be an opportunity for encouraging a more sustainable growth • Increasing numbers of cities in LAC participate in activities aimed at mitigating the carbon footprint and improving the capacity to adapt to climate change. • The households most vulnerable to climate change are those located in areas with poor infrastructure, as well as low-income households, female-headed households, senior-headed households, and households with a disabled member. In most cities in LAC, these households are largely concentrated in informal housing developments. • Despite evidence of LAC's vulnerability, adaptation and mitigation actions are not yet	residents have access to quality urban infrastructure and public services, which helps to reduce their vulnerability to climate-related and geophysical risks and support environmental stewardship.

SFD (Year approved)	**International Evidence** (Section II)	**Main Challenges** (Section III)	**Principles, Dimensions of Success and Lines of Action** (Section V)
		predominant in the region's agenda, often due to the assumption that support for sustainability comes at the expense of investment in social equity. • A large percentage of cities in the region are vulnerable to rising sea levels, and more than 26 million inhabitants of Latin America live less than 5 kilometers from the coastline. In the Caribbean, approximately 70% of the population resides in flood zones.	
OP-2005 **Health and Nutrition** (2016)	• Hospital buildings have a substantial carbon footprint • Climate change is expected to increase the frequency and magnitude of extreme meteorological events, and this could create risks for health infrastructure. • Patterns of climate change are expected to increase the risks of malnutrition, vector-borne diseases, malaria, caloric stress, and other pathologies.		• Among activities: investment to improve physical and technological infrastructure at all levels of care, and to comply with modern standards of energy efficiency and climate change resilience.
OP-2007 **Transportation** (2016)	• The role of infrastructure with respect to climate change mitigation and adaptation should be considered to secure the sustainability and potential benefits of infrastructure. • Risk management, and the associated development of infrastructure based on resilience standards, can reduce the vulnerability of infrastructure to natural disasters. • Proactive climate change adaptation measures result in lower fiscal costs and higher levels of connectivity	• There is growing attention in the region to measures that help improve climate resilience • Although many countries in the region have publicized their intentions to reduce sector emissions and have presented specific strategies to meet these commitments, adaptation measures have been scant. • Adaptation is relevant to the design of hydraulic and drainage infrastructure that makes allowance for hydrological projections. Changes in the intensity	• Transportation interventions will be compatible with climate-resilient development and low greenhouse gas emissions, with a view to maintaining world temperature increases below 2°C compared to preindustrial levels (as established in the Paris Agreement). • The Bank will promote the inclusion of climate change adaptation criteria in the design, construction, and management of transportation infrastructure. • Among the dimensions of success: the region is making progress in the

SFD (Year approved)	**International Evidence** (Section II)	**Main Challenges** (Section III)	**Principles, Dimensions of Success and Lines of Action** (Section V)
	• The incorporation of Disaster Risk Management (DRM) from the planning stage onward is highly profitable and has the advantage of safeguarding food security and other social objectives of transportation • Reducing the vulnerability of infrastructure to hydroclimatic anomalies is of special importance for lower-income groups. • Urban transportation can help to mitigate climate change given the potential reduction in fuel consumption and the promotion of nonmotorized transportation. • Worldwide, initiatives have been under development to create smart, sustainable, digital cities with respect to various dimensions, including low-carbon urban transportation • The use of new, more efficient (clean) technologies in vehicles heightens the benefits of sustainable transportation in cities.	and frequency of precipitation are a critical factor for the design of sustainable infrastructure that is resilient to the impact of climate change. The need to expand adaptation criteria for the construction and upgrading of infrastructure extends to port facilities on coasts and close to water courses • Scenarios involving hydrological and climatic anomalies underline the need to make allowances for climate change not only in road design and in the management of catchment basins for transportation projects, but also in the design and protection of transportation infrastructure in coastal areas, islands, and low-lying regions. • New infrastructure can encourage new types of land use that were not part of the original intent and result in deforestation and carbon emissions	development of accessible, efficient, and safe urban transportation systems, and is also promoting mitigation and adaptation measures as a strategy for sustainability
OP-2008 **Support to SMEs and Financial Access/Supervision** (2017)	• Financing can be crucial in addressing liquidity constraints and credit risks or in implementing mitigation actions in the event of infrastructure failures (such as power outages) or adverse climate conditions (such as droughts or floods).		
OP-2010 **Tourism** (2017)	• Tourism can contribute to environmental protection and enhance resilience to climate change. • Models suggest that the main consequences of climate change for tourism are a loss of destination attractiveness (Caldecott, et al. 2016). • High latitudes and mountain regions will experience more favorable conditions for	• There is a need to strengthen environmental management and climate change adaptation efforts in tourism destinations. • Destinations in the region exhibit weak environmental management and low levels of adaptation to climate change.	• Among the dimensions of success: support a model of tourism in which natural and cultural heritage resources are exploited in a sustainable manner and in which destinations strengthen their resilience to climate change and the risk of natural disasters.

SFD (Year approved)	**International Evidence** (Section II)	**Main Challenges** (Section III)	**Principles, Dimensions of Success and Lines of Action** (Section V)
	tourism in the spring, summer, and fall seasons, while conditions in subtropical and tropical destinations will deteriorate (Scott et al. 2012a). • Empirical evidence suggests that investments to reduce the risk of natural disasters (from weather as well as other types of events) yield returns and are effective in ensuring the sustainability of benefits from tourism. • The contribution of tourism to world climate change was estimated at between 5.2% and 12.5% in 2005 • Tourism-related emissions will continue to grow in absolute terms even if emissions from car journeys and accommodation fall to zero. This is a result of the growth in air travel (which is expected to continue) and obstacles to substituting biofuels for fossil fuels • Public policies are including support for low-carbon modes of transportation and shifts toward renewable energy sources. • A growing number of destinations are focusing their efforts on becoming carbon-neutral destinations. • In most countries, the preparation of specific policies and plans to support tourism sector management of climate change-related risks is still in its infancy.	• Tourism is currently considered one of the economic sectors that is least prepared for the risks of climate change. • Climate change makes 30% of the resorts at risk of flooding, while around 60% would be damaged by erosion due to a lack of adequate coastal protection and management	
OP-2011 **Social Protection and Poverty** (2017)	• Social safety net for adverse events due to climate change—reduce absenteeism caused by adverse events and increase coverage and funding.		
OP-2012 **Water and Sanitation** (2017)	• Several of the goals of the Paris Agreement are related to the WSA sector. • The long-term planning of services should consider climate change risks.	• Exacerbating the existing problem and leading to other challenges, climate change demands greater coordination between institutions,	• Promoting multisector interventions, deepening articulation with other sectors (health, disaster risk management, climate change, urban development,

SFD (Year approved)	**International Evidence** (Section II)	**Main Challenges** (Section III)	**Principles, Dimensions of Success and Lines of Action** (Section V)
	• The sustainable use of groundwater is crucial for the capacity to adapt to droughts and climate change. • Climate change adaptation plans, and climate action plans are key planning instruments for the WSA sector • Climate funds can be used to finance operations in the WSA sector with climate benefit • The definition of water security includes considering climate change related risks, including impacts such as floods and droughts • In general, climate change has been evidenced in several ways, such as in the acceleration of the detriment of Andean glaciers, the rise of the sea level in coastal zones, variations in occurrence, intensity and localization of rainfall, as well as temperature increase. Understanding the effects of these impacts in the availability of the water resources is extremely important to ensure not only the sustainability and continuity of the potable water distribution services, but also to guarantee that the related infrastructure projects meet their operational, financial and economic goals.	better knowledge of availability and quality of resources, planning of infrastructure, considering future changes in availability of the resource, innovation in the technological, finance and management fields, better mechanisms of preservation and management of the resource, better knowledge of the impacts of climate change on water resources and ecosystems producers of water and more contact with users. • Climate impact is manifested particularly in some regions and countries, and it generates serious variations and instability in the supply and availability of water for current and future consumption, aside from causing serious damage to the infrastructure. In high-Andean ecosystems, the potential impact of climate change on water resource availability and quality (for example loss of tropical glaciers and degradation of high-Andean wetlands are important.	agriculture, education, energy, etc.), seeking greater social and economic impact. • Dimension of success: The programs and services that are promoted take into account climate change and risks of natural disasters considerations and promote water security.
OP-2013 **Innovation, Science and Technology** (2017)	• LAC countries to lead the development and adoption of low-carbon and climate resilient technologies. • Increase in the investment for innovation and science in green technologies and climate change mitigation and adaptation technologies. • Understanding and mitigating the effects of climate change for the whole LAC region, in		

SFD (Year approved)	**International Evidence** (Section II)	**Main Challenges** (Section III)	**Principles, Dimensions of Success and Lines of Action** (Section V)
	which case research acquires the form of a regional public good.		
OP-2014 **Gender and Diversity** (2017)	• Most rural indigenous and Afro-descendant communities are located in areas of high biodiversity that are disproportionately affected by climate change. Given the strong degree to which the members of these communities depend on natural assets for their subsistence and cultural survival, climate change and the reduction in biodiversity are a threat to their existence. • Various climate funds have the potential to include indigenous territories in their management, meaning that land regularization processes are of fundamental importance.		• Build the capacity of men and women to contribute to climate change adaptation and mitigation through the transfer of knowledge and technology. • Build the capacity of indigenous peoples to adapt to climate change and finance climate change adaptations at the community level.
OP-2015 **Decentralization and Subnational Governments** (2018)			• Promote inclusion of the dimensions of gender, diversity, and climate change.
OP-2016 **Environment and Biodiversity** (2016)	• Countries of all income levels can build long-term economic growth models while reducing the risks of climate change and environmental degradation.	• The retreat of Andean glaciers and the drying up of wetlands and heathlands due to climate change are substantially altering stream flow patterns, posing a threat to water supply and power generation.	• The environment and biodiversity do not acknowledge borders and take the form of biological corridors, cross-border rivers, and transnational regional ecosystems, both land and marine, requiring joint and integrated action among countries as well as global action, as in the case of climate change. • Urban environmental management, promoting development of urban greenspace and ecosystems, air decontamination in all its forms, and reduction of disaster risks and climate threats.

SFD (Year approved)	**International Evidence** (Section II)	**Main Challenges** (Section III)	**Principles, Dimensions of Success and Lines of Action** (Section V)
			• Implementation of integrated disaster risk management measures, incorporating priority risk identification and reduction and climate change adaptation actions. • Undertake studies on climate change resilience in the context of the integrated management of coastal areas and their ecosystems, focusing on the development of policy instruments, impact assessment models, and monitoring systems.
OP-2017 **Food Security** (2018)	• Food availability could be seriously affected by natural disasters and climate change. In Latin America, maize, wheat, soy, and rice export earnings are forecast to suffer significant losses. • Regarding livestock productivity, climate change is projected to affect the quantity and quality of fodder as well as the fertility of dairy cattle and the animals' energy for productive activities; negative effects are expected with the rise in temperatures. • Climate change favors the proliferation of certain pests, the emergence or reemergence of infectious diseases, and alterations in the geographic locations in which they appear and threatens food availability. • The vulnerability of food security to the impacts of climate change on fish resources is particularly high in developing countries that rely on these resources both in economic terms and as a source of protein • Risk reduction and adaptation measures can make agricultural production less vulnerable to climate events. Such measures include irrigation, adoption of agroforestry crops, use of improved varieties, and agricultural insurance.	• In general, the region's main challenges are to: (i) strengthen and maintain an adequate supply of food, reducing the vulnerability of food systems in the face of climate change and natural disasters	• Modernize country agricultural innovation systems by strengthening technology generation and promotion to help small producers adapt to climate change, employing a food systems approach. • Implement cost-effective mechanisms to stimulate the adoption of technological innovations that are profitable, environmentally appropriate, and contribute to climate change adaption among producers, with a particular focus on vulnerable groups such as women and indigenous. • Foster climate-smart agriculture and actions to make food systems less vulnerable to natural disasters.

SFD (Year approved)	**International Evidence** (Section II)	**Main Challenges** (Section III)	**Principles, Dimensions of Success and Lines of Action** (Section V)
	• Regarding the adoption of improved technologies for climate change adaptation, such as improved seed varieties or livestock breeds, the empirical evidence confirms positive effects on yields, income, and nutrition • Climate change and natural disasters can reduce food access. However, direct food distribution, food voucher, and/or cash transfer programs and climate insurance can counteract the lack of food in the event of natural disasters and soften consumption. • Climate change and natural disasters are significant causes of food instability since they create uncertainty in food production, access, and utilization. There is a tendency to reduce the nutritional quality of children's diets in response to climate shocks.		
OP-2019 **Energy** (2018)	• Energy Sustainability (energy efficiency, renewable energy, and climate change adaptation) is one of the central pillars of the energy SFD.	• Energy Sustainability (energy efficiency, renewable energy, and climate change adaptation) is one of the central pillars of the energy SFD.	• Encourage clean, high quality, and modern cooking facilities adapted to local conditions, with awareness raising, training, and monitoring on use of new technologies. • Upgrade backbone and regional transmission infrastructure capacity when operating over rated capacity and to allow new power generation capacity from variable RE sources. • Improve the resilience and adaptability of the infrastructure to natural phenomena and adverse effects of climate change. • Promote EE in providing access. • Utilize advanced systems such as satellite data to assess the availability of renewable resources, including solar, wind, small hydro, and geothermal, and

SFD (Year approved)	**International Evidence** (Section II)	**Main Challenges** (Section III)	**Principles, Dimensions of Success and Lines of Action** (Section V)
			preparation of master plans, schedules and investment programs. • Devote efforts to promoting learning-by-doing by supporting, for example, large-scale pilots and commercial demonstrations of grid-integrated battery storage. • Evaluate energy conservation and efficiency potential, along with demand-side management. • Promote efficient and sustainable power generation. • Analyze technical and economic viability of substituting conventional generation with renewable sources. • Analyze the impacts of electric transportation on the grids. • Develop the institutional capacity to manage and coordinate public agencies and private actors involved in investment in RE and EE. • Review subsidies to ensure that when these are used, the sources and beneficiaries are identified, progressively phasing out generalized and fossil-fuel subsidies.

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