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World Bank Group A ROADMAP FOR CLIMATE ACTION IN LATIN AMERICA AND THE CARIBBEAN 2021-2025 Technical Background Report



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1. A Resilient, Low Carbon Transition for Recovery and Growth

1.1. Building Resilience to Climate Change in LAC: The Urgent Need for Action

Climate change–related disasters are already having major economic impacts across Latin America and the Caribbean (LAC) and intensifying poverty. Several countries are experiencing deep, long droughts, increasingly intense storms, and floods that disrupt economic activities and affect livelihoods, with particular impacts on the most vulnerable populations. By 2030, climate change could push an estimated 2.4–5.8 million people in the region into extreme poverty, with Brazil and Central American countries most vulnerable in per capita terms (figure 1).¹ On average, climate-related disasters have cost Latin America the equivalent of 1.7 percent of gross domestic product (GDP) per year over the last two decades.² The most recent assessments of the physical science by the Intergovernmental Panel on Climate Change (IPCC) finds that the world will probably reach or exceed 1.5°C of warming within the next two decades, with no region left untouched by the impacts of climate change.^{3,4} Food and nutrition security could be severely affected, with projected reductions in the yields of most crops in most LAC countries. By 2050, without concrete climate and development action, over 17 million people in LAC (some 2.6 percent of the population) could be forced to move within their own countries to escape slow-onset impacts such as reduced and irregular rainfall.⁵ That, in turn, will swell migration to cities, potentially increasing urban growth by up to 10 percent,⁶ affecting in particular the poorest neighborhoods most exposed to increasingly frequent and severe floods and landslides as a result of the changing climate.

The impacts of a rapidly changing climate are continuing to build. Globally, the past six years have been the six warmest on record,⁷ and 2020 was the second warmest year for South America and one of the three warmest years on record for Mexico/Central America and the Caribbean.⁸ Some losses are already irreversible, such as the first species extinctions driven by climate change, and others are approaching irreversibility, such as the hydrological changes resulting from the retreat of glaciers. A tipping point from forest to savannah-like vegetation is approaching in the Amazon basin driven by a combination of climate change and deforestation, and could be triggered if the loss of forest area reaches 20–25 percent, a relatively small step from the 17 percent already lost to date. Other systems already approaching critical thresholds under current warming levels include coral reefs in Central America, as well as ocean and coastal ecosystems in virtually all subregions.⁹

The rapidly changing climate is increasing the frequency and intensity of extreme weather-related events. Brazil's Pantanal wetland region experienced a catastrophic fire season in 2020, with more than

1 Jafino et al. 2020. Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030— World Bank Policy Research Working Paper #9417.

2 According to Germanwatch, out of the top 20 countries with the most climate-related losses as a percentage of GDP are in Latin America.

3 IPCC, 2021. Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis.

4 IPCC, 2022.: Summary for Policymakers. In: Climate Change 2022: 6th Assessment Report: Impacts, Adaptation and Vulnerability.

5 Clement, Viviane, Kanta Kumari Rigaud, Alex de Sherbinin, Bryan Jones, Susana Adamo, Jacob Schewe, Nian Sadiq, and Elham Shabahat. 2021. "Groundswell Part 2: Acting on Internal Climate Migration." Washington, DC: World Bank, September 2021. <http://hdl.handle.net/10986/36248>.

6 Compared to the base case estimated in World Urbanization Prospects, UN 2019.

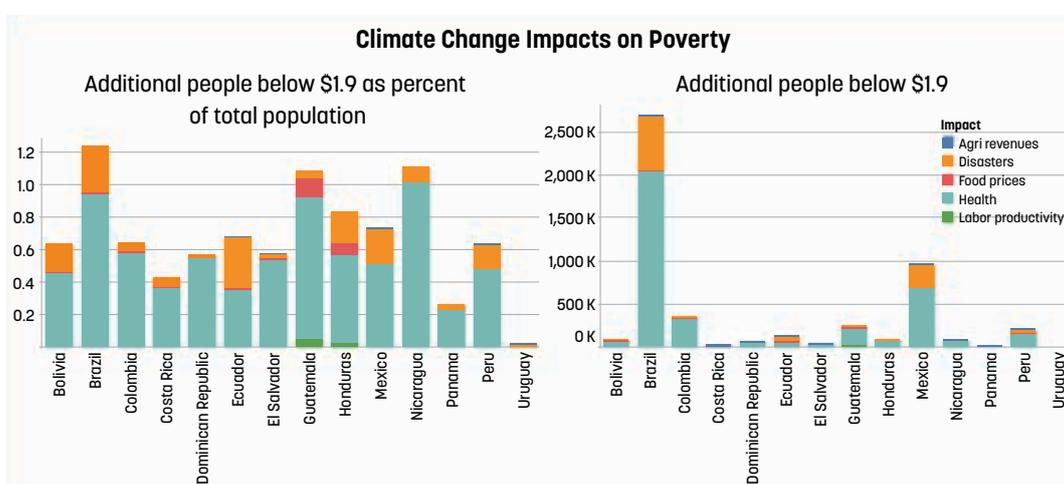
7 State of the Global Climate 2020. World Meteorological Organization.

8 State of the Climate in Latin America and the Caribbean 2020. World Meteorological Organization.

9 IPCC, 2022, Summary for Policymakers. In: Climate Change 2022: 6th Assessment Report: Impacts, Adaptation and Vulnerability.

26 percent of its area burned, which is four times more than the long-term average observed between 2001 and 2019.¹⁰ In 2020, the Atlantic basin cyclone season registered a total of 30 storms, beating the previous record of 28 storms in 2005.¹¹ Eta and Iota, two category 4 hurricanes, affected more than 8 million people in Central America, causing tens of billions of dollars in damage to homes, infrastructure, and livelihoods, overlapping with the health and economic crises imposed by the COVID-19 pandemic. Guatemala, Honduras, and Nicaragua were the worst affected, with damage to 11 million hectares of crops and disruptions to the agricultural livelihoods of people living in Indigenous territories.¹² In Honduras, annual average losses due to climate-related shocks are estimated at 2.3 percent of GDP. Extreme precipitation events, which result in floods and landslides, are projected to intensify in magnitude and frequency due to climate change, with a 1.5°C increase in mean global temperature projected to result in an increase of 100–200 percent in the population affected by floods in Colombia, Brazil, and Argentina; 300 percent in Ecuador; and 400 percent in Peru.¹³

FIGURE 1: Climate Change Could Increase Poverty in LAC



Source: Jafino et al. 2020. "Revised Estimates of the impact of Climate Change on Extreme Poverty by 2030." September 2020. Available at: <https://documents1.worldbank.org/curated/en/706751601388457990/pdf/Revised-Estimates-of-the-Impact-of-Climate-Change-on-Extreme-Poverty-by-2030.pdf>.

Note: People falling into extreme poverty by 2030 due to climate change impacts, in percent of countries' population (left) and in number of people (right). In common with other regions, impacts on health and natural disasters are identified as the principal factors.

Extreme weather events affect critical sectors such as power and transport, and the poor experience the greatest losses. Weather-related damage to infrastructure disrupts service, generating economic and financial losses across supply chains, especially in the Caribbean and Central America. In rankings of the impacts of extreme weather events from 2000 to 2019, five Caribbean nations figure among the top 20 globally in terms of fatalities per capita, and eight for losses as a percentage of GDP.¹⁴ On average in LAC, 56 percent of losses to firms after climate shocks are due to transport disruptions.¹⁵ Brazilian firms lose an average of US\$22 billion per year (1.27 percent of GDP) due to infrastructure

¹⁰ NASA, Earth Observatory. 2021. Fires raged in the Amazon again in 2020, <https://earthobservatory.nasa.gov/images/147946/fires-raged-in-the-amazon-again-in-2020>.

¹¹ In 2020, the Atlantic basin cyclone season registered a total of 30 storms, beating the previous record of 28 storms in 2005.

¹² In the livestock sector, more than 190,000 head of cattle, pigs, and poultry were lost, as well as critical assets such as infrastructure and agricultural equipment.

¹³ IPCC 6th Assessment Report: Impacts, Adaptation and Vulnerability. October, 2021.

¹⁴ Germanwatch Global Climate Risk Index 2021, based on data from MunichRE NatCatSERVICE.

¹⁵ The World Bank. 2019. "From A Rocky Road to Smooth Sailing: Building Transport Resilience to Natural Disasters." <https://openknowledge.worldbank.org/handle/10986/31913>.

disruptions, the majority in transport and power linked to extreme climate flooding events.¹⁶ Vulnerable communities in LAC are disproportionately affected by climate shocks, with the bottom 40 percent of the population suffering income losses that are twice as large as the regional average.¹⁷

In addition to extreme events, slow-onset effects of climate change are impacting many sectors, in particular agriculture. Climate change will affect agricultural yields and jeopardize food security and nutrition across the region, especially in Northeast Brazil, the Andean zone, and Central America. Climate-related reductions in the yields of wheat, soybean, maize, and rice could also have significant negative economic impacts. Severe drought affected many parts of the South American interior in 2020, with the worst affected areas being northern Argentina, Paraguay, and the western border areas of Brazil. The Bolivian Chaco and Pantanal regions suffered the most severe droughts in the past 60 years in 2020.¹⁸ Brazil experienced agricultural losses estimated at nearly US\$3 billion, and there were additional losses in Argentina, Uruguay, and Paraguay. In Argentina, droughts could lead to soybean yield losses of up to 50 percent by 2050.¹⁹ Extreme droughts across the Amazon are projected to spur rural migration to cities, impacting Indigenous peoples and traditional communities.²⁰

Slow-onset climate change impacts are affecting growth and employment in multiple sectors. Waterway transport and hydropower are already being affected by changes in water availability in the region. By July 2021, the still ongoing drought caused the Paraguay and Parana Rivers to shrink to their lowest levels in one-half a century, hampering shipping and water security in five Argentinean cities. At the same time that water availability constrains the supply of hydropower, rising temperatures and the growing use of air-conditioning are putting additional pressure on power systems. In the Caribbean, the tourism sector is vulnerable not only to more frequent extreme events, but also to coastal flooding due to sea level rise. Climate change can also result in job and income loss through heat-related conditions such as heat stress, resulting in lower labor productivity, particularly for subsistence farmers, rural workers, and construction workers.²¹ At the same time, climate policies domestically and in export markets in support of the transition to a net-zero carbon economy will result in job losses in carbon-intensive economic activities, including those associated with deforestation.²²

The 160 million people in the region who lack access to safely managed water supplies and the 350 million without access to safe sanitation are particularly vulnerable to health impacts from climate change. This includes the consequences of water scarcity due to droughts and a rise in prevalence of some diseases. In recent years, major cities such as São Paulo have suffered water shortages, raising the specter of a future where water rationing becomes the norm. There is an urgent need to integrate climate and development strategies to support resilient growth, including access to clean water and sanitation to protect the health of low-income households, who will be the most vulnerable to increases in the prevalence of vector-borne disease because of climate change.

16 Hallegatte et al. 2019. *Lifelines: The Resilient Infrastructure Opportunity*. Sustainable Infrastructure. Washington, DC: World Bank.

17 Jafino et al. 2020. *Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030*—World Bank Policy Research Working Paper #9417.

18 Marengo, J. A. et al. 2021. Extreme drought in the Brazilian Pantanal in 2019–2020: characterization, causes, and impacts. *Frontiers in Water*, 3: 639204, <https://doi.org/10.3389/frwa.2021.639204>.

19 World Bank. 2021. *Poverty and Macro-Economic Impacts of Climate Shocks—Argentina*.

20 IPCC's Sixth Assessment Report, *Working Group II's contribution*.

21 Burke, Marshall, Solomon M. Hsiang, and Edward Miguel. 2015. "Global Non-Linear Effect of Temperature on Economic Production." *Nature* 527:235-9; World Bank. 2021. "Latin America and the Caribbean Climate Change Action Plan: Technical Background Report." World Bank, Washington, DC.

22 IDB. 2020. *Jobs in a Net-Zero Emissions Future in Latin America and the Caribbean*. IDB and ILO, Washington, DC and Geneva.

1.2. National Climate Change Adaptation and Mitigation Commitments

Most LAC countries have committed to the Paris Agreement²³ and have ratified nationally determined contributions (NDCs). Of the NDCs submitted from the LAC region, 93 percent have an adaptation component or mention adaptation as relevant, although only 44 percent of LAC countries have established adaptation objectives or targets. Most NDCs identify key sectors for adaptation action, with the most highly cited sectors being water (21 countries), agriculture (19 countries), land use (18 countries), and health (16 countries). Water was cited as the top strategic sector in eight countries, highlighting its importance for adaptation in multiple sectors. Chile, for example, identified water security and nature-based solutions as the main priorities to protect people, livelihoods, and ecosystems.

As of mid-2021, 48 percent of LAC countries (accounting for 81.0 percent of regional emissions and 6.8 percent globally) had updated their NDCs, most of them with enhanced ambition. Of these, Argentina, Chile, Colombia, Costa Rica, and Peru committed to the greatest relative increase in greenhouse gas (GHG) emission reductions. However, the region's top two emitters, Brazil and Mexico, made similar commitments in their updated NDCs as in their initial submissions. Across the region, 40 percent of the NDCs have economy-wide GHG targets in the form of absolute targets, intensity targets, or targets against a baseline.²⁴ As part of the Paris Agreement, countries have also been invited to submit a long-term strategy (LTS) to achieve net-zero GHG emissions by around mid-century. While most LAC countries intend to decarbonize their economies, as of February 2022, only Chile, Colombia, Costa Rica, Guatemala, Mexico, and Uruguay had submitted an LTS to the United Nations Framework Convention on Climate Change (UNFCCC), as part of the Paris Agreement Accord.

A distinctive feature of GHG emissions in LAC is the large share from agriculture, and land-use change and forestry, which together account for 47 percent of emissions across the region (figure 2), significantly exceeding the global shares of these sectors (19 percent of global GHG emissions). Emissions from energy systems, mainly linked to fossil fuel combustion, account for 43 percent of total emissions in LAC, including 15 percent from transport, 13 percent from electricity and heat, 6 percent from manufacturing and construction, and 3 percent each from fugitive emissions, buildings, and other fuel combustion.²⁵ International bunker fuels (aviation and maritime) are excluded from national emissions inventories, but across the region, they amount to 2.1 percent of total GHG emissions.

Three major emitters produce two-thirds of GHG emissions in the region: Brazil (36 percent), Mexico (18 percent), and Argentina (12 percent).²⁶ Indeed, the seven most significant emitting sectors across these three countries alone account for 41 percent of the region's emissions (in Brazil, agriculture, land-use change and forestry, and transport; in Mexico, electricity/heat, transport, and agriculture; and agriculture in Argentina—see figure 3). Overall, LAC countries produce 8 percent of global GHG emissions and 12 percent of emissions from World Bank borrower countries.²⁷ This

23 The Paris Agreement is a legally binding international treaty on climate change intended to keep the world below a change of 2°C (and ideally 1.5°C) by 2050. It was adopted by 196 parties at COP21 in Paris, on December 12, 2015.

24 Regarding gas coverage, only Chile has an NDC including the seven Kyoto gases plus black carbon, followed by Mexico and Colombia, each with six gases plus black carbon.

25 "Sector and End Uses." N.d. Available at: http://pdf.wri.org/navigating_numbers_append2.pdf.

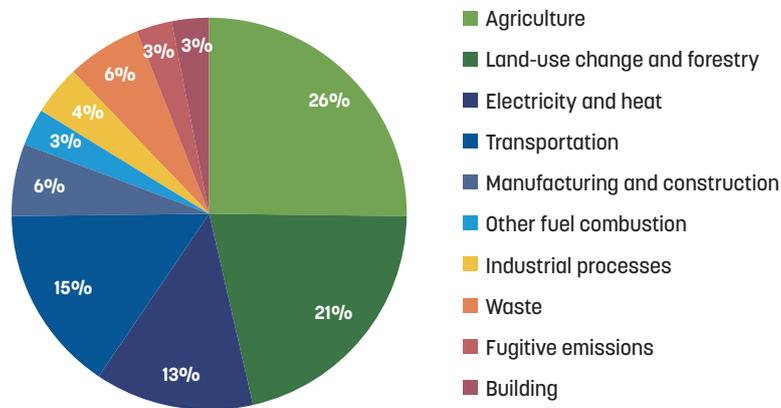
26 World Resources Institute. 2020. Climate Analysis Indicators Tool (CAIT).

27 World Resources Institute. 2020. Climate Analysis Indicators Tool (CAIT).

relatively modest contribution would significantly increase, however, if high- and upper-middle-income countries reduce emissions to limit global warming to 1.5°C while low-middle-income and low-income countries in the region pursue business-as-usual development. Moreover, the region’s contribution to global emissions could be significantly increased if a tipping point is reached in the Amazon basin leading to a transition from forest to savannah-like vegetation (see box 3). During two major droughts in 2005 and 2010, the Amazon temporarily turned into a carbon source due to increased tree mortality²⁸, and as the forest dies off the Amazon has the potential to release the equivalent of several years of global GHG emissions into the atmosphere.²⁹

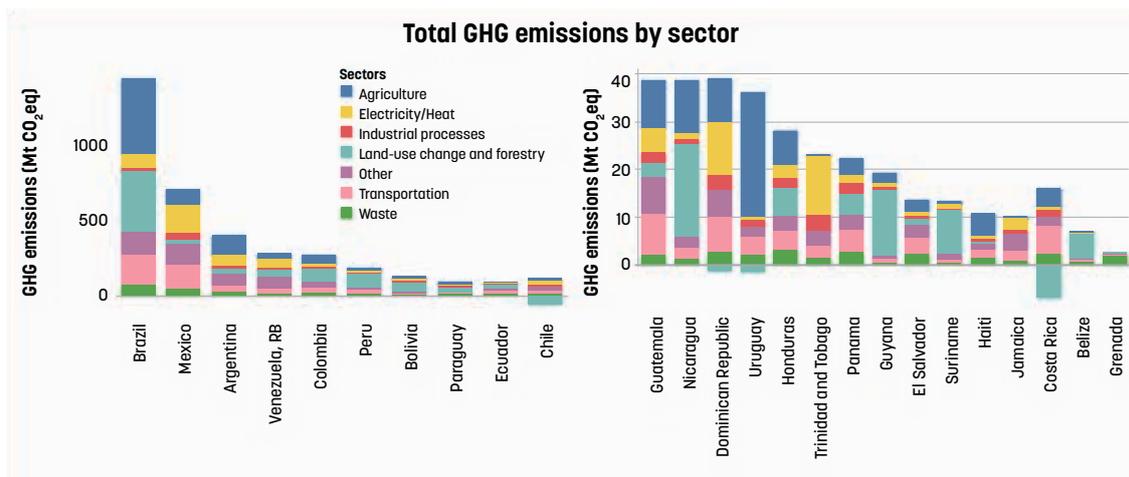
FIGURE 2: Agriculture, Land Use Change and Forestry, Transportation, and Electricity Production Account for Three-fourths of GHG Emissions in LAC

Distribution of GHG Emissions in LAC 2018



Source: CAIT/Climate Watch. 2020. Washington, DC: World Resources Institute. Available online at: <https://www.climatewatchdata.org>.

FIGURE 3: A Few Sectors in Brazil, Mexico, and Argentina Produce the Largest Share of LAC’s Emissions



Source: CAIT Climate Data Explorer.

Note: Other includes Buildings, Fugitive Emissions, Manufacturing & Construction and Other Fuel Combustion. International Bunker Fuels are excluded.

28 Laan-Luijckx, I., et al. 2015. Response of the Amazon carbon balance to the 2010 drought derived with CarbonTracker South America, *Global Biogeochem. Cycles*, 29, 1092–1108.

29 Harvey, C. 2022. Amazon rainforest nears dangerous ‘tipping point’. E&E News, March 8, 2022.

1.3. Resilient, Low-Carbon Development Offers Opportunities for Recovery and Growth

Adaptation responses, including resilient infrastructure and landscape restoration initiatives, present valuable opportunities to create employment, while helping vulnerable communities cope with extreme weather. With an incremental cost estimated at around 3 percent of the overall infrastructure investment needed, and a benefit of US\$4 per US\$1 invested,³⁰ financing climate resilience is both urgent and cost-effective. There is also potential for significant private sector participation (box 1).

Box 1: Resilience Roadmaps for Private Sector Participation in Dominica and Barbados

A global upstream seed launched in Dominica by the International Finance Corporation (IFC), and expected to be replicated shortly in Barbados, is creating “Resilience Roadmaps” to help identify priority investments. The purpose of this initiative is to use comprehensive risk data to assess the vulnerabilities these countries face from a climatic and broader environmental resilience perspective. Based on a set of granular targets, the IFC will then identify priority interventions across all infrastructure sectors—water, waste, telecommunications, transport, and electricity—that would substantially close the gap between the baseline and the resilience goals set by each government. Finally, using objective decision criteria, the IFC will identify a “top 10” list of capital projects that lend themselves to significant private sector participation through direct investments or public-private partnerships (PPPs). Renewable energy projects figure significantly on the emerging priority capital project lists, and the IFC is defining reforms and preconditions needed to convert the list into investments.

Combining green with grey infrastructure can provide lower-cost, more resilient, and more sustainable infrastructure solutions while creating jobs and contributing to mitigation.³¹ Many of these projects involve labor-intensive landscape management. Good catchment management, for example, lessens rates of runoff, recharging aquifers and reducing water treatment costs as well as erosion. Roads are especially vulnerable to landslides, and different landscape management practices can have large implications for landslide susceptibility; replacing clear-cutting with partial cutting, for instance, has been found to lower the volume of landslides by a factor of 1.5.³² Mangroves and coral reefs protect coastlines against floods and storm surges, halving the annual global damages from flooding and reducing storm-related costs by two-thirds.³³ Protecting and restoring these coastal ecosystems is thus a resilience building priority for several LAC countries.

30 Hallegatte, Stephane; Rentschler, Jun; Rozenberg, Julie. 2019. *Lifelines: The Resilient Infrastructure Opportunity*. Sustainable Infrastructure. Washington, DC: World Bank.

31 Browder, G. et al. 2019. *Integrating Green and Gray: Creating the Next Generation Infrastructure*. Washington, DC: World Bank and World Resources Institute.

32 Dhakal, A. S., and R. C. Sidle. 2003. “Long-Term Modelling of Landslides for Different Forest Management Practices.” *Earth Surface Processes and Landforms* 28 (8): 853–68.

33 Beck, M. W. et al. 2018. “The Global Flood Protection Savings Provided by Coral Reefs.” *Nature Communications* 9 (2186): n.p.

Achieving net-zero emissions implies rapid and far-reaching transitions in land use and agriculture, energy supply and demand, transportation modes and technologies, and urban form, infrastructure, and buildings. By 2030, the structural changes in production and consumption necessary to be on track for full decarbonization will generate opportunities for new jobs,³⁴ increased competitiveness, and growth. Economic stimulus packages for COVID-19 recovery can include investments in renewable energy, energy efficiency, climate-smart buildings, low carbon public transport, and other needed systemic shifts to reduce GHG emissions.

The package of actions in response to the challenges of the climate crisis can form an important element of countries' post COVID-19 stimulus development packages, as well as support for longer-term development needs across the region. In Chile, for example, 30 percent of the additional public investments being made for COVID-19 recovery are going to initiatives that promote a green economy. These projects aim to address urgent social and socio-environmental needs, such as water supply, pollution reduction, forest conservation, and protection of biodiversity, with a special focus on generating green jobs and investment. Most of these actions will help Chile meet its NDC commitments and will provide investment opportunities under the country's Climate Bond Initiative, while creating jobs to support post COVID-19 economic recovery.

While emission reduction measures are beneficial overall, some actions could have negative impacts, especially on poor and vulnerable populations. Without well-designed interventions, the financial burden of some climate policies can fall disproportionately on poorer households. For example, raising taxes on polluting industries or removing key subsidies, such as on fuel, while helpful in steering economies onto lower emission pathways, can also lead to job losses and price increases. The impact of higher gasoline prices will be particularly felt by poorer workers for whom transport represents a larger share of household spending. This means that when undertaking any such reforms, in addition to analyzing political economy considerations to ensure they can be successful and durable, it is also crucial to consider the distributional impacts. Special attention needs to be paid to the most vulnerable population segments, including women and children, the elderly, persons with disabilities, Indigenous peoples, migrant workers, ethnic and racial minorities (such as Afro-descendants), and other socially marginalized groups. Such analyses can help countries identify opportunities for transitions to lower-carbon pathways that not only reduce emissions, but are also participatory, just, and equitable, taking the needs and interests of these vulnerable groups into account. This is the essence of what has been called the just and equitable transition (JET) approach. Through such an approach, a carbon tax that incentivizes firms to adopt emission reducing technologies, for instance, can also generate additional resources for job retraining or other social assistance programs to compensate the poor and vulnerable for their losses.

1.4. Financing a Resilient, Low Carbon Transition

Almost one-half of LAC NDCs include some estimate of the cost of implementation of the actions and targets presented, and it is clear that significant resources will be needed. Some, such as Costa Rica, Honduras, and Saint Lucia, have indicated that a separate investment and financing plan will be developed, and others are working on financing strategies to implement their climate commitments. Chile estimates that it will cost a minimum of US\$41.3 billion over the period 2020-2050 to implement

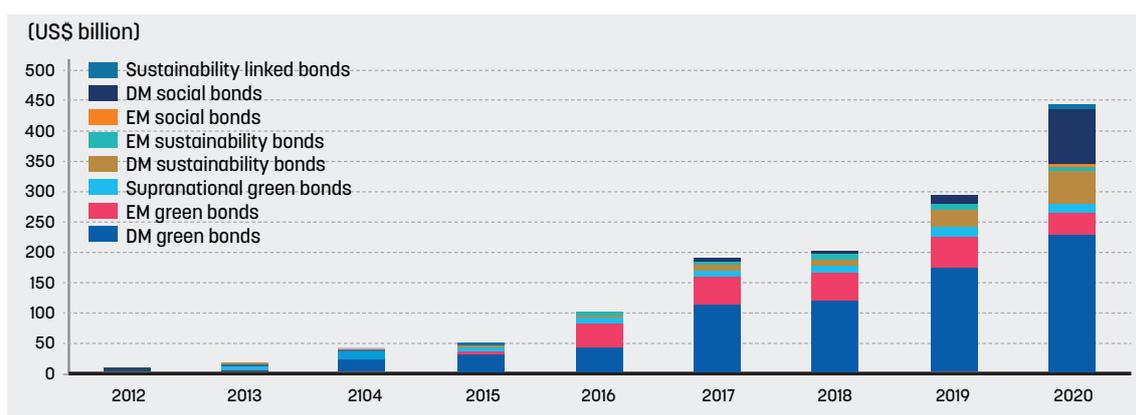
34 Recently estimated at 15 million more jobs in LAC compared to a business-as-usual scenario—ILO, 2020

its planned climate-related actions.³⁵ Globally, it has been estimated that achieving net-zero will require an average annual investment in decarbonization of US\$1.9 trillion between 2021 and 2050, with a peak in 2036 (US\$2.9 trillion) representing 2.3 percent of global GDP.³⁶

LAC countries may need to find new ways to generate revenue for climate investments: from environmental taxes, to green bonds. With fiscal conditions constrained by the COVID-19 pandemic, LAC countries may find that rolling out or scaling up environmental taxes enables them to raise resources in a more progressive manner and with less of an economic impact than raising income or consumption taxes. Coming out of the pandemic, however, most governments will not be able to fully fund climate action through tax revenues, so mobilizing investment from the private sector and Financial Institutions (FIs) will be essential. Following the example of Chile, several LAC countries are exploring options to access financing through green or blue bonds. These offer the opportunity to access a wider pool of institutional investors, while benefiting from slightly lower interest rates than conventional bonds. At the same time, FIs are setting climate targets and net zero pledges, seeing sustainability as a source of growth in the coming decades.

Despite unprecedented challenges in 2020, the green bond market proved resilient, allowing countries to tap into more private sector funds. The global green bond market achieved a key milestone of US\$1 trillion in cumulative issuance since 2007, with issuance of US\$280 billion in 2020. Overall, momentum for bonds with environmental, social, and governance (ESG) objectives accelerated, as social, sustainability, and sustainability-linked bonds reached record levels of issuance (figure 4).³⁷ In 2020, Chile led LAC as the largest issuer in the region (and the second largest among emerging markets), with issues of its sovereign bonds totaling US\$3.8 billion, about one-half the total for the region. Planned sovereign issues are likely to generate considerable momentum for green bond markets in Latin America. Brazil, which seeks to finance railroad infrastructure, and Paraguay are the most recent countries to announce their intentions in this regard. Mexico successfully

FIGURE 4: Global ESG Thematic Bond Issuance



Source: IFC, Bloomberg, Environmental Finance, Climate Bonds Initiative.
 Note: Developed Markets (DM) and Emerging Markets (EM).

35 ISCI Instituto Sistemas Complejos de Ingeniería. April 2020. Available at: <https://isci.cl/ministerio-de-energia-explica-como-calculo-el-costo-del-plan-de-reduccion-de-emisiones-de-chile-a-2050/>

36 Goldman Sachs.2021. "Goldman Sacha Investment report". April 2021. Available at: <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fecommons.luc.edu%2Fcgj%2Fviewcontent.cgi%3Farticle%3D1259%26context%3Dures&clen=1138697>.

37 IFC. 2021. Emerging Market Green Bonds Report 2020.

placed a sustainability bond in 2020, while green bond issues planned in Colombia, Costa Rica, the Dominican Republic, and Peru were delayed due to the pandemic. Some efforts to strengthen the market infrastructure for green bonds through guidelines and frameworks that meet international standards gained traction. One notable example is Colombia's banking regulator, which established a regulatory framework for issuing and investing in green bonds.

Private sector investment will be critical for transitioning to a low carbon, resilient future. Private sector participation can be a tool to foster the development and transfer of innovation in products, processes, and financing mechanisms through international alliances, direct investments, and public-private partnerships. Innovation-boosting competition will be essential to accelerate adoption of the technological improvements needed for resilient, low carbon growth, for example, in climate-smart agriculture, digitizing transport, distributed generation, and smart grids and cities. Commercial capital can also complement scarce public-sector resources and increase total investment in sustainable urban infrastructure projects. Entry points for World Bank Group (WBG) support to stimulate private sector investment for climate action can be structured around (i) the establishment of pricing and regulatory incentives; (ii) the provision of information to facilitate private sector action on these incentives; (iii) the establishment of competitive markets and institutions that encourage innovation in the application of cleaner technologies; and (iv) instruments to enhance access to green finance. De-risking tools and various forms of credit enhancement to crowd in the private sector can be adapted to work in many climate relevant areas. The private sector also has a prominent role to play in strengthening national taxonomies to adopt and promote sustainable asset classes and security issuances, including green, blue, and sustainability linked bonds.

Making the case for private investments in adaptation financing is easier where these correspond to cost savings. Examples include new irrigation technologies that yield significant water savings in drought-prone areas, community-based water harvesting, or storage and distribution systems. In many cases, however, the benefits are less visible, as they come in the form of avoided losses, and the cost of addressing climate risks can reduce profits in the near term. In addition, adaptation projects can be difficult to design due to a lack of company knowledge and capacity to evaluate the climate science, and projections of localized climate impacts can be hard to estimate. Given these constraints, schemes such as the UNFCCC Adaptation Private Sector Initiative³⁸ can play an important role in promoting investment.

A mix of economic and market forces is changing the private sector's perspective on greening the economy. First, investing in low carbon initiatives can be cost-effective for companies through production efficiencies, reducing the long-term cost of energy use, storage, and waste management. Second, increased investor activity in greener products based on heightened consumer interest means that organizations can benefit from adopting cleaner technologies and sustainable business models. People are increasingly willing to pay a premium for the goods and services they perceive as sustainable, with 73 percent of consumers around the world saying they would definitely or probably change their consumption habits to reduce their impact on the environment.³⁹ In recent research, Latin

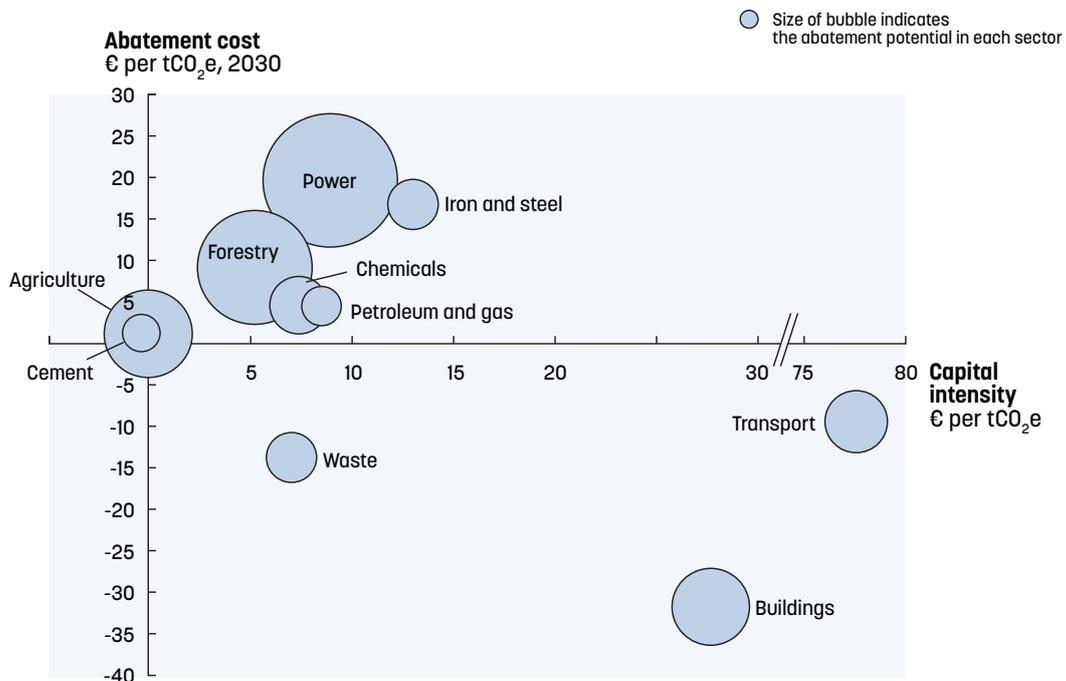
³⁸ The Private Sector Initiative (PSI) aims to catalyze the involvement of the private sector in the wider adaptation community, providing a platform for businesses to contribute in a sustainable and profitable manner to a strong and effective response, both in their own adaptation efforts and in those of the most vulnerable communities around the world.

³⁹ Nielsen. 2019. A Natural Rise in Sustainability Around the World. Available at: <https://www.nielsen.com/eu/en/insights/article/2019/a-natural-rise-in-sustainability-around-the-world/>.

America ranked highest in the world for consumers who believed it was extremely or very important for companies to implement programs to improve the environment, with 94 percent agreeing.⁴⁰ During the COVID-19 pandemic, 61 percent of global consumers started making more sustainable shopping selections, and 89 percent are likely to continue to do so in the post-pandemic period.⁴¹

The capital investment required to transition to more climate-friendly technology can be costly for some activities and varies significantly by sector. For example, while the net additional cost of investing in fuel efficient vehicles and energy efficient houses is typically low, as much of the investment is regained through energy savings, finding effective ways to incentivize and finance the up-front capital investment can be challenging.⁴² To finance these up-front investments, mobilizing private capital and reducing its cost will be crucial. In other industrial sectors, however, average abatement costs are relatively high, whereas up-front investments are lower (figure 5). Making abatement happen in these sectors is likely more a question of ensuring a level playing field than financing the investments.⁴³

FIGURE 5: Up-front Investment (capital intensity) and Overall Abatement Cost Vary Significantly by Sector



Source: Global GHG Abatement Cost Curve v2.0 (McKinsey, 2013).

⁴⁰ The Conference Board's Global Consumer Confidence Survey conducted in 2017 in partnership with Nielsen Available at https://www.foodnavigator-latam.com/Article/2018/12/06/Latin-America-consumers-have-greatest-environmental-concerns-globally?utm_source=copyright&utm_medium=OnSite&utm_campaign=copyright.

⁴¹ Accenture. 2020. COVID-19: New habits are here to stay for retail consumers. Available at: <https://www.accenture.com/us-en/insights/retail/coronavirus-consumer-habits>.

⁴² Extracted from McKinsey. 2013. Pathways to a low-carbon economy: Version 2 of the global greenhouse gas abatement cost curve.

⁴³ Extracted from McKinsey. 2013. Pathways to a low-carbon economy: Version 2 of the global greenhouse gas abatement cost curve.

1.5. Supporting the Transitions of Key Systems: A Roadmap for Climate Action in LAC

The LAC Roadmap for Climate Action 2021–2025 (the LAC Roadmap) is intended to guide the World Bank’s response for scaled-up and transformational climate action in the region. The framework for this Roadmap is provided by the World Bank Group’s Climate Change Action Plan 2021–2025,⁴⁴ the new Adaptation and Resilience Action Plan,⁴⁵ the International Bank for Reconstruction and Development (IBRD) capital increase, and International Development Association (IDA) commitments.⁴⁶

The LAC Roadmap focuses on driving WBG climate finance and leveraging private capital in ways that deliver continued growth that is decoupled from emissions and resilient to climate change. That means helping the largest emitters flatten the emissions curve and accelerate the transition to net-zero pathways, as well as ramping up financing on adaptation to help governments and private sector clients prepare for and adapt to climate change while delivering on broader development objectives. The LAC Roadmap also represents a shift from interventions focusing on greening projects, to programs that green economies, and from focusing on inputs, to focusing on low carbon, resilient outcomes. The LAC Roadmap is intended to guide this dialogue inform the prioritization of transformative, climate-smart investments, and identify enabling reforms in key systems.

The guiding principles for development of the LAC Roadmap include the need to (i) prioritize adaptation and resilience; (ii) build on country climate priorities and commitments such as the NDCs and LTSs; (iii) focus on win-win solutions for resilience and emissions reduction that support inclusive growth; (iv) avoid irreversible impacts on natural capital and the lock-in of carbon intensive infrastructure; (v) strengthen co-benefits such as reduced air pollution and enhanced access to public transport; and (vi) identify opportunities to respond to the challenges of the low carbon transition in key export markets, especially for agricultural products and fuels. Recognizing the essential role that the private sector will play in financing climate action, the LAC Roadmap emphasizes the creation of markets for climate business solutions through policies, financial innovations, and business models that support competition and innovation. The LAC Roadmap also seeks to align climate action with development challenges, supporting post COVID-19 economic recovery and job creation in the near term, and over the longer term ensuring a just and equitable transition that considers the distributional impacts of climate change and the low-carbon economic transition.

The targets of the LAC Roadmap are grounded in the overall WBG commitment to support countries in enhancing resilience and addressing climate change as set out in the World Bank Group’s Climate Change Action Plan 2021–2025. In December 2020, the WBG announced an ambitious target of committing 35 percent of its lending portfolio to climate-related actions on average over the next five years. The LAC Roadmap is intended to support the achievement of this enhanced goal in the LAC region. In addition, and in line with the overall WBG Climate Change Action Plan, all new World Bank operations in the LAC will be aligned with the Paris Agreement by July 2023. Finally, the WBG

44 World Bank Group Climate Change Action Plan, 2021–2025. 2021. Supporting Green, Resilient, and Inclusive Development. The World Bank Group.

45 The World Bank Group’s Action Plan on Climate Change Adaptation and Resilience: Managing Risks for a More Resilient Future. 2019. World Bank Group.

46 IDA19. 2020. Ten Years to 2030: Growth, People, Resilience: Report from the Executive Directors of the International Development Association to the Board of Governors, February 11, 2020.

will continue to deepen climate mainstreaming in LAC by screening projects for climate risks and building in appropriate risk mitigation measures, disclosing both gross and net GHG emissions, and applying a shadow carbon price for all material investments.

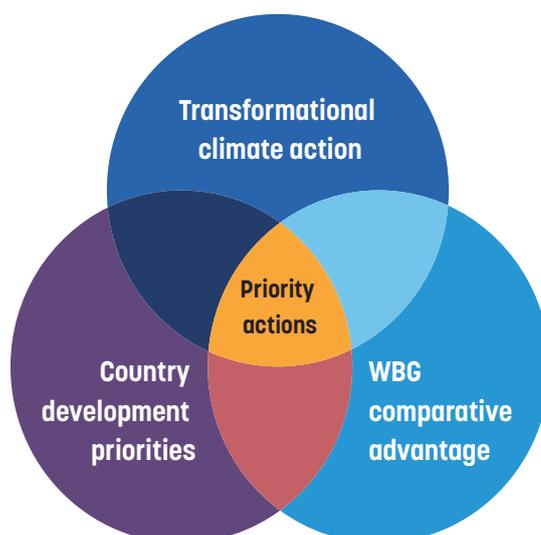
The LAC Roadmap is designed to serve as a strategy document and platform for subsequent WBG engagement with clients and other stakeholders. It identifies transformative public and private investments and best practices that can be replicated and scaled up under the following priority systems and cross-cutting areas:

- » **Landscapes, agriculture, and food systems:** promoting sustainable landscape management for resilience, the management of water resources, carbon sequestration, and the protection of environmental services, and a transition to resilient, low emission agriculture and food systems;
- » **Energy and transport systems:** focusing on decarbonizing and building resilience of the power, transport, and manufacturing sectors;
- » **Cities:** urban planning and investment to make cities more efficient, lower-emitting, and resilient to climate shocks;
- » **Economy-wide actions:** to establish the fiscal, financial, and institutional conditions for an economy-wide response to climate change; and
- » **Support for vulnerable populations:** focusing on protecting the most vulnerable people against climate shocks and transition risks, as well as ensuring their involvement in decision-making for climate action.

The selected systems contribute the bulk of GHG emissions in LAC and face significant adaptation and transition challenges. They also present opportunities for short- and long-term green, resilient, and inclusive development benefits. Within each system and cross-cutting area, the LAC Roadmap identifies opportunities for transformative new engagement in areas of WBG comparative advantage, highlighting those that are urgent to avoid the higher costs that delays would entail. Building on internal consultations with sector and country experts, and a series of country climate snapshots, the LAC Roadmap focuses on identifying priorities for new WBG engagement at the intersection of opportunities for transformational climate action with country priorities for recovery, development, and growth, and areas in which the WBG can draw on global experience and financial instruments to provide effective policy advice and investments solutions (Figure 6).

The synthesis tables at the end of each section of this report highlight potential priority actions at the country levels that would be additional to the existing WBG portfolio and pipeline. They also identify those that are aligned with current government priorities offering near-term opportunities for action, as well as those that are urgent. Urgent actions are those for which delay would increase costs by (i) allowing irreversible harm, for example through the permanent loss of ecosystem services; (ii) creating lock-in of carbon intensive power, transport, or urban infrastructure; (iii) failing to reduce the vulnerability of power, transport, and urban infrastructure already highly exposed to climate-related extreme events; (iv) failing to prevent a significant increase in extreme poverty as a result of climate change; or (v) failing to identify and mitigate financial sector exposure to physical or transition-related climate risks.

FIGURE 6: Prioritizing WBG Engagement for Recovery, Growth, and Resilient Low Carbon Development



Source: WBG LAC Roadmap team development.

1.6. Implementing the LAC Roadmap for Climate Action

Implementation of the LAC Roadmap will be achieved through integration of the priority actions identified for potential new WBG support into strategic country dialogues and key engagement instruments (including systematic country diagnostics [SCDs], country partnership frameworks [CPFs]), leading to the identification of new investment and development policy operations for transformative climate action. This process will be further informed by Country Climate and Development Reports (CCDRs), which together with the LAC Roadmap will also provide a focus for the inclusion of climate risks and opportunities in the knowledge and analytical agenda, as well as for enhanced technical support for climate action in investment project and development policy lending. Development policy finance can play a critical role in rebalancing fiscal incentives, including fossil fuel subsidy reforms and carbon pricing, as well as supporting the implementation of standards and regulations such as building codes and energy efficiency standards, while Catastrophe Deferred Drawdown Options (Cat DDOs) can provide immediate liquidity to countries to address shocks related to natural disasters and other crises.

A coordinated WBG approach will combine World Bank analytical, advisory, and financial support for policy and project development with initiatives of the IFC and the Multilateral Investment Guarantee Agency (MIGA) to mobilize capital and mitigate risk to maximize private sector participation. The IFC and MIGA will work closely with the World Bank to use CCDRs to identify new private sector opportunities for climate business, while continuing to integrate climate into all new country private sector diagnostics.

Concessional funds will play an important role in leveraging other WBG instruments to deliver scaled-up climate action. The Global Climate Investments Funds (CIFs), Forest and Land Use Funds (FCPS, ISFL), the Global Facility for Disaster Risk Reduction (GFDRR), the Green Climate Fund (GCF), the Global Environment Facility (GEF), and the Adaptation Fund, as well as other sources of finance under development such as the WBG Climate Emissions Reduction Facility, will be key resources

to support investment, capacity building, and advisory services for the implementation of the LAC Roadmap. The WBG climate umbrella trust fund, the Climate Support Facility (CSF), will also play a critical role in providing additional resources to support implementation of the LAC Roadmap. The CSF has already committed US\$3.95 million to the LAC region to embed green recovery measures in projects, provide specialized advice on climate action, and develop tools for the design and evaluation of climate policies in support of NDCs and LTSs.

Building on the foundation provided by the LAC Roadmap, the CCDRs will further identify transformative actions, providing a more detailed assessment of the economic costs and benefits, as well as associated fiscal consequences and institutional roles. They will capture the interplay between development (including poverty reduction, growth, and inequality) and climate policies, providing an opportunity to analyze the social and spatial distribution of the costs and benefits of climate action, and to identify skill development opportunities. The CCDRs will also investigate how global decarbonization may impact a country's development path and priorities, as well as potential areas for country action in the low carbon transition to improve development outcomes. In LAC, the CCDRs will be prepared for Argentina, Brazil, Colombia, Honduras, and Peru in FY2022, and for the Dominican Republic, Ecuador, Guyana, the Organisation for Economic Co-operation and Development (OECS), Paraguay and Uruguay in FY2023.

Partnerships for collective climate action will be essential for the effective implementation of the LAC Roadmap. The WBG will continue to facilitate and participate in a range of global, regional, and national partnerships for climate action. Thematic partnerships with global and regional organizations will be important to act collectively on issues such as climate finance and goal setting (for example through the Coalition of Finance Ministers for Climate Action, the Forum of Ministers of Environment of Latin America and Caribbean, and the NDC partnership) and the protection of the Amazon (for example through the Amazon Cooperation Treaty Organization), as well as for sharing innovation and best practices, for example through the C40 Cities global network of mayors. Collaboration between financial institutions will be important to align financial flows with national climate and development priorities, for example through the Network for Greening the Financial System, a network of 83 central banks and financial supervisors. Partnerships will also play a significant role in strengthening the capacity of national and subnational institutions to collaborate the alignment of climate action, while knowledge partnerships with academia, think tanks, civil society organizations, and youth networks, such as the Low Emission Development Strategies (LEDS) LAC partnership, provide a platform for the exchange of bold ideas for climate resilience, mitigation, and the low carbon transition.

Reporting on the delivery of the LAC Roadmap's recommendations, on at least an annual basis, will serve both to inform WBG regional leadership on progress in undertaking transformative climate action, and to furnish updates on regional contributions toward implementation of the WBG CCAP. The LAC Roadmap provides country-specific guidance on priority areas for climate action that can serve as a basis for country and sector teams to monitor implementation. Given that these are defined in part by country development priorities, however, they can be expected to evolve in line with the changing development programs of different administrations.



2. Landscapes, Agriculture, and Food Systems

Improving landscape management, agriculture, and food systems offers key opportunities to build climate resilience while also reducing emissions through carbon sequestration. LAC countries need to transform their food systems to eliminate deforestation and restore landscapes. This is essential not only for achieving net-zero emissions, but also to ensure the long-term productivity of the natural resource base by reducing soil erosion, the degradation of ecosystems and biodiversity, and the severity of flooding, droughts, and landslides in a changing climate. The integrated management of landscapes for the full range of environmental services the countries provide is first about protecting livelihoods and productivity, with the global public goods of biodiversity conservation and climate change mitigation generated as co-benefits.

Landscape restoration and reforestation can provide both near-term and long-term economic benefits. Most immediately, they can create jobs as part of post-pandemic economic recovery efforts. Over the longer term, adopting climate-smart agriculture can contribute to the diversification of rural livelihoods and reduce exposure to transition risks arising from the growing demand for deforestation-free, low carbon products. Reforestation can provide a basis for the long-term growth of sustainable forest product value chains, while the ecosystem and biodiversity co-benefits of sustainable landscape management are critical for agricultural productivity and can support further development of ecotourism, creating employment and income opportunities.

Commercial crop and livestock production historically have been the primary drivers of deforestation in the region. An analysis conducted in 2015 by the Center for International Forestry Research (CIFOR) estimates that between 1990 and 2005, pasture for livestock grazing accounted for about 71 percent of deforestation across seven LAC countries, followed by commercial cropland (about 14 percent). In Brazil, where nearly two-thirds of the continent's deforestation occurred over that period; the conversion of land for pasture accounted for about 82 percent of this loss.⁴⁷

Incentivizing the private sector to transition to climate-smart agriculture and sustainable landscape management will require a mix of policy nudges, incentives, and access to information and finance. In addition to regulations and policy instruments such as carbon credits and offsets, international trade regulations, such as the EU's move to prohibit the import of selected agricultural products linked to deforestation, will play an increasingly important role in incentivizing greener agricultural production in LAC. The investments needed to adopt climate-smart agriculture (CSA) and ecotourism may be prohibitive for small farmers and firms, underscoring the importance of supporting the banks, funds, and innovators who are working directly with micro, small, and medium enterprises (MSMEs).

2.1. Impacts of Climate Change and Climate Policy

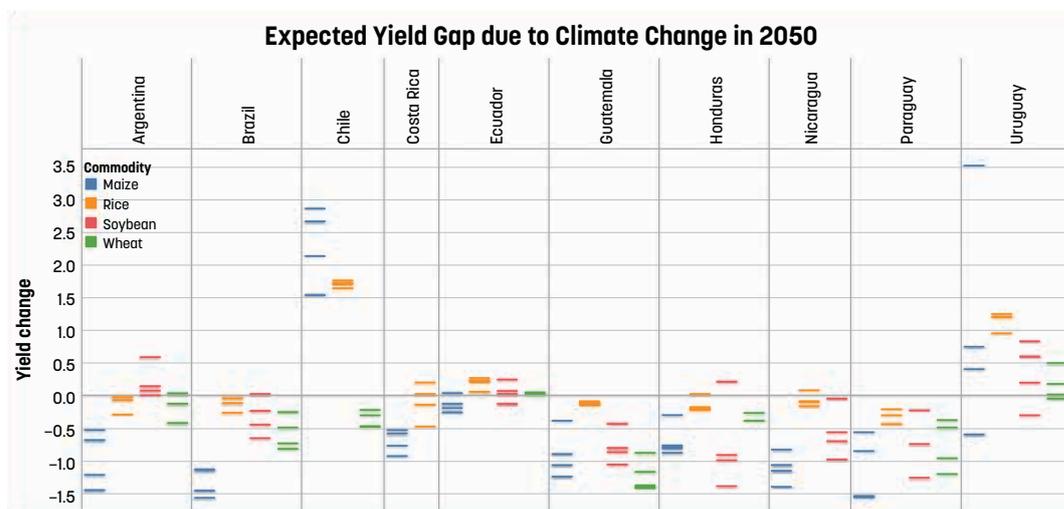
One of the main ways in which climate change affects ecosystems, livelihoods, and economic activities is by affecting water availability and precipitation. Those changes can translate into extreme events such as floods, storms, and droughts, and into slow-onset impacts on agroecological

⁴⁷ V. De Sy et al 2015. "Land use patterns and related carbon losses following deforestation in South America." *Environ. Res. Lett.* 10 124004.

conditions and the prevalence of pests and diseases. In the LAC region, annual precipitation is already highly variable due to the influence of El Niño, and this variability will be compounded by climate change. In addition, in the Andes, glaciers are retreating rapidly as the climate warms, with major implications for water supplies. In many countries, more intense rainfall events will accelerate rates of soil erosion, compounding the challenges of soil degradation that already affects an estimated 26 percent of the land in Central America and 14 percent in South America.⁴⁸ At the same time, higher temperatures and longer dry seasons are drying out forests, leading to their degradation, affecting in particular the Amazonian, Atlantic, and Costa Rican tropical rainforests.⁴⁹ The marine and coastal resources of the LAC region are also increasingly at risk, as temperature changes reshape marine ecosystems and increasing atmospheric carbon dioxide (CO₂) concentration drives ocean acidification, eroding coral reefs. Net erosion of the Mesoamerican Barrier Reef due to acidification is estimated at 37 percent.⁵⁰

Agricultural production is highly sensitive to temperature and precipitation and vulnerable to climate change impacts in the form of both slow-onset changes in agroecological conditions and extreme events such as drought, floods, and storms. Climate change will have negative impacts on yields for most crops and most countries in LAC (figure 7). These impacts may jeopardize food security locally, as well as globally, given that LAC is the world’s largest net food exporter. As the sector provides significant formal and informal employment in rural areas with high poverty rates, as well as to migrants and other marginalized populations, poverty reduction may also be adversely impacted.

FIGURE 7: Climate Change Will Have Negative Impacts on Yields for most Crops and Most Countries in LAC



Source: IFPRI.

Note: Each bar represents a different Climate Model. A negative value means that climate change is expected to have negative impact on yields. Countries with agricultural exports representing more than 30% of total exports were selected.

48 FAO. 2014. Systematization of Soil and Water Conservation Practices for Adaptation to Climate Change. FAO. Available at: <https://www.fao.org/3/i4067e/i4067e.pdf>.

49 Chazdon, R. L., et al. 2005. Effects of climate and stand age on annual tree dynamics in tropical second-growth rain forests. *Ecology* 86 (7): 1808–1815.

50 McField, M. 2017. Impacts of Climate Change on Coral in the Coastal and Marine Environments of Caribbean Small Island Developing States (SIDS), Caribbean Marine Climate Change Report Card: Science Review.

Agriculture consumes nearly three-fourths of the region’s freshwater resources. Almost 90 percent of farmland in LAC is rainfed, which makes agricultural production very sensitive to changes in precipitation patterns.⁵¹ Climate change could worsen water scarcity in many LAC countries,⁵² heightening the need to improve the efficiency of water use for irrigation and to invest in both water storage and landscape restoration to slow runoff and recharge aquifers.

Demand for low carbon global agricultural value chains presents both a risk and an opportunity. Regulatory initiatives in the European Union and the United States aim to constrain the import of agricultural products linked to deforestation (box 2), and consumers are increasingly conscious of the environmental impact of their food and willing to pay more for sustainably produced goods. Climate certification and labeling schemes can help the private sector respond to this demand by setting clear standards for producers and enabling consumers to make more sustainable choices. Labels may indicate a product’s carbon footprint or, if it is sold as carbon-neutral, how any emissions were offset. Independent (third-party) verification will be critical for maintaining transparency and consumer confidence. An example is Costa Rica’s Carbon Neutrality National Program, which makes it possible to label products such as coffee as carbon-neutral, incentivizing emission reductions while enhancing market access and increasing exports.

Box 2: Regulatory Initiatives to Constrain the Import of Agricultural Products Linked to Deforestations

In November 2021, the European Commission proposed a regulation to curb EU-driven deforestation and forest degradation. It would ban imports of selected agricultural commodities (beef, cocoa, soy, palm oil, wood pulp, and coffee) that cannot be documented to be free from deforestation and forest degradation. The proposed regulation would cover both illegal and legal deforestation. Companies will be asked to collect detailed information, including the coordinates of the farm or plantation where their goods are produced, to prove they comply with the requirements. The European Commission will establish a ranking of countries based on their risk of deforestation, with products made in high-risk countries subject to closer scrutiny and more stringent rules.

In the U.S. Congress the “Fostering Overseas Rule of Law and Environmentally Sound Trade Act of 2021” (FOREST Act) has been introduced, also seeking to constrain imports of deforestation-linked products. It would bar the import of selected agricultural commodities produced on illegally deforested land, targeting cattle products, cocoa, soybeans, palm oil, wood pulp, and rubber.

As figures B.2.1 and B.2.2 indicate, some 4–6 percent of total exports from Argentina, Brazil, Paraguay, and Uruguay could be affected by the proposed EU regulation, primarily through the export of beef and soy to the EU from these countries. Honduras would be more exposed, with coffee and palm oil exports to the EU comprising 17 percent of total exports. The U.S. FOREST Act would have a different pattern of impact, with Nicaragua and Uruguay most exposed, through exports of cattle products to the US that make up 4–6 percent of their total exports.

Continued →

⁵¹ Wani et al. 2009. “Rainfed Agriculture- Past trends and future prospects.”

⁵² IPCC. 2014. “AR5 Climate Change 2014: Impacts, adaptation, and vulnerability.” Available at: <https://www.ipcc.ch/report/ar5/wg2/>.

FIGURE B.2.1:

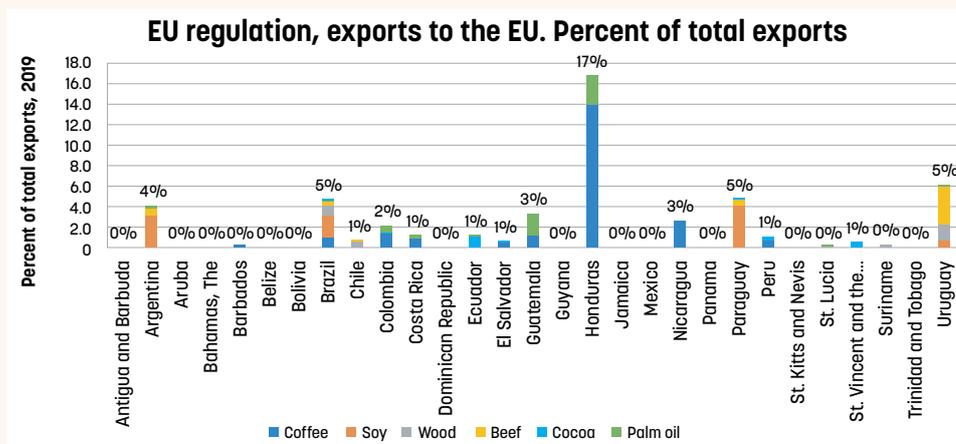
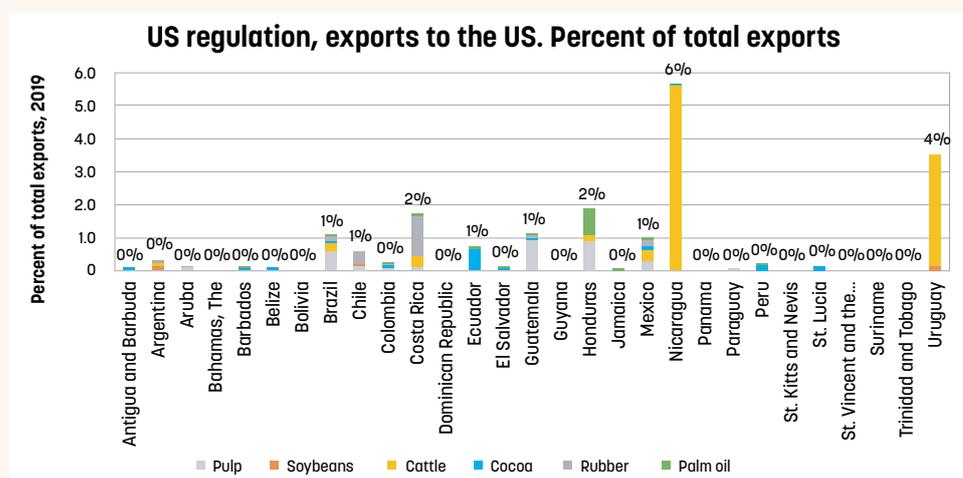


FIGURE B.2.2:



Source: World Integrated Trade Solution data, 2019.

Deforestation-free beef and alternative proteins such as plant- and insect-based products are gaining prominence in the sustainability agenda, with implications for existing beef producers. Demand for those products has been growing due to their smaller environmental footprint (carbon, water, and land use) relative to animal products, and the COVID-19 pandemic has added concerns about the potential for transmission of zoonotic diseases to humans. Any large-scale shift in consumption would have significant socioeconomic implications for major LAC beef exporters (Brazil, Argentina, Mexico, Uruguay, Paraguay) as well as for soy and other animal feed producers (Brazil and Argentina). Financial incentives for LAC producers to meet these new demands include mitigation offset programs, conditional lines of credit, and low carbon and deforestation-free certification and labeling schemes for both livestock and animal feed value chains.

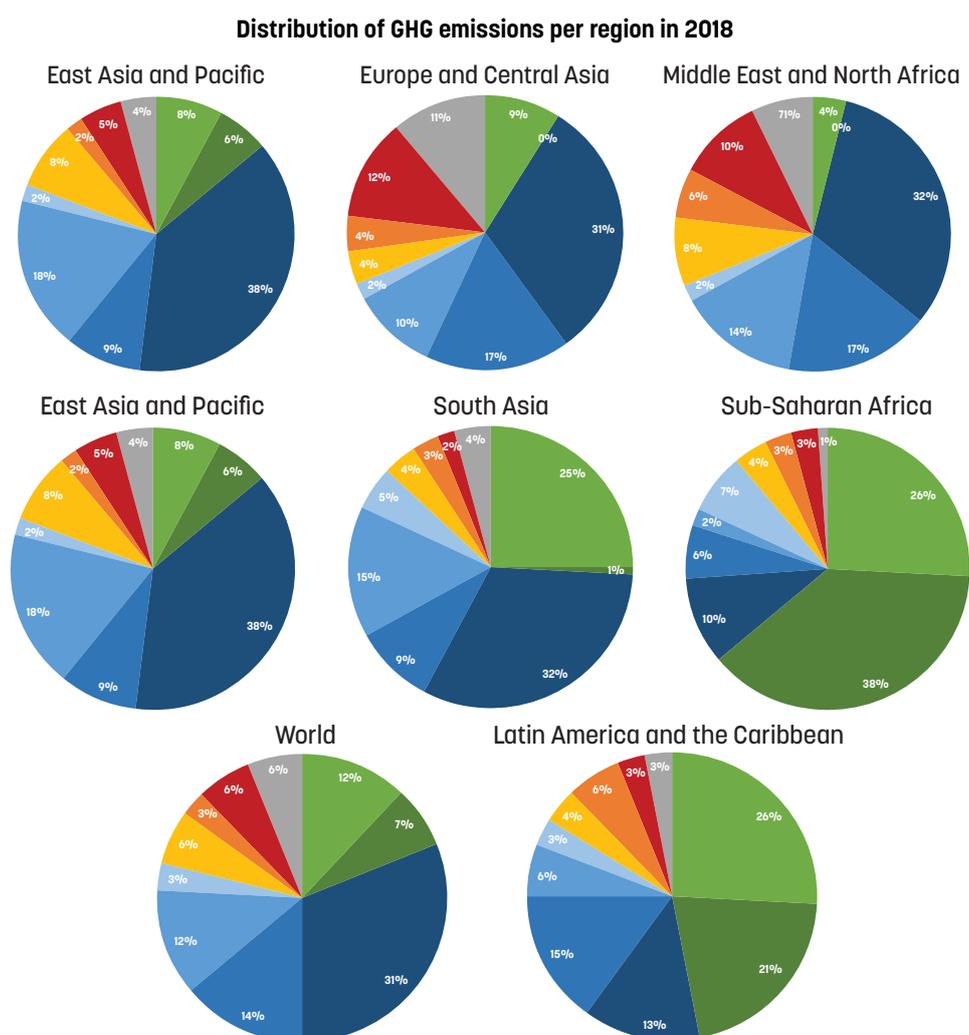
Several LAC governments have recognized significant opportunities to reduce agricultural GHG emissions by promoting energy efficiency and renewable energy technologies and have made this a national priority for the sector. Increasing the reliability and affordability of energy inputs has the potential to improve agricultural productivity both on- and off-farm, with important income

effects through job creation and production increases for those engaged in agriculture. To the extent that remote communities tend to be the poorest and most vulnerable, off-grid solutions to provide electricity access for agricultural livelihoods are an important component of strategies to tackle extreme poverty and enhance shared prosperity.

2.2. Emission Reduction Challenges

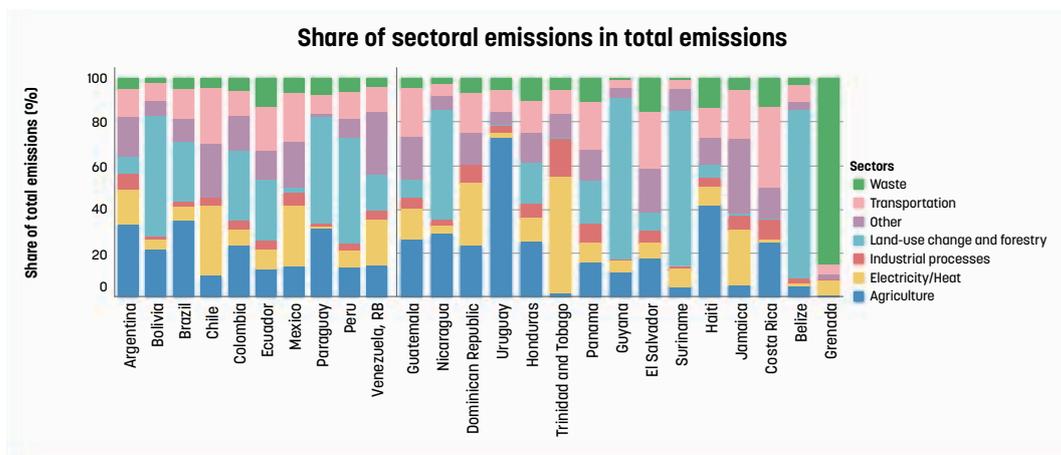
Agriculture is the sector with the largest share of total GHG emissions across LAC at 25 percent, followed by land-use change and forestry at 21 percent, which is largely driven by expansion of the agricultural frontier. The significant contribution of these two sectors is a distinguishing feature of the pattern of emissions in LAC, far surpassing the share of these sectors in global emissions (12 percent and 7 percent, respectively). The only region where the contribution of land-use change and forestry is larger is Sub-Saharan Africa, reflecting lower emissions from energy and transport systems (figure 8). As shown in figure 9, agriculture is the largest source of emissions in many LAC countries, including Uruguay (73 percent), Haiti (42 percent), Brazil (35 percent), Argentina (33 percent), and Paraguay (32 percent).

FIGURE 8: The Share of GHG Emissions from Agriculture, Land-Use Change, and Forestry in LAC far Exceeds That in Most Other Regions



Source: CAIT/Climate Watch. 2020. Washington, DC: World Resources Institute. Available online at: <https://www.climatewatchdata.org>.

FIGURE 9: Agriculture Is the Largest Source of GHG Emissions in Many LAC Countries (data from 2016)



Source: CAIT Climate Data Explorer.

Note: Other includes Buildings, Fugitive Emissions, Manufacturing and Construction, and Other Fuel Combustion. Negative emissions from Land-use change and Forestry and International Bunkers are excluded.

Within agricultural emissions, the principal source is enteric methane from ruminant livestock production, followed by livestock manure management and manure left on pasture. Taking into account these sources as well as land-use change to expand pasture and produce cattle feed (especially soybeans in Brazil and Argentina), the livestock sector in LAC emitted almost 1.6 billion tonnes (Gt) of CO₂ equivalent in 2005, which is over one-third of total LAC emissions.⁵³ Much of these emissions are from specialized beef production, with LAC producing the highest volume of beef emissions of any region worldwide.⁵⁴ Other important sources include synthetic crop fertilizers, rice cultivation, and fossil fuel use in agri-food processing and transport.

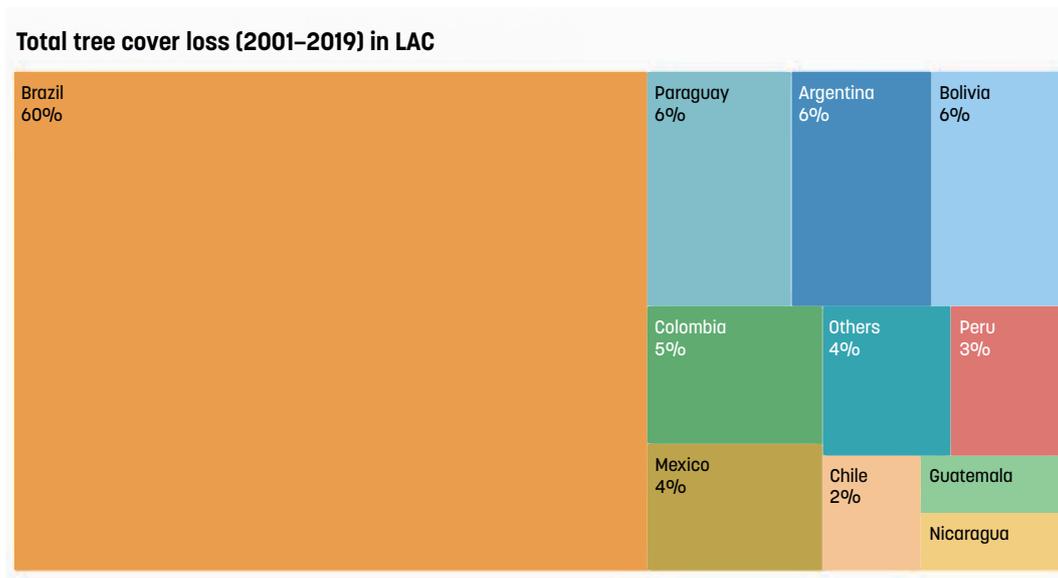
Land clearing for agriculture is also the main driver of deforestation in the region, making land-use change and forestry the top source of emissions in many countries. In Belize, Guyana, and Suriname, it accounts for more than 70 percent of total GHG emissions; in Bolivia, Nicaragua, Paraguay, and Peru, about 50 percent, and in Colombia and Ecuador, about 33 percent (figure 9). In absolute terms, however, emissions from land use change and forestry in LAC are dominated by Brazil, where it contributes about 25 percent of national emissions, but makes up 48 percent of the LAC total for the sector. Sixty percent of the tree cover loss in LAC since 2000 occurred in Brazil, and about 5 percent each in Paraguay, Argentina, Bolivia, and Colombia (figure 10). Emissions from deforestation decreased in the 2000s thanks to Brazil's efforts to reduce deforestation, but they have been increasing since 2016, with the largest annual increase since 2010 occurring in 2020.⁵⁵ Over the last decade, two-thirds of the net increase in GHG emissions in LAC came from land use change and forestry (figure 11).

⁵³ Gerber et al. 2013. "Tackling Climate Change through livestock: a global assessment of emissions and mitigation opportunities". 2013. Available at: <https://www.fao.org/3/i3437e/i3437e.pdf>.

⁵⁴ Gerber et al. 2013. "Tackling Climate Change through livestock: a global assessment of emissions and mitigation opportunities". 2013. Available at: <https://www.fao.org/3/i3437e/i3437e.pdf>.

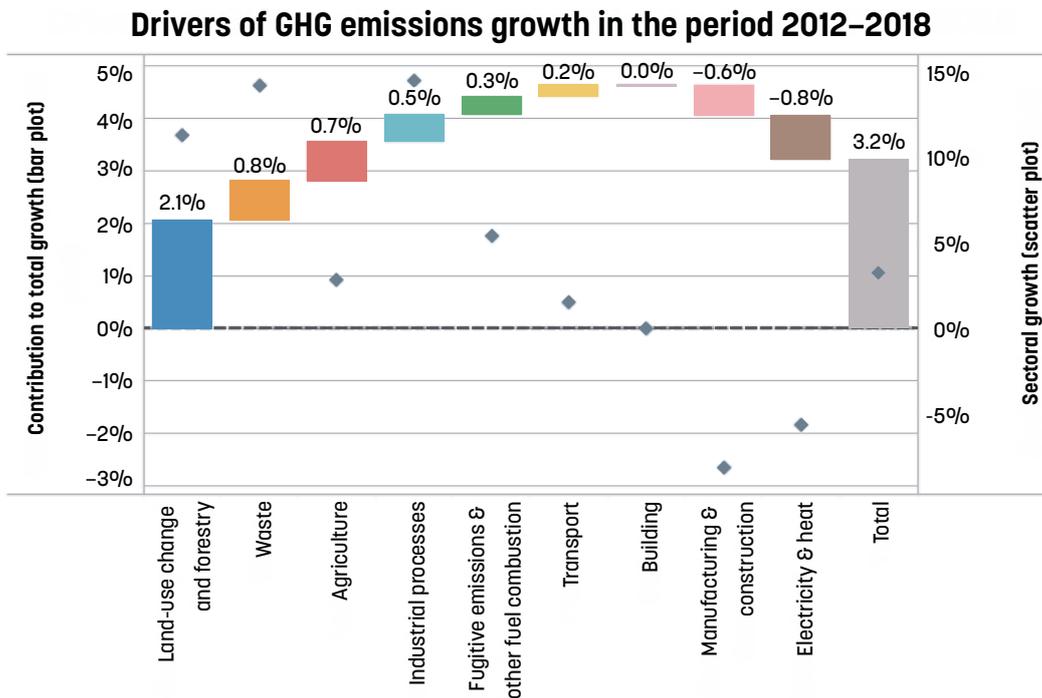
⁵⁵ Silva Junior et al. 2020. "Brazilian Amazon deforestation rate in 2020 is greatest of the decade." December 2020. Available at: <https://www.nature.com/articles/s41559-020-01368-x>.

FIGURE 10: Brazil Accounts for 60 Percent of Tree Cover Loss in LAC



Source: Global Forest Watch.

FIGURE 11: Land Use Change and Forestry Is the Largest Contributor to GHG Emissions Growth in LAC



Source: Authors' calculation based on World Resources Institute, Climate Analysis Indicators Tool (CAIT) 2020.

2.3. Avoiding Irreversible Losses of Natural Capital

Without action to protect natural capital, LAC countries may suffer irreversible losses, with potentially dangerous consequences.⁵⁶ Ecosystem services cannot be easily replaced, and coping with their degradation imposes significant costs. Substituting ecosystem services may demand significant capital investments (such as chemical, mechanical, and biological inputs) that can raise the costs of farming. Even if land can be restored, the evidence indicates that avoiding degradation in the first place is always economically preferable. The consequences of inaction include the loss of biodiversity, soil, and water resources such that they no longer support agricultural production; reduced resilience of agricultural production to climate shocks; loss of competitiveness due to low productivity; and failure to avoid climate change tipping points due to rising emissions.⁵⁷

The risks to natural capital are strongly entangled with the water crisis. Agriculture driven deforestation is often accompanied by fire, and a more intense dry season makes regions such as the Amazon more flammable, resulting in forest losses. Deforestation itself affects the regional water cycle, limiting tree evapotranspiration that normally would act as a buffer during drought periods, generating self-reinforcing cycles of forest loss. Groundwater is a buffer during drought, but this resource is also threatened by climate change, deforestation, and irrigation demand, which influence recharge and discharge patterns. As noted above, the Andean glaciers are also receding due to rising temperatures, and the loss of this water storage will reduce the resilience of economic activities sustained by the water cycle.

Potentially imminent tipping points in the degradation of the Amazon hydrological cycle represent a particularly severe form of irreversibility that could result in large-scale “savannization.” Recent models indicate that negative feedback between deforestation, climate change, and fires could bring the Amazon to a tipping point. If 20–25 percent of the forest is lost, forest areas could turn into non-forest ecosystems in eastern, southern, and central Amazonia.⁵⁸ The urgency of action is underlined by the fact that some estimates already place Amazon deforestation at more than 17 percent (box 3).⁵⁹

56 Pachauri et al. 2014. “Climate Change 2014 Synthesis Report. ». Available at: https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf.

57 LAC AGF 2021 Future Foodscapes Report The world bank. “Future Foodscapes: Re-imagining Agriculture in Latin America and the Caribbean”. January 15th, 2021.

58 Thomas E. Lovejoy, and Carlos Nobre. 2018. Science Advances. February 21, 2018: Vol. 4, no. 2, eaat2340, doi: 10.1126/sciadv.aat2340

59 “Deforestation in the Amazon.” 2020. WWF.

Box 3: Savannization of the Amazon: Nearing the Tipping Point

The Amazon region holds the largest rainforest in the world and at least 10 percent of all species. Its tropical location enclosed by the Andes, large extent (around 7.3 million km²), thick forest cover, and wetlands make it a critical element of the global climate system. The basin stores huge amounts of carbon in its vegetation and soils, including below ground peat deposits in wetlands. The Amazon also influences atmospheric dynamics and circulation patterns, both within and outside the tropics, via its “flying rivers.” The tree canopy reduces heat and maintains soil moisture, and the vegetation and soil are capable of recycling up to 75 percent of the moisture of the westward moving airmass that heads from the Atlantic toward the Andes.¹ The precipitation resulting from the Amazon supplies water to nearly every country on the continent.

The relationship between vegetation and climate in the Amazon is intricate, and unchecked deforestation would trigger a tipping point, changing the hydrological cycle to the extent that the rainforest is no longer viable. When the land is deforested, 50 percent of rainfall runs off and is not available to recycle.² A transition of forest to different degraded states such as savannah-like vegetation in eastern, southern, and central Amazonia could be triggered by the loss of 20–25 percent of the forest area.³ About 17 percent of Amazonian forests have already been converted to other land uses, and at least another 17 percent have been degraded.⁴ In Brazil, which contains more than one-half the forest, over 19 percent has disappeared since the 1970s. In 2020, deforestation in Brazil rose to almost 10,000 km², the largest loss in a decade, and increases in deforestation were also seen in Colombia and Bolivia.

In parallel, over the past century, the average temperature in the Amazon forest has risen by 1–1.5 °C. In some areas, the dry season has also grown longer over the past 50 years, from four to almost five months. Three severe droughts have occurred since 2005 as a result of climate change compounded by the effects of deforestation.

A transition to savannah-like vegetation would have impacts at the local, regional, and global scales. Estimates suggest a loss of up to US\$2.2 billion annually for Brazilian agribusiness due to decreased yields associated with modified rainfall patterns,⁵ as well as a loss of livelihoods for forest- and river-dependent communities, including Indigenous peoples. Regionally, the resulting modifications in rainfall patterns would impact agricultural production as far as the Río de La Plata basin and the Argentina Pampa, as well as hydroelectric power throughout the American continent.

Globally, such a tipping point would accelerate climate change by turning the Amazon from a carbon sink to a carbon source.⁶ More directly, recent simulations indicate that deforestation of the Amazon could be a driver of climate change in agriculturally important areas of the United States, potentially resulting in 20 percent less rain in the U.S. Northwest, and 50 percent less snowpack in the Sierra Nevada, which is an important source of water for irrigation in California’s Central Valley.⁷

1 Lovejoy , and Nobre. 2019. Amazon tipping point: Last chance for action. *Science Advances*. doi:10.1126/sciadv.aba2949.

2 Ibid.

3 Science Panel for the Amazon. Resilience of the Amazon forest to global changes: Assessing the risk of tipping points.

4 Science Panel for the Amazon. 2021. Executive Summary of the Amazon Assessment Report 2021.

5 Jon Strand et al. 2018. Spatially explicit valuation of the Brazilian Amazon Forest’s Ecosystem Services, *Nature Sustainability*.

6 Gatti et al. 2021. Amazonia as a carbon source linked to deforestation and climate change, *Nature*, July 14, 2021.

7 Medvigy et al. 2013. Simulated changes in Northwest U.S. Climate in Response to Amazon Deforestation. *Journal of Climate*. doi: <https://doi.org/10.1175/JCLI-D-12-00775.1>.

2.4. Adaptation Solutions: Landscape Restoration, Sustainable Land Management, and Climate-Smart Agriculture

Improved water management and water infrastructure design are essential to climate change adaptation. The first step in this transition is to generate accurate and timely climate, weather, and water information for probabilistic models that allow for the optimization of water management and infrastructure. Based on such models, integrated watershed planning can help countries to better manage water resources, build resilience to droughts and flooding, and sustain agricultural and hydropower production. These broader frameworks enable more cost-effective investment in water infrastructure to address the increasing hazards associated with climate change. Bringing the private sector on board for the adoption of climate-smart approaches to water resource management is critical for investment and innovation, requiring incentives that hinge on secure land tenure and market competition.

Landscape restoration and sustainable land management practices generate rapid local benefits in improving agricultural productivity and reducing vulnerability to flooding, landslides, and drought. By reducing soil erosion, estimated to affect one-half of all agricultural land regionally,⁶⁰ such practices also contribute to agricultural productivity, while slowing the sedimentation of hydropower reservoirs and other hydraulic infrastructure. In contrast, deforestation amplifies the effects of climate change⁶¹ and contributes to large biodiversity losses with unknown but potentially catastrophic consequences.⁶² Activities associated with deforestation also contribute to the spread of disease vectors.⁶³ Addressing deforestation and restoring degraded landscapes can restore these environmental services, reduce GHG emissions, and benefit Indigenous peoples and others whose livelihoods depend on forest resources.

Along with near-term investments in landscape restoration, integrated landscape management is needed for the longer term, with approaches that recognize and value ecosystem services. In production landscapes, mechanisms that incentivize the assessment and provision of local and global environmental services (including carbon sequestration and conservation of biodiversity) can be combined with support for sustainable forest product value chains, complementing strengthened regulatory protection of critical ecosystems in conservation landscapes. In this context, a key measure is to incentivize the agricultural recovery of land that is degraded, rather than expanding the agricultural frontier through further deforestation.

Adoption of climate-smart agriculture practices and technologies can build food system resilience to climate variability, drought, and other impacts.⁶⁴ Given that water scarcity in many LAC countries may worsen,⁶⁵ and that almost 90 percent of farmland in LAC is rainfed,⁶⁶ incentives for adopting climate-

60 FAO (Food and Agriculture Organization), and ITPS (Intergovernmental Technical Panel on Soils). 2015. "Status of the World's Soil Resources: Main Report. Rome: Food and Agriculture Organization; Rome: Intergovernmental Technical Panel on Soils." Available at: <https://www.fao.org/3/i5199e/i5199e.pdf>. Farming activities that have contributed the most to soil degradation include mechanized land preparation and overgrazing (Gardi, Angelini, and Barceló 2014). About 70 percent of the region's grazing areas are considered to be in various stages of degradation (FAO 2018).

61 Staal et al. "Feedback between drought and deforestation in the Amazon" 2020. Available at: <https://iopscience.iop.org/article/10.1088/1748-9326/ab738e/meta>.

62 Dasgupta. 2021. "The economics of Biodiversity: The Dasgupta review." Available at: <http://bibliotecadigital.ciren.cl/handle/123456789/32687>.

63 Ellwanger et al. 2020. "Beyond diversity loss and climate change: Impacts of Amazon deforestation on infectious diseases and public health." Available at: <https://www.scielo.br/j/aabc/a/ffRVhxyPq4NLCsKTZPJMzV8J/?format=html&lang=en>.

64 Climate-smart agriculture (CSA) is a framework for guiding action on food security and climate change through jointly pursuing three objectives: sustainably increasing agricultural productivity and incomes, adapting and building resilience to climate change, and reducing and/or removing greenhouse gas emissions. (WB CSA Topic Page).

65 IPCC . N>d. "AR5 Climate Change 2014: Impacts, Adaptation, and Vulnerability". Available at: <https://www.ipcc.ch/report/ar5/wg2/>.

66 Wani et al 2009. "Climate Change and Sustainable Rain-fed Agriculture : Challenges and Opportunities". In *Agricultural Situation in India* (pp.221-239) Editors: RC.RAY, PADMAJA MEHTA, GANGARAM. Spera et al 2016. "Land-use change affects water recycling in Brazil's last agricultural frontier." *Global Change Biology*, Vol. 22, Issue 10, pages 3405-3413, October 2016.

smart approaches to water resource management are critical. These include water use efficiency measures such as precision irrigation, soil management and landscaping to increase water retention and reduce runoff; rainfall capture and storage; communal water resource monitoring and budgeting to recharge aquifers; and the re-use of wastewater (as adopted in the Mexico Valley, for example, where the re-use of municipal wastewater is proving to be a more reliable resource that also conveys nutrients). Other climate-smart practices important for adaptation include crop diversification, adopting drought resistant crop varieties, and integrating revegetation through agroforestry and silvopastoral systems. Through the adoption of silvopastoral systems complemented by other landscape management tools in Colombia, milk productivity increased by about 25 percent, the cost of milk production decreased by 9 percent, the animal stocking rate increased by 26 percent, and farmers' incomes were up to US\$523 higher per hectare per year than in production areas without such systems.⁶⁷ Given differences among groups in access to land, with women having less ownership, incentives to adopt CSA also provide an opportunity to ensure that building rural resilience is done in an inclusive manner by targeting extension, technical assistance, credit lines, and other mechanisms to historically marginalized groups.

Early warning systems and insurance instruments adapted to smallholders are needed in those countries most vulnerable to frequent or extreme climate events. Many countries hard hit by climate change, such as those in Central America and the Caribbean, lack adequate early warning systems that can quickly and effectively communicate climate-related risks to farmers. Moreover, while commercial farms may have access to an increasingly sophisticated set of insurance products to manage such risks, smallholders generally are not equally served by financial institutions and thus remain exposed to climate shocks. Research, systems, and partnerships are thus needed to obtain and facilitate the dissemination of climate information to producers, including smallholders in remote areas. Agricultural insurance instruments are also needed that recognize the differing needs of clients and are accessible to small farmers, women, and other vulnerable groups.

Existing and emerging technologies for monitoring, data collection, reporting, and forecasting, including climate-hydrological models, show great promise for proactive solutions. They also offer robust data and tools for better credit and policy underwriting, risk assessment, and monitoring of loans and investments. Supporting and deploying technologies that improve the quality of data at the farmer level will be a fundamental part of climate-smart activities and their financing. Only 37 percent of the rural population in the region has access to internet services that meet minimum quality standards, creating an obstacle to the uptake of climate monitoring applications.⁶⁸ The success of these services will also depend on the availability of internet-enabled devices and a minimum level of digital skills among users. At the same time, an appropriate legal and regulatory framework for data management is needed to enable the potential of digital technologies while minimizing the related risks (e.g., cybersecurity, data protection).

2.5. Reducing Emissions from Food Systems, and Land-Use Change and Deforestation

Halting agriculture-driven deforestation requires integrated, multisector action along the full supply chain. Critical forest ecosystems require regulatory protection, including zoning and property rights to reduce unsustainable land use and financial support to disincentivize deforestation. Enhanced

⁶⁷ <https://www.worldbank.org/en/topic/climate-smart-agriculture>.

⁶⁸ "Rural Connectivity in Latin America and the Caribbean – a Bridge to Sustainable Development During a Pandemic." 2020., IICA, IDB, Microsoft.

capacity for third-party verification of sustainable agricultural products and improved traceability can strengthen market linkages to buyers responding to the growing demand for deforestation-free products, complementing increased enforcement capabilities using remote monitoring systems.

The reorientation of agricultural subsidies toward the adoption of sustainable practices can discourage further expansion of the agricultural frontier through deforestation while improving productivity on existing agricultural land and restoring degraded agricultural land. Subsidies coupled to the production of specific commodities or the use of specific factors of production have proven in many countries to be ineffective, expensive, and counterproductive. The value of coupled agricultural subsidies in LAC countries in 2019 was US\$5.05 billion, though these have exhibited a downward trend over recent years.⁶⁹ Replacing coupled subsidies with decoupled payments without greatly reducing the overall payment level to farmers should encounter much less political opposition than would eliminating the subsidies outright. Decoupled payments can be used to encourage environmental and agricultural good practices while raising farm revenues.⁷⁰

Adoption of climate-smart agriculture practices and technologies can reduce crop and livestock emission intensities while also boosting productivity. Lower emission intensities, or emissions per unit of food output, are correlated with higher agricultural productivity. This means that by modernizing farms to reduce emissions, LAC countries can also contribute to food security and development objectives. Key practices include adoption of high-productivity seeds and breeds, improved livestock feed rationing, and modernization of farm logistics to reduce the emissions associated with food loss and waste, increase energy efficiency, and replace fossil fuel usage with renewable energy. To adopt these practices, FIs, asset managers, and agriculture finance groups will be central to delivering results and impact, as they can access all segments related to this sector. Large agriculture conglomerates, already a source of financing for MSMEs, can also be instrumental in supporting climate-smart practices and programs all along the input and output value chains.

Where agricultural emissions remain high, policy measures such as carbon offset programs can be introduced to incentivize decarbonization and the offsetting of emissions. Regulatory mechanisms may be introduced that require high emitting operations to finance or otherwise support complementary activities that remove carbon from the atmosphere. A livestock producer, for example, could reduce their net emissions by adopting enhanced grazing management practices that increase soil carbon sequestration, or invest in afforestation or reforestation locally, or fund it in other locations. FIs can play a central role in financing the greening of supply chains, including climate friendly inputs, such as ammonia fertilizers produced using green hydrogen rather than natural gas. Green hydrogen could also be used for transport of agricultural products. Concessional funding may be justified in the short term to buy down green hydrogen-related capital expenditure while the technology reaches commercial parity.

There is a business case for agribusiness to invest in CSA. Companies can stay competitive by building resilience to climate change impacts, in particular droughts (for which innovative irrigation will be critical) and increased pest attacks, while reducing their GHG emissions. There is a firm size gap in responding to climate challenges. While large agricultural producers can afford state-of-the-art production equipment, smaller producers face more barriers in adopting climate-friendly and climate

⁶⁹ IADB calculations from Agrimonitor initiative.

⁷⁰ Morris, M., et al., 2020. Future Foodscapes – Re-imagining Agriculture in Latin America and the Caribbean. World Bank Group.

adaptive technologies. Post COVID-19, agricultural commodity prices have increased, providing a good opportunity to undertake CSA improvements on a commercial basis. There is significant evidence that CSA technologies can improve yields and reduce costs, increasing revenues and margins for producers, while moderating the effect of higher temperatures and increasing irrigation water productivity.

The investment potential in CSA adoption is large, giving the financial sector an important role to play in making appropriate products available to agribusiness. CSA technologies require country- and subsector-specific prioritization in terms of economic and financial benefits, encompassing practices that cover more sustainable and efficient use of inputs such as seeds, fertilizer, water, and energy (table 1).

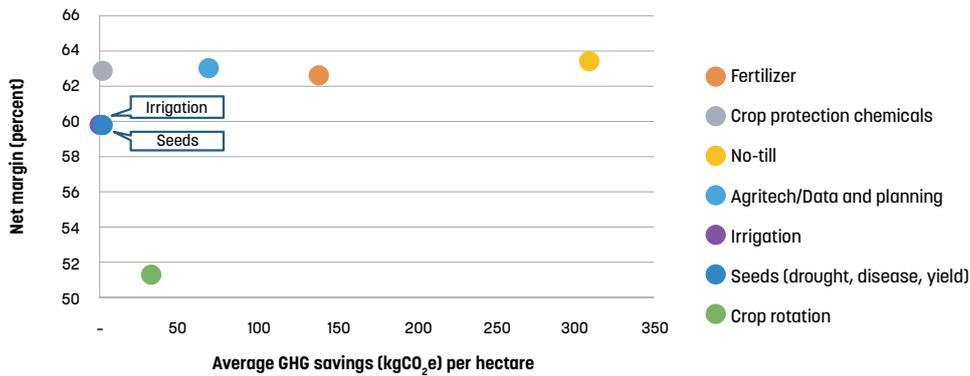
Table 1: Climate-Smart Agriculture Technologies

CSA Type	CSA Measure	Description	Benefit
Nutrient smart	Fertilizer	Soil sampling and mapping	Improved yields/lower input costs
		Type of fertilizer	
		GPS application following/ drone/satellite/tractor data	
	Crop protection chemicals	Types of protection	Improved yields/less crop losses
		GPS application following/ drone/satellite/tractor data	
Crop rotation	Rotation of crop types to increase soil nutrition	Preserve soil nutrients/less fertilizer	
Water smart	Irrigation	Irrigation of crop when required	Produce crops on unproductive land where there is low precipitation
Knowledge smart	AgriTech/Data and planning	Weather Station/Precipitation records	Efficiencies across farm inputs (e.g., fertilizer, fuel)
		Production and yield records	
	Seeds	Drought, disease resistant or yield increasing	Improved yield/less crop loss
Energy smart	No-till	No-till/low till, seeders, cover crops	Less inputs (fuel, fertilizer)

Source: IFC compilation.

The lion's share of the capital expenditure needs for CSA is for climate-smart irrigation systems. Financial viability for such a market exists, with positive economic benefits and analysis from the Ukraine indicating that potential net margin increases from CSA adoption are significant (figure 12). Potential investors to fill this financing gap include financial institutions, and fertilizer and agricultural producers. Nature-based financing is on the rise, including funds such as the Nature Based Carbon Fund by HSBC Pollination, the Nature +Accelerator Fund by Mirova, the Global Ecosystem-based Adaptation (EbA) Fund by the United Nations Environment Programme (UNEP) and the International Union for Conservation of Nature (IUCN), the Restoration Seed Capital Facility, and AGR13 for nature positive agriculture. In addition, financing vehicles have emerged for forest preservation and reforestation investments, including investments from private companies (e.g., Total), REDD+ projects, and forest bonds.

FIGURE 12: The Net Profit Margin of CSA Technologies Can Be Significant



Source: Ukraine CPSD (2020).

CSA practices need to be tailored to local and regional contexts. For instance, in Mexico, adaptation to frost and hail is needed in the northern irrigated region by continuing to invest in protected agriculture (greenhouses), drip irrigation, and insurance, while in the south, a key opportunity is to expand forest plantations on deforested and degraded land. In Colombia, livestock are a major source of GHG emissions, with potential for scaling CSA options such as improved pastures and silvopastoral systems, which mitigate climate change, improve livelihoods, and create sustainable landscapes. In Peru, agroforestry in coffee, cocoa, and fruit crops can increase carbon sequestration while also providing adaptation benefits, such as diversified farmer livelihoods, increased biodiversity, and regulation of microclimates that offer resilience toward climate variability. Agricultural-based biofuel development in countries such as Haiti, the Dominican Republic, and Jamaica could support existing transport and energy needs while greatly reducing imports, revitalizing degraded lands, and creating local jobs and industry.

An integrated package of actions that provides a model for addressing deforestation in the region is provided by the Amazon Sustainable Landscapes Program (ASL),⁷¹ which employs sustainable use and restoration agreements to engage communities in agroforestry value chains. This is combined with regulatory and enforcement measures to strengthen the conservation status of protected areas, as well as capacity building at the national and subnational levels to monitor drivers of deforestation and enforce deforestation control policies. Actions to mainstream environmental considerations in sectors that drive deforestation, including agriculture and mining, encompass initiatives to reinforce and respond to growing market pressure for value chains that are deforestation-free, such as supporting partnerships for independently verified sustainability certification of agricultural products. Financial institutions can support local producers of forest products or byproducts and their green supply chains. In Brazil, for example, the banking sector (Bradesco, Santander, and Itau) is leading this kind of effort with programs such as the Sustainable Amazon Initiative. By monetizing carbon credits as an asset class, producers can attain long-term profitability, support local communities and sustainable practices, and create a buffer to deforestation.

⁷¹ The Amazon Sustainable Landscapes Program (ASL), funded by the Global Environment Fund and led by the World Bank, currently operates in Brazil, Colombia, and Perú with the objective of fostering sustainable land use and restoration of native vegetation cover.

A similar package of measures has enabled Chile to reverse historical deforestation trends.⁷² A participatory approach has empowered communities to manage their own forests, with additional incentives provided through the benefit sharing plan of the National Emissions Reduction Program. At the same time, the forest sector regulatory framework has been strengthened, including through early alert monitoring systems for illegal deforestation, stricter requirements for interventions in native forests, and increased penalties for the illegal deforestation of native forests. International market pressures have also been important in promoting the adoption of sustainable forest certification schemes. Forestry is Chile's thirdlargest export sector, and international markets have required the adoption of certification schemes such as those issued by the Forest Stewardship Council (FSC) and the Program for Endorsement of Forest Certification (PEFC). More than 70 percent of Chile's forest plantations are now certified. These certifications not only require companies to improve plantation management practices but prohibit the deforestation of native forests.

Costa Rica has had significant success in recovering its original forest cover. In 1940, forests covered 75 percent of the country, but pressures from a growing population and agricultural expansion reduced forest cover to 21 percent by 1987.⁷³ The government's early recognition of the value of forests led to remarkable efforts at rehabilitating forest lands and setting aside large protected areas.⁷⁴ By 2015, forest cover was back to 61 percent of the country's land area, making Costa Rica one of the first tropical countries to reverse deforestation.⁷⁵ The increase in deforestation is attributed in part to an internationally acclaimed system of payments for environmental services (PES)⁷⁶ that provide incentives for forest conservation and rehabilitation, covering an average of 310,000 hectares per year over the past two decades. The PES program builds on legislation that establishes reforestation as a legal imperative and makes the costs of reforestation tax deductible.⁷⁷ Together, Costa Rica's National System of Protected Areas and the PES program cover 35 percent of the country's area and 70 percent of forests, in addition to 24 territories distributed among eight distinct Indigenous groups.

The eight Central American countries announced at COP25 that they would restore and conserve 10 million hectares of forests and degraded land by 2030 and achieve carbon neutrality in the agriculture and forest sectors by 2040. That ambitious initiative is now under implementation, drawing on a similar package of measures that combines regulatory, institutional, and community-based initiatives to promote integrated landscape management, restoration, and reforestation, with partnerships that strengthen value chains for sustainable agroforestry products.

Combined with the right regulations, fiscal policy can help reduce deforestation and even encourage reforestation and sustainable forest management. For example, "feebate" mechanisms can be used to tax forestry exports, and these can then be refunded for exports that are certified as originating from sustainably managed forests. The revenues raised can be allocated to projects that reforest or develop sustainable forestry. Adjusting existing forestry and land taxes and fees away from "area fees," which encourage excessive logging, may be appropriate in some cases.

72 The World Bank Press Release. 2019. Available at: <https://www.worldbank.org/en/news/press-release/2019/12/05/world-bank-and-chile-sign-agreement-to-reduce-forest-emissions-improve-local-livelihoods>.

73 National Fund for Forest Financing (Fondo Nacional de Financiamiento Forestal, FONAFIFO). 2001.

74 Oviedo, Ana Maria, Susana M. Sanchez, Kathy A. Lindert, and J. Humberto Lopez. 2015. Costa Rica's Development: From Good to Better. Systematic Country Diagnostic. Washington, DC: World Bank.

75 Agresta. 2015. Generating a consistent historical time series of activity data from land use change for the development of Costa Rica's REDD plus reference level. San José, Costa Rica; Córdoba Peraza, J. 2019. Informe final elaboración del mapa de cobertura y uso de la tierra en Costa Rica 2015. San José, Costa Rica.

76 Established in 1996 when the government adopted Forest Law No. 7575.

77 Forest Law No. 4475 of 1969, Forest Law No. 6184 of 1977, Forest Laws No. 7032 of 1986 and 7174 of 1990.

2.6. Contribution to Recovery and Development: Sustainable Landscape Management and Agricultural Production for Employment and Long-Term Growth

Landscape restoration, reforestation, and climate-smart agriculture are important entry points to support the income and employment of informal workers in rural areas impacted by the pandemic, who often lack the basic protections and safety net benefits that formal employment provides. The rate of informal employment in agriculture across LAC is more than 80 percent, with informality particularly high (87 percent) among Indigenous peoples; in contrast, it is less than 50 percent in industrial and service sectors.⁷⁸ Agriculture and forestry are sectors with high job multipliers in many LAC countries, including for low skill levels (figure 13), meaning that a high share of the cost of interventions in landscape restoration, reforestation, and climate-smart agriculture can be directed to provide broad-based income support for low-skilled rural labor. The implementation of such interventions can also be relatively fast, requiring little in the way of significant new infrastructure, which serves to keep fiscal costs down.

Investing in food systems, including by reducing waste, is an immediate priority in the recovery, as food insecurity has risen significantly due to the pandemic and now affects 16 million people across LAC.⁷⁹ This will be particularly important in countries where the COVID-19 crisis has been compounded by impacts linked to climate change, for example, in Central America, where severe droughts in 2019 and the disastrous 2020 Atlantic hurricane season have combined with economic effects of the pandemic. Acute food insecurity has increased notably in Honduras, Guatemala, El Salvador, Nicaragua, and Haiti.

Natural capital is a key input to regional productivity, resilience, and growth. The achievement of national long-term development goals will require the recognition and protection of key environmental services such as water regulation, local and global climate stabilization, nutrient cycling, pollination, soil retention, and sedimentation control that result from sustainable landscape management. The environmental footprint of agriculture in the region is large, and the current rate of resource use poses a significant threat to the provision of local environmental services as well as global public goods.⁸⁰ Food production models based on unsustainable extraction and extensification threaten the ecosystem services on which they depend and the future capacity of agriculture itself.⁸¹ In Brazil, for example, more than 50 percent of the forest lands cleared for livestock have later been abandoned due to diminishing returns from raising cattle on soils that degrade rapidly due to unsustainable ranching practices. Combating land degradation and restoring degraded land is an urgent priority to protect the biodiversity and ecosystem services on which agriculture relies, while delivering resilience to climate change and emission reductions.

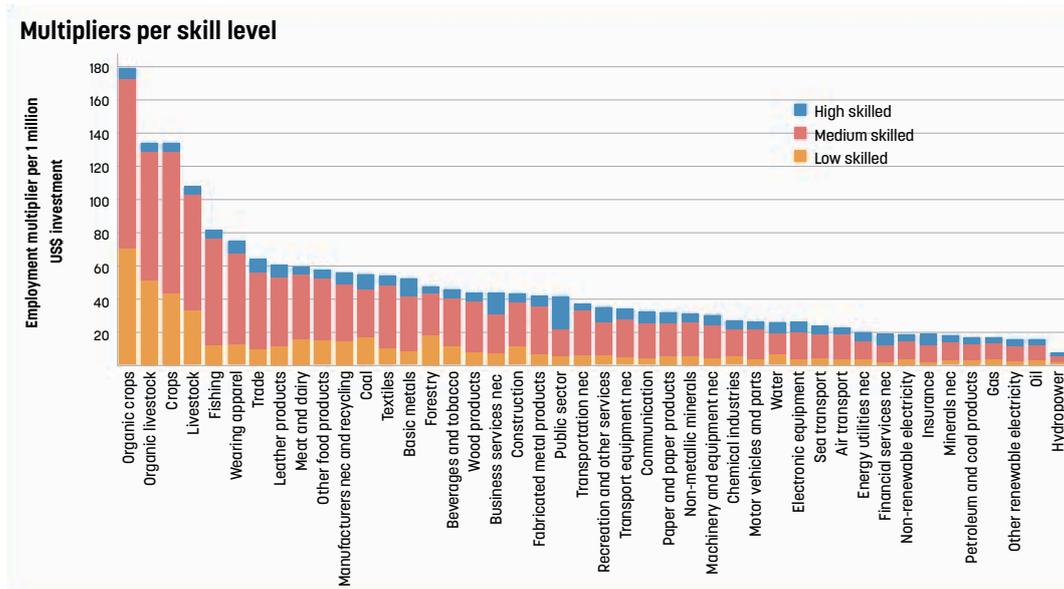
78 ILO. 2020. "Hacia la territorialización de medidas para prevenir y mitigar el contagio con el COVID-19 al empleo en las áreas rurales de América Latina." May 1, 2020. Available at: https://www.ilo.org/americas/publicaciones/WCMS_743352/lang--es/index.htm.

79 WFP. 2020.

80 LAC is the world's most significant provider of a range of global public goods. With almost one-half of the region's land surface covered by forests, storing an estimated 104 Gt of carbon, the region is home to 57 percent of the world's remaining primary forests and the source of between 40 and 50 percent of the world's biodiversity.

81 Globally, agricultural land degradation has reduced productivity in 23 percent of the global terrestrial area, and between US\$235 billion and US\$577 billion in annual global crop output is at risk because of pollinator loss (IPBES 2019b).

FIGURE 13: Agriculture and Forestry Are Sectors with High Job Multipliers in Many LAC Countries



Source: SINTEF.

Improved environmental management will also be important to sustain LAC’s dominant position in global food markets⁸² by responding to changing market demand, such as growing interest in deforestation-free and low carbon products (see box 2). In particular, the increasing global demand for animal products and opportunities for livestock sector development in LAC need to be balanced with the sector’s considerable impacts on natural resources and climate change. Technologies and approaches that improve livestock yields while enhancing carbon sequestration can contribute significantly to climate change mitigation in LAC. One such approach is silvopastoral systems (successfully applied in Colombia, for example), which combine trees and managed pasture to improve animal and grassland productivity and contribute to carbon capture and biodiversity recovery. In Uruguay, meanwhile, improved feeding and breeding, combined with rangeland restoration and afforestation, are expected to increase livestock productivity in intervention areas by over 50 percent while sequestering over 5 Mt CO₂e over 20 years.⁸³

Sustainable landscape management and CSA are also essential elements of comprehensive frameworks to support water security for long-term growth, combining water resource management with water infrastructure. A diagnostic carried out for Argentina found that a scenario incorporating measures to support water security could boost GDP by an annual average of 2.7 percent in 2030.⁸⁴ Similar results were also obtained in Colombia, where improving water security could avoid up to a 3 percent loss in GDP and support the country’s economic recovery from the COVID-19 crisis.⁸⁵

⁸² Future Foodscapes. 2020. World Bank.

⁸³ LAC AGF. 2021. [Future Foodscapes Report](#).

⁸⁴ Argentina Water Security: Valuing Water— Brief for Policy Makers. World Bank, 2021.

⁸⁵ Water: a strategic asset for economic recovery in Colombia. World Bank, 2021.

2.7. Priority Actions for Landscapes, and Agriculture and Food Systems

Table 2 highlights, by country, potential areas for new WBG support in LAC's landscapes, agriculture and food systems under five entry points identified based on the assessment presented above: (i) climate-smart agriculture; (ii) sustainable land management; (iii) water resource management; (iv) leveraging market forces to meet growing demand for deforestation-free and low carbon agricultural products; and (v) the protection of critical habitats. More details on country-specific actions (of which there may be several for each country for a given entry point) is provided in the country climate change snapshots that accompany the LAC Roadmap.

The table distinguishes between potential actions in three dimensions:

1. between those already incorporated in the WBG portfolio (either under implementation or included in the pipeline of operations) or that are adequately supported by non-WBG programs, and those that would be new (either under discussion or aspirational, including potential operations to scale up existing initiatives);
2. between those new actions that would be aligned with current government priorities and those that would not; and
3. also highlights those new actions that are urgent, in the sense that delay would significantly increase their cost. In the context of landscapes, and agriculture and food systems, urgent actions are identified as those necessary to prevent an irreversible loss of ecosystem services with negative long-term impacts on growth, in particular to avoid an ecological tipping point in the Amazon.

As table 2 indicates, the potential areas for new WBG support that are both urgent and prioritized by governments include sustainable land management initiatives in Brazil, Colombia, Ecuador, and Peru, as well as the protection of critical habitats in Brazil and Ecuador. Such actions will be important to avoid a transition in the Amazon to savannah-like vegetation, with the local, regional, and global consequences that would entail (see box 3). New WBG engagement on sustainable land management is also a priority in Belize and Haiti to reduce flooding and erosion as a result of increasingly intense rainfall, and in Uruguay to increase carbon sequestration through pasture management. Support for climate-smart agriculture is already being provided or is in the pipeline for WBG engagement in most LAC countries, but new support would be aligned with government priorities in Brazil, Costa Rica, Guyana, Paraguay, and Peru, as would new initiatives to leverage market forces for deforestation-free and low carbon agricultural and forest products in Brazil, Colombia, Paraguay, Peru, and Uruguay, which are among the countries likely to be most affected by the proposed EU regulation on deforestation-free agricultural products.

Many Central American and Caribbean countries are highly threatened by drought and increasing rainfall variability, with losses associated with drought in the Central American Dry Corridor, which extends from Panama up to southern Mexico, estimated at US\$10 billion over the last 30 years, one-half of which were in the agricultural sector.⁸⁶ As a result, new WBG support for water resource management would be aligned with the priorities of government development programs in Belize, the Dominican Republic, El Salvador, Haiti, Nicaragua, Panama, and a number of Caribbean nations, as well as countries in South America increasingly affected by drought and changing precipitation regimes, including Argentina, Bolivia, Brazil, Ecuador, Peru, and Uruguay.

⁸⁶ Diego Pons. 2021. Climate Extremes, Food Insecurity, and Migration in Central America: A Complicated Nexus. Migration Information. Feb. 18, 2021.

Table 2: Priority Actions for Landscapes, and Agriculture and Food Systems⁸⁷

	Climate Smart Agriculture	Sustainable Land Management	Water Resource Management	Leveraging Market Forces	Protection of Critical Habitats
Argentina	●	●	●	●	●
Belize	●	●	●	—	●
Bolivia	●	●	●	●	●
Brazil	●	*	●	●	*
Colombia	●	*	●	●	●
Costa Rica	●	●	—	—	—
Dominican Republic	●	●	●	—	—
Ecuador	●	*	●	●	*
El Salvador	●	—	●	—	—
Guatemala	●	—	●	—	●
Guyana and Suriname	●	—	—	●	●
Haiti	●	●	●	—	●
Honduras	●	—	●	—	—
Jamaica	●	●	—	●	●
Mexico	●	●	●	—	●
Nicaragua	●	●	●	—	●
Panama	●	—	●	—	—
Paraguay	●	●	●	●	●
Peru	●	*	●	●	●
Uruguay	●	●	●	●	●
Caribbean SIDS*	●	●	●	●	●

Source: WBG LAC Roadmap team development.

Note: SIDS = small island developing states, which include Saint Vincent and the Grenadines, Dominica, Grenada, St Lucia St Maarten, and Barbados.

Key:

- * Urgent area for new WBG engagement aligned with government priorities

● Area for new WBG engagement aligned with government priorities
- * Urgent area for new WBG engagement not aligned with current government priorities

● Area for new WBG engagement not aligned with current government priorities

● Existing WBG or adequate other engagement

⁸⁷ The identified actions reflect the input from a consultative process with WBG Country Management Units and sector experts.



3. Energy and Transport Systems

The priorities for energy and transport systems in LAC are to make assets and networks more climate resilient, and to decarbonize power generation, transport systems, and manufacturing. Climate-related disruptions in energy and transport systems through extreme weather events and slow-onset climate change directly affect the productivity of firms and threaten the jobs, livelihoods, and well-being of citizens. Across the region, 43 percent of total GHG emissions come from transport, the power sector, and other energy systems. Decarbonizing these sectors will help ensure that countries both achieve their emission reduction goals and remain competitive in the face of an increasing demand for low carbon goods and services. Given the long lifetimes of the investments involved, there is a high risk of locking in emissions and stranded assets. Renewable energy, including off-grid and near-grid systems supported by distributed generation and battery storage, offers significant business opportunities for investment in decarbonization. Given enabling regulations, the private sector can help deliver improved energy market efficiency, additional jobs, and competitiveness. While transition costs are higher in other energy markets, transport, and manufacturing, further private sector investment opportunities abound, for example in the growth of electric vehicle fleets.

3.1. Impacts of Climate Change and Climate Policy

Power and transport infrastructure disruptions cause significant harm to firms and households alike. Interruption of power and transport services directly impact the productivity of firms, constraining productive capacity due to unserved energy, which threatens jobs and livelihoods. The annual average cost to firms of infrastructure disruptions exceeds 1 percent of GDP in many LAC countries, rising beyond 2 percent of GDP in Panama, Nicaragua, and the Dominican Republic (Figure 14).⁸⁸

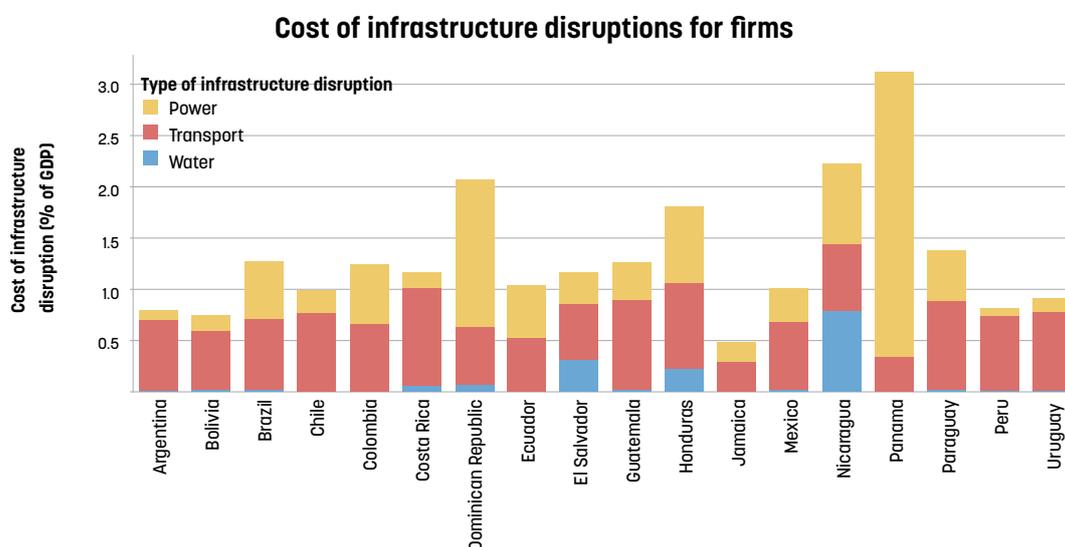
Six LAC countries (Suriname, Haiti, Nicaragua, Belize, Honduras, and Guatemala) are among the top 20 worldwide with the highest multi-hazard risks to transport assets, relative to the value. As a result, infrastructure disruptions are the main contributors to firm losses after a disaster occurs in these countries, with on average 60 percent of firms' losses due to transport disruptions. Climate-related infrastructure disruption also affects citizens' well-being, limiting their ability to engage in productive and recreational activities, hindering access to health care, aiding the spread of water-borne diseases, and causing higher levels of air pollution due to emissions from backup power generation.

Extreme weather events such as hurricanes, tropical storms, and flooding severely impact the power system, particularly in the Caribbean and Central America, causing a variety of financial and economic impacts. Damages to power sector infrastructure and revenue losses due to disruptions in service jeopardize the profitability and viability of power companies, as well as the provision of affordable and reliable energy, especially affecting the most vulnerable populations. Hence the importance of resilience measures, such as redundancy in the power system, can be strengthened via distributed generation,

⁸⁸ Hallegatte, Stephane; Rentschler, Jun, and Rozenberg, Julie. 2019. Lifelines: The Resilient Infrastructure Opportunity. Sustainable Infrastructure. Washington, DC: World Bank.

storage, and updated transmission and distribution infrastructure. The negative economic impact of unserved energy can hinder economic development due to the pervasive role that the power sector plays throughout the economy, facilitating productive activities and the provision of social services.

FIGURE 14: The Cost of Infrastructure Disruptions to Firms Exceeds 1 Percent of GDP in Many LAC Countries



Source: Hallegatte et al. 2019. Lifelines: The Resilient Infrastructure Opportunity. Sustainable Infrastructure. Washington, DC: World Bank.

Climate change is affecting power generation through changes to the availability of water resources.

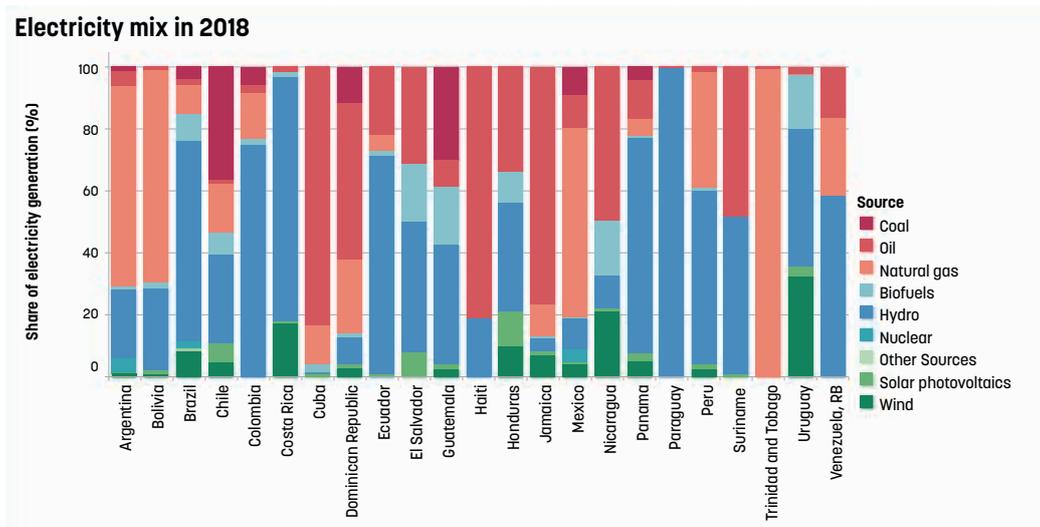
The dependence on hydropower in most LAC countries exposes power systems to hydro-climatological variability (figure 15). Changing weather patterns have created shortages and pushed some countries to use expensive and carbon intensive (oil-fired) supply solutions to meet shortfalls in generation and capacity requirements. In 2012, a drought pushed Uruguay’s public utility (UTE) to import oil to cover demand for electricity at a record cost of US\$1.4 billion, far exceeding original projections of US\$953 million. During the drought of 2014–2015, Brazil (which has the largest hydro reserves in LAC) opted to dispatch additional expensive and carbon intensive thermal energy, causing electricity prices to soar. In 2001, Brazil had responded to another drought by rationing energy, which cost the government US\$9 billion and consumers US\$14 billion, forcing a drastic slowdown in economic activity. Low rainfall in 2021 once again put Brazil’s power system under pressure, increasing generation costs and ultimately tariffs for consumers. In addition, climatic changes, such as an increase in extreme heat or in heavy downpours, could increase risks associated with hydropower dams. Even thermoelectric power generation can be affected by a decrease in the availability of water for cooling.

Rising temperatures are changing heating and cooling demand patterns in LAC countries, jeopardizing the stability of the power system.

There is a growing use of air conditioners in LAC, and by 2050, the number of units in the region is expected to increase more than sixfold.⁸⁹ More extreme temperatures will increase the demand for cooling appliances in many countries, and thus the demand for electricity, affecting in particular peak electricity consumption, with consequences for the stability of the power system and generation capacity requirements.

⁸⁹ Consumers can transform Latin America’s power systems: Here’s how, IEA.

FIGURE 15: The Electricity Mix of Many Countries in LAC Is Dominated by Hydropower



Source: IEA.

Infrastructure damage to roads, railways, airports, and ports due to climate impacts is costly to repair and generates large economic losses. Annual direct damages due to natural hazards to transport infrastructure across the region could reach up to US\$4 billion per year. This figure jumps to US\$38 billion, equivalent to 0.7 percent of the total GDP of the region, if the indirect impacts on firm productivity are considered.⁹⁰ Vulnerabilities of the transport infrastructure are particularly critical in Central America, the Caribbean, and Bolivia. Damage to airports and ports is particularly costly for Caribbean countries, given their dependence on tourism and on maritime transport systems for their import and export flows. The countries with the highest exposures are Jamaica, Haiti, and the Dominican Republic, where more than 30 percent of the transport networks is exposed to climate impacts (figure 16).

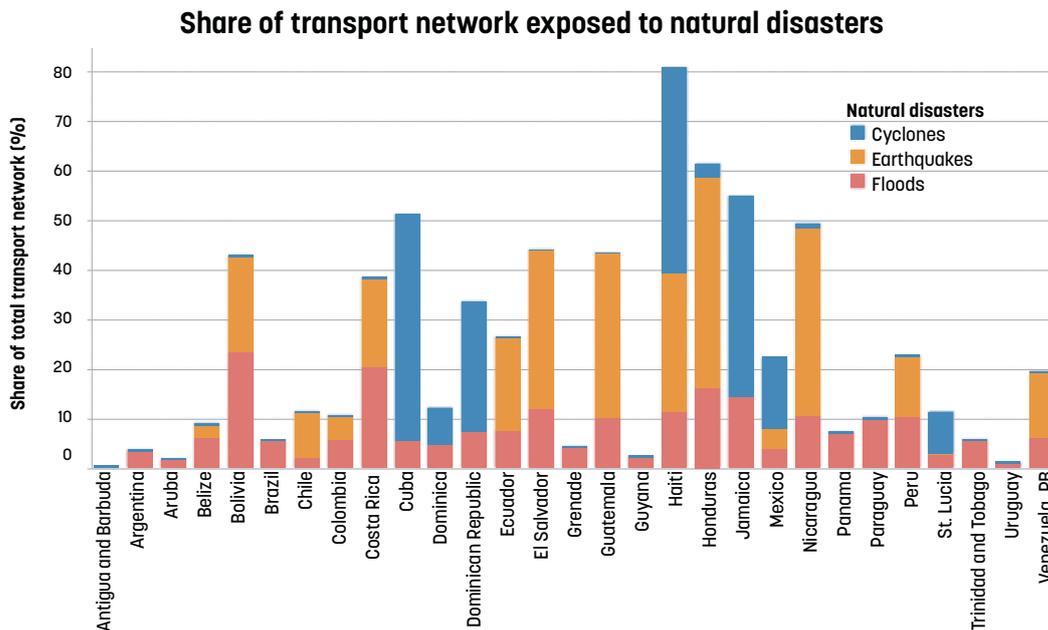
Sea level rise, storm surges, and droughts affect air, maritime, and inland waterway transport. Storm surges and sea level rise may compromise critical transport infrastructure assets, such as airports and ports, in coastal areas.⁹¹ This could have important economic impacts as a result of disruptions to tourism and shipment of critical goods. It would also constrain the ability to respond to disasters, as airports tend to be a lifeline infrastructure for island states during emergencies. Two airports in LAC (Sangster International, Jamaica; and Puerto Jiménez, Costa Rica) are among the top 20 airports most at risk due to projected sea level rise.⁹² Additionally, drought may put at risk inland navigation waterways at risk, with large impacts on freight transport, particularly in Brazil, Uruguay, Paraguay, and Argentina. Climate change is already impacting traffic flow through the Panama Canal, where delays have been caused by both water shortages and excessively high flow rates.

⁹⁰ Rozenberg et al. 2019. From A Rocky Road to Smooth Sailing: Building Transport Resilience to Natural Disasters. World Bank, Washington, DC.

⁹¹ Science Direct. 2021. "Global analysis of sea level rise risk to airports." 2021. Available at: <https://www.sciencedirect.com/science/article/pii/S2212096320300565>.

⁹² Global analysis of sea level rise risk to airports— Yesudian and Dawson. 2021. Climate Risk Management, Vol. 31.

FIGURE 16: Transport Infrastructure is Particularly Vulnerable to Climate Impacts in Central America, the Caribbean, and Bolivia



Source: Hallegatte, Rentschler and Rozenberg (lifelines).

The decarbonization of energy and transport systems will become increasingly important to ensure the competitiveness of targeted products in markets that increasingly require low carbon products and services. The EU has already announced plans to introduce pilot Carbon Border Adjustment Mechanism (CBAM) tariffs comparable to the EU Emissions Trading System (ETS) on cement, iron, steel, aluminum, fertilizers, and electricity imports from 2023. These are designed to prevent carbon leakage from the transfer of domestic production to jurisdictions with laxer GHG emission restrictions, and to protect domestic producers from unfair competition from firms producing in such countries. For now, the impact of the targeted pilot phase of the EU CBAM on LAC exports will probably be limited. Iron and steel sector exports to the EU from Brazil are likely to be the most affected, amounting to about 1 percent of total Brazilian exports, but with potentially important local effects in a sector that employs more than 200,000 people nationally.⁹³ As such mechanisms are broadened, however, it will become increasingly important for LAC economies to decarbonize to keep their exports competitive. At the same time, in sectors where the region's exports are less emissions intensive than those of competitors, opportunities may arise to expand their market shares.

The lithium triangle of Argentina, Chile, and Bolivia holds 60 percent of global lithium reserves.⁹⁴ Lithium is a key component of batteries used for battery energy storage, which will be crucial to the viability of deploying intermittent renewable energy sources at utility scale and is also important for off-grid applications such as remote cell phone towers. Grid-connected battery storage is still in the early stages and remains expensive, but technologies continue to advance. Foreign investors and governments can play a huge role in catalyzing this market through blended finance. The prices of lithium Li-ion batteries have dropped by 80 percent since 2010 and continue to fall, so there is

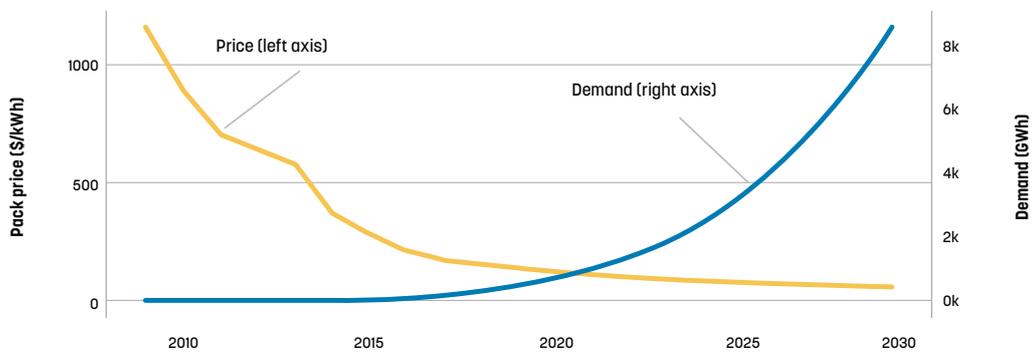
⁹³ WB estimates.

⁹⁴ USGS. 2020. Lithium Data Sheet. Mineral Commodity Summaries, January 2020.

considerable potential for demand growth (figure 17). Demand for electric vehicles (EVs) is also rising rapidly, from 3.1 million sold in 2020, representing 4.7 percent of new passenger cars, and projected to rise to 48 percent of passenger cars by 2030 (figure 18).

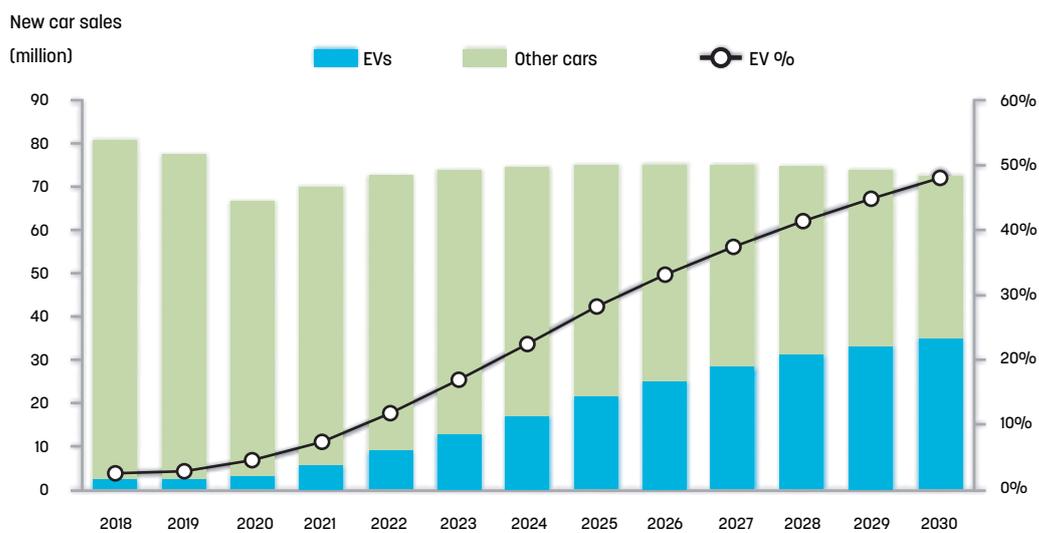
As demand for low-carbon air and maritime transport increases, the ability to provide alternative fuels may present a competitive opportunity. In the Clydebank Declaration signed at COP26 in November 2021, 22 governments, including those of Chile and Costa Rica, committed to establish at least six green shipping corridors by 2025 where vessels regularly run on zero carbon bunker fuels. Costa Rica, Chile, Argentina, Colombia, Brazil, and Panama have already expressed interest in producing green hydrogen for export or becoming a bunkering hub of green or blue ammonia as an alternative fuel for maritime transport.⁹⁵ Areas along the Chilean and Mexican coasts, close to shipping lanes, are ideal for offshore wind power generation to support green hydrogen production.

FIGURE 17: Considerable Demand Potential Is Projected for Li-ion Battery Market Development for Electric Vehicles



Source: Rocky Mountain Institute Bloomberg NEF. Data is projected starting with 2020.

FIGURE 18: Rapidly Rising Demand for Electric Vehicles Is Projected



Source: Canlys estimates, January 2021.
*Excludes commercial vehicles.

95 Ammonia requires less complex equipment and space in vessels compared to hydrogen.

Such initiatives would significantly reduce emissions from bunker fuels. Used mainly for international air and maritime transport, combustion of those fuels accounts for 10 percent of transport sector emissions in LAC, ranging from less than 5 percent in Bolivia, Nicaragua, or Paraguay, to more than 40 percent in Jamaica, Barbados, the Bahamas, Trinidad and Tobago, and Panama.

3.2. Emissions Reduction Challenges

Across LAC, energy systems account for 43 percent of GHG emissions, mainly from fossil fuel combustion. This includes transport (15.0 percent), electricity/heat (13.6 percent), and manufacturing/construction (6.0 percent), with fugitive emissions, buildings, and other fuel combustion each contributing 3.0 percent (see figure 2).⁹⁶ International bunker fuels (aviation and maritime) are excluded from national emissions inventories, in accordance with guidelines from the Intergovernmental Panel on Climate Change (IPCC). In 2018, they amounted to 83 Mt CO₂e across the LAC region, or 2.1 percent of total GHG emissions.

Electricity generation produces 13.6 percent of GHG emissions in the region, but with significant variations, as some LAC countries use mainly hydropower, and several rely heavily on fossil fuels. The latter include Argentina (62 percent), Bolivia (64 percent), Chile (56 percent), and Mexico (72 percent).⁹⁷ Fossil fuel-based generation is even more prevalent in the Caribbean, averaging 91 percent. Given that coal power produces almost twice as much CO₂ per unit of energy as natural gas,⁹⁸ it is worth noting that it continues to play a significant role in the power generation mix of several LAC countries. Chile tops the list, at 24 percent, followed by the Dominican Republic (18 percent) and Guatemala (15 percent). In absolute terms, the biggest consumers of coal in LAC are Brazil, Colombia, and Mexico, together accounting for 87 percent of the region's coal consumption in 2020.⁹⁹ The decarbonization of LAC economies cannot be achieved without the mobilization of private sector investments and capital, as well as the electrification of end uses, which will significantly increase the demand for low carbon power generation.

The transport sector is the largest emitter of CO₂ from fossil fuel combustion in LAC, and its emissions are growing faster than total emissions (by 50 percent in 2000–2018, versus 31 percent) due to the increasing motorization rate (cars and motorcycles) and freight volumes. In fact, car ownership in LAC is growing faster than any other region in the world, with a 58 percent increase from 2005 to 2015, compared with a global average of 27 percent. Several countries, including Peru, Bolivia, Ecuador, Paraguay, and Panama, have more than doubled their emissions from transport since 2000. Transport is the top emitting sector in Costa Rica, Panama, and El Salvador (see figure 9). The region's transport emissions are evenly split between freight and passenger transportation, with most emissions coming from road transport, which accounts for 75 percent, followed by aviation at 20 percent.

⁹⁶ "Sector and End-uses", N.d. Available at: http://pdf.wri.org/navigating_numbers_append2.pdf.

⁹⁷ OLADE, "Latin American and the Caribbean Energy Information system." Available at: <http://www.olade.org/en/latin-american-and-caribbean-energy-information-system-sielac/>.

⁹⁸ US Energy Information Administration. 2021. Carbon Dioxide Emissions Coefficients, Nov. 18, 2021. https://www.eia.gov/environment/emissions/co2_vol_mass.php.

⁹⁹ In 2020, Brazil accounted for 42 percent of regional coal consumption, Colombia 23 percent, and Mexico 22 percent according to BP Statistical Review of World Energy 2021.

3.3. Avoiding Lock-In of High Emission Systems and Stranded Assets

Countries that continue down a path of short-term expansion of investments in fossil fuel technologies face growing risks that future climate change mitigation actions will create stranded assets. It is estimated that meeting the Paris Agreement goals in LAC could result in stranding US\$37–90 billion of carbon-intensive assets before the end of their useful lifetimes. In the LAC power sector, it is estimated that between 60 GW and 128 GW of fossil fuel power plants could be prematurely retired before the end of their physical lifetimes from 2021 to 2050, equivalent to 15–33 percent of the total installed capacity in the region.¹⁰⁰ It is critical to manage the stranded assets risk and implement policies to mitigate the impacts of falling exports of coal and oil.

As high-income countries transition to electric vehicles, imported used internal combustion engine cars may become cheaper and more accessible across LAC, competing with greener options. Most low- and middle-income countries in the region already import large numbers of used vehicles, which account for most of their vehicle fleets. With the rapid introduction of EVs in high-income countries, there may be a large stock of used internal combustion engine vehicles, reducing their cost. This effect may accelerate motorization in some LAC countries while reducing incentives to use public transport or nonmotorized options, or to purchase EVs. It will thus be important to address the trade in used vehicles by adopting stricter vehicle and fuel standards, among other measures.

3.4. Resilient Energy and Transport Systems to Protect Livelihoods and Growth

For several LAC countries that rely heavily on hydropower, diversifying power generation and improving landscape management practices will be important to make energy systems more resilient. Diversification of the energy mix with a larger share of non-hydro renewables is not only important for decarbonization, but also for building power sector resilience, as droughts impact hydropower production. Technologies such as wind and solar power can also be affected by extreme events, so resilience considerations need to be incorporated into plant design and power sector expansion plans. LAC countries will also need to regulate markets well to ensure competition, which will open energy to new (private sector) entrants. At the same time, catchment management, including reforestation and afforestation, will be increasingly important for maintaining hydropower production by regulating hydrological regimes and reducing sediment loads in the face of changing rainfall patterns.

Energy efficiency measures and demand-side management strategies can increase system resilience against shocks and reduce the need to invest in additional capacity to meet the growing demand for electricity. They can also decrease the vulnerability of the power sector to climate change and, consequently, the vulnerability of businesses and consumers to potential disruptions to the power supply. Distributed generation and behind the meter storage¹⁰¹ also hold promise for enhanced energy efficiency, while distributed generation could ease constraints to competition in the LAC electricity sector.¹⁰²

¹⁰⁰ Matthew Binsted et al. 2020. *Stranded asset implications of the Paris Agreement in Latin America and the Caribbean*. Environ. Res. Lett. 15 044026.

¹⁰¹ Behind the meter refers to onsite solutions, on the energy user's side of the meter provided by the electricity utility.

¹⁰² *Renewing With Growth*. Semi-annual Report of the LAC Region. World Bank, 2021.

Interventions on many different fronts are necessary to address the vulnerability of the power sector to extreme weather events and mitigate the economic costs of climate impacts. Strengthening the existing power infrastructure (through investments in transmission, distribution, and substations) and the operational capabilities of utilities and dispatch centers (through network segmentation, improvements to weather forecasting, and early warning systems) are key to minimize damage and disruptions. This is especially important for the hydropower sector. In particular, dam risk models must be updated to analyze the effects of climate change on each of the risk components, allowing the transition from stationary climate models to updated probabilistic models that prioritize adaptation and resilience. Risk management instruments and mechanisms can also be utilized to enhance the resilience framework, including climate insurance, sovereign insurance pools, regional risk pools, and catastrophe bonds.

Climate change impacts, suboptimal power planning, and the energy transition can exacerbate cost volatility in the electricity sector, affecting the consumer's tariff. To mitigate the impact of renewable electricity cost volatility on firms and households, a tariff smoothing mechanism can be adopted under which tariffs reflect average medium-term generation costs, and deviations from the average are absorbed through government transfers. Single-purpose price stabilization funds can be used to address the fiscal impact of tariff smoothing policies. The Uruguay Energy Stabilization Fund provides a model, operating as both a risk management and fiscal stabilization instrument. When favorable weather conditions push electricity generation costs below the average tariff rate, the fund accumulates resources; when unfavorable conditions drive up costs, drawdowns from the fund limit the impact on the budget. The fund plays a key role in sustaining the price smoothing policy while protecting fiscal accounts from weather-related shocks.

Investing in targeted climate adaptation transport assets in LAC could help save up to US\$6 billion in annual losses, saving an estimated US\$12 per \$1 invested in resilience.¹⁰³ When possible, nature-based solutions (such as vegetation to stabilize slopes, or the restoration of mangroves and reefs to protect coastal infrastructure)¹⁰⁴ should be prioritized, as they bring multiple co-benefits, such as protecting ecosystems, supporting local livelihoods, and enhancing water management and quality.¹⁰⁵ The development of a comprehensive sectoral adaptation portfolio is particularly important for Caribbean and Central American countries (i.e., Panama, Honduras, and Nicaragua) due to their high exposure to extreme events, which could make such investments very cost-effective. Transport system-wide vulnerability assessments would provide the basis for the development of climate resilience asset management planning, contingency planning, and institutional strengthening of the sector. Additionally, investments in resilient rural roads can ensure all-weather access of rural populations to essential goods and services, such as education, health, jobs, and food. For example, in rural Haiti, where the loss of access due to heavy rains is a major barrier for women needing to access hospital services, continuing support for resilient rural road projects has been instrumental in improving the Rural Access Index¹⁰⁶ from 36 to 55 percent in vulnerable regions.

¹⁰³ Koks et al. 2019. "A global multi-hazard risk analysis of road and railway infrastructure assets." Available at: <https://www.nature.com/articles/s41467-019-10442-3.pdf?proof=t>.

¹⁰⁴ Becoulet et al. 2021. Resilient recovery: How can Nature-Based Solutions improve transport infrastructure resilience? Lessons from Haiti". April 21, 2021. Available at: <https://blogs.worldbank.org/transport/resilient-recovery-how-can-nature-based-solutions-improve-transport-infrastructure>.

¹⁰⁵ Inter-America Development Bank. 2020. "Increasing infrastructure resilience with Nature-based Solutions." 2020. Available at: <https://publications.iadb.org/publications/english/document/Increasing-Infrastructure-Resilience-with-Nature-Based-Solutions-NbS.pdf>.

¹⁰⁶ The Rural Access Index (RAI) measures the proportion of the rural population who live within 2 km of an all-season road.

Airports, ports, and waterways also need targeted adaptation measures. Detailed vulnerability assessment for airports should provide the basis for investment in climate adaptation retrofits to runways and airport facilities, as well as the development of contingency plans. For waterways, proposed solutions may include the redesign of waterway infrastructure and allocation of financing for maintenance dredging to ensure climate change and water level changes do not affect serviceability, as well as improvement and development of tools to monitor changes in climate conditions to support contingency and emergency preparedness.

3.5. Decarbonizing Power and Transport Systems, and Electrifying End Uses

The technology to decarbonize the power generation sector is already available. The costs of renewable sources have dropped substantially over the last decade, decreasing by about 80 percent in the case of solar power and 40 percent for wind, making them economically competitive with fossil fuels in many countries.¹⁰⁷ Cost reductions, maturing technologies, and further renewable energy policy reforms offer an unprecedented opportunity to tap the vast renewable energy potential in LAC, leveraging private investment. Chile and Mexico have some of the world's highest levels of insolation,¹⁰⁸ making them ideal to develop further solar energy capacity, and high winds in northern Colombia and southern Argentina have vast untapped potential to generate wind power. In addition, there are significant untapped geothermal resources in the LAC region, not only in Central America and Mexico, where development is more advanced, but also in the Caribbean and in South America.

The LAC region still lags in the development of renewable energy beyond hydropower, but that is changing.¹⁰⁹ Cost reductions, new technologies, energy diversification strategies, and regulatory measures have been promoting large private investments in renewable energy capacity. Renewable energy auctions in Argentina, Brazil, Colombia, Mexico, Chile, and Peru are accelerating the growth of clean electricity sources. Today the region hosts some of the most dynamic renewable energy markets in the world. Colombia's auctions for non-hydro renewable electricity generation have resulted in the procurement of more than 2 GW, with the goal of at least an additional 4 GW installed capacity by 2030. Argentina also increased its share of non-hydro renewable generation from 2 percent in 2018 to 11 percent in 2021, through a guarantee program that resulted in almost 5 GW of capacity committed.¹¹⁰

Further increasing the participation of the private sector in renewable energy will require the vertical and horizontal unbundling of the electricity sector. Vertical unbundling will enable the separation of potentially competitive segments (generation, retail, and storage) where many actors can participate, from less competitive segments (transmission and distribution) that generally require single providers to manage the grid infrastructure. Horizontal unbundling increases the resilience of the sector, as multiple providers allow for the diversification of power sources, spreading risks to the energy supply.

¹⁰⁷ [How to decarbonize global power systems](#) Finkelstein et al. McKinsey, 2020.

¹⁰⁸ Global Solar and Wind Atlas, ESMAP.

¹⁰⁹ Nonconventional renewable energy sources include geothermal, wind, solar, tidal, biomass, and small hydroelectric plants.

¹¹⁰ This program was directly supported by approximately US\$700 million in IBRD guarantees that are estimated to have leveraged US\$6 billion in private financing.

Attracting private sector investment will also require an independent regulator setting tariffs that allow cost recovery, combined with incentives to cut technical losses and commercial theft. Regional integration can also play an important role in enabling the addition of larger shares of clean energy, especially in Central America, in Belize (with Mexico), or in the Arco Norte (Guyana, Suriname, Brazil, and French Guiana), by allowing access to cheaper resources that might be produced elsewhere, sharing reserves (ancillary services), and taking advantage of differences in time profiles of generation and load, among others. In addition, regional integration can improve the overall reliability, security, and sustainability of the electricity sector in the long term.

Support for off-grid and near-grid renewable energy through distributed generation (DG) and battery energy storage system (BESS) solutions can scale up decarbonization of the power sector. These solutions can provide additionally stable supplies of energy to energy poor and vulnerable areas, reducing the climate damage of diesel use, transport, and storage, while creating new industries and jobs. Financial institutions and asset managers are key to financing these initiatives that are usually locally generated. Distributed generation and micro-generation solutions, including hybrid systems using renewable energy, could be considered in countries such as Bolivia, Belize, Guyana, and Haiti as a solution for electrification in remote rural areas where the cost of extending the grid is higher than this alternative.

Energy efficiency measures are among the most cost-effective means to reduce emissions and could contribute 40 percent of total emissions savings through 2050.¹¹¹ Most countries in LAC have committed to improving energy efficiency in their NDCs, with buildings, transport, and industry offering the largest share of mitigation potential through energy efficiency improvements. Key measures include minimum energy performance standards, labeling programs, green building codes, energy management systems, and the electrification of end uses. Policy measures that would encourage and support investment in energy efficiency include scaling back subsidies for fossil fuels and implementing carbon pricing. Existing business models and financing mechanisms can be deployed to unlock private sector financing for energy efficiency, such as energy service companies (ESCOs), utility on-bill financing, guarantees, insurance, credit lines, and revolving funds. Energy efficiency funds can also be established to provide reduced cost financing for firms and households to invest in energy efficiency since up-front costs may discourage some investors despite the longer-term savings. Behavioral measures have also been shown to be effective. These include indicating to households how their energy consumption compares with that of similar households and what measures they could take to improve efficiency. Finally, establishing standards and regulations on energy efficiency for new construction and appliances is important, as demonstrated by IFC's Sustainable Industries project in El Salvador and the energy efficiency program in Central America, which aim at establishing an integrated approach to promote energy efficiency from policy design to real sector investment, and financing through commercial financial institutions (Box 4).

Natural gas can be part of a net-zero power sector if coupled with carbon capture and storage, and measures to minimize flaring and fugitive emissions. A rapid transition from carbon intensive thermal generation to renewables may not be economically viable for all LAC countries, especially if it requires costly investments in energy storage. For midcycle and peak demand applications, gas-fired generation may remain a competitive option for some time. Gas power plants can be efficiently and rapidly started up and turned off to manage variability in electricity demand, support integration

¹¹¹ World Energy Outlook Special Report 2015: Energy and Climate Change.

Box 4: Energy Efficiency Program in Central America

In Central America, the WBG's Energy Efficiency Program supported a regional assessment that identified potential high-impact opportunities for improvements in energy efficiency (EE) and demand-side management (DSM) and evaluated their impact on the electricity system and consumers. In Panama, a comprehensive approach leveraged the advisory work on sectoral policies, regulations, and technologies with the potential mobilization of financial resources to deliver solutions led by both the public and private sectors.

The EE program supported the government of Panama to design and implement core regulations derived from its Energy Efficiency Law (Law 69). The analytical and advisory work developed informed the definition, approval, and successful implementation of minimum energy performance standards (MEPS) and a labeling program to promote efficient cooling appliances (mainly ACs and refrigerators), which are major drivers of electricity demand in the country. This work also supported the definition of a Green Building Code and a sustainable construction guide, pushing the Panamanian construction market to use higher standards on insulation and energy conservation. Complementing these technical and regulatory measures, a behavioral change strategy is being designed to adapt consumer habits and overcome the learning curve associated with new technologies and practices. With WBG support, an EE Fund was designed with a public-private partnership (PPP) approach to mobilize private capital at scale to enable a market transformation toward more energy efficient cooling appliances and buildings. The EE Fund aims to leverage the local banking sector and financial markets to develop a sustainable green capital market that facilitates bankable EE investments in Panama.

The WBG is now supporting Panama to develop its national Energy Efficiency Strategy, one of the main pillars of the country's Energy Transition Agenda, including priority lines of action, energy efficiency targets, and a roadmap for its implementation. Through this new engagement, the government of Panama aims to increase its climate change ambition by updating existing MEPS, creating new technical standards, and updating the labeling program to also integrate refrigerants as part of the overall strategy and in line with Panama Cooling Plan recently developed. This holistic approach can be replicated and scaled up in the LAC region, yielding savings while creating green markets and jobs.

of intermittent wind and solar energy, and improve the resilience of hydropower-dominated energy systems to variable and decreasing rainfall. That said, given that methane is itself a powerful greenhouse gas, it is crucial to not only capture and store CO₂ emissions from gas-fired power plants, but also take care to avoid pipeline leaks and other fugitive emissions.

3.6. Increasing Renewable Energy Penetration through Sector Coupling and Green Hydrogen

The decarbonization of the economy cannot be achieved without the electrification of end uses currently reliant on fossil fuels. This requires the coupling of planning, policy, and investments between power and end use sectors, combined with clean power generation. The electrification of transport, buildings, and heavy industry, together with the use of low carbon fuels, could enable the decarbonization of these hard-to-abate sectors. In the LAC region, it could support more sustainable

transport, mining, cement, and manufacturing sectors. However, electrifying these sectors will sharply increase demand for clean power. The electrification of end uses will also have an impact on peak load, while a higher share of solar photovoltaics and wind will increase the variability of the system. Sector coupling and the integration of energy systems will be critical to increase overall system flexibility and will enable energy systems to access more options for storage to balance fluctuating supply and demand. A mix of technologies, coherently planned and targeted investments, and the digitalization of processes to better synchronize supply and demand will be needed to decarbonize and interconnect the different sectors. A robust legal and regulatory framework will also be needed to ensure the appropriate governance of sector coupling; support grid expansion, energy systems coordination covering the operation of power generators, grids, and storage devices; and the adequate management of power flows; as well as the implementation of demand-side management strategies.

Improved legal and regulatory frameworks are critical to support deep decarbonization, adapt the energy system to new technologies, and enable greater private sector participation. Variable renewables are changing the dynamics of power markets, and system adjustments are required to ensure security of supply. Emerging technologies, such as storage solutions and green hydrogen, can play an important role to further support the integration of solar and wind, but developing an adequate legal and regulatory framework is critical to provide a set of rules for power sector operations and commercialization without compromising the security of the system. For example, the development of green hydrogen will require the adoption of safety standards for sustainable production, storage, transportation, and commercialization. A robust legal and regulatory framework will also be needed to ensure the appropriate governance of sector coupling, grid expansion support, smart grids, energy system coordination covering the operation of power generators, grids, storage devices, and the adequate management of power flows, as well as the implementation of demand-side management strategies. Other regulatory improvements are needed to scale up investments in low carbon technologies, such as strengthening PPP regulatory frameworks to attract private investment or promote direct uses of geothermal energy, adjusting to electricity tariff structures to incentivize clean investment without compromising power utility's financial viability, and supplying power system auction mechanisms. In addition, reducing gas flaring is a low-hanging fruit for the decarbonization agenda of oil producing countries in LAC, such as Brazil, Colombia, Ecuador, and Mexico.

Green hydrogen¹¹² can play a catalytic role in reducing GHG emissions as a low carbon fuel and by enabling greater integration of wind and solar power. Green hydrogen could decarbonize hard-to-abate sectors such as heavy industry, transport, and shipping. It can also provide a long-term energy storage solution to ensure a steady electricity supply as more variable renewables are introduced, thus enabling a faster transition. LAC countries with abundant renewable energy resources could produce green hydrogen locally, generating economic opportunities and increasing energy security by reducing exposure to oil price volatility and supply disruptions. Chile has tremendous potential to produce green hydrogen, with the International Energy Agency labeling it the “Hidden Champion” in 2019, estimating that Chile could produce 160 million tons per year. Chile's Coordinador Eléctrico Nacional estimates that today in optimal sites, large-scale solar and wind have a levelized cost of energy of US\$25/MWh, which would allow Chile to be one of the most competitive countries in the world to produce green hydrogen.

¹¹² Green hydrogen is hydrogen fuel that is created using renewable energy instead of fossil fuels and is distinct from blue hydrogen, which is created from fossil sources with carbon emissions captured and stored.

Innovative financing, de-risking mechanisms, and market-based instruments will be critical in channeling the financing required while leveraging private sector participation and maximizing scarce public resources. Low carbon technologies have higher up-front capital expenditures than other solutions, so support from development finance institutions and concessional funds can play an important role in accelerating the uptake of these technologies. Innovative cofinancing and concessional funds could support first-of-a-kind green hydrogen projects in LAC countries such as Chile, Argentina, Costa Rica, or Colombia. Investors could use commercial financing for renewable power projects such as wind and solar assets dedicated to producing green hydrogen, benefiting from blending with concessional funds to reduce the financing cost of the electrolysis plant. De-risking mechanisms can also catalyze private sector participation (box 5). In countries such as St. Lucia, El Salvador, and Nicaragua, successful geothermal development has relied on public sector investments for the riskier exploration phase, with private sector investors entering once the resource risk has been mitigated.

Box 5: Innovative Financing and Market-Based Instruments

Guaranteeing products that leverage the WBG's credit rating allow "crowding-in" private sector and leveraging different sources of financing that may not have been available otherwise due to the risk profile of the project. In Argentina, the WBG's Renewable Fund Guarantee Project (FODER) aimed at mitigating the risk perceived by financiers to foster private sector investment in the development of renewable energy. FODER has become a model for maximizing financing by attracting international private investment in a challenging environment. In Panama, the WBG also supported the conceptual design of an Energy Efficiency Fund (UREE Fund) that aimed at leveraging the local banking sector and financial markets, through a WBG guarantee, to develop a sustainable green capital market that facilitates bankable EE investments.

3.7. Decarbonizing Transport Systems

More than one-third of energy-related greenhouse gas emissions in LAC come from transport due to the high amount of fossil fuels consumed across the sector.¹¹³ By 2050, the regional motorization rate is expected to triple, exceeding 200 million vehicles,¹¹⁴ with regional demand for freight transport estimated to double by 2050.¹¹⁵ Transitioning to zero-carbon transport is essential to slow climate change, and it can also improve quality of life. Transitioning from fossil fuels to electric mobility could create new jobs and economic opportunities, especially if supported by a strong partnership between the transport and energy sectors. Modernizing freight transport also offers big wins. For instance, powering ships with fuels such as ammonia and hydrogen, rather than fossil fuels, would not only reduce emissions but could help many countries break into the zero carbon fuel market while modernizing energy and industrial infrastructure. Modern, well-located distribution centers also enable the reduction of transportation costs and associated emissions of the associated fleet, lowering idle times at the centers, optimizing the number of deliveries, reducing time to destination, and allowing for higher-scale distribution.

¹¹³ WB. 2021. Transitions at the Heart of the Climate Challenge.

¹¹⁴ UNEP, EU. Movilidad Eléctrica—Oportunidades para Latinoamérica.

¹¹⁵ UNEP. Zero Carbon: The opportunity, cost, and benefits of the coupled decarbonization of the power and transport sectors in Latin America and the Caribbean.

Decarbonization of passenger transport should focus on curbing the growing motorization rate by investing in cleaner modes. Transport of passengers accounts for some 45 percent of total emissions from transport, dominated by emissions from fossil-fueled cars and motorcycles. The motorization rate in LAC was 58 percent for the 2005–2015 period, far above the global average (at 27 percent). At the same time, LAC has one of the lowest levels of rail passenger transport, and despite being highly urbanized has a low rate of mass transit provision. The priority of most countries in LAC should be to invest in cleaner transport modes (such as rail, bus, cable cars, or nonmotorized transport) to incentivize the shift of people away from private vehicles and polluting modes. Commuter rail and long-distance passenger rail (almost nonexistent in LAC) may have a role to play, while continuing to prioritize mass transit systems and nonmotorized transport at the city level (see box 6; specific actions on urban transport are discussed further under Cities, below). These investments will deliver multiple co-benefits, such as improved accessibility, social inclusion, and reduction of congestion, pollution, and road accidents.

Box 6: Mitre Passenger Railway Line Modernization Project

Buenos Aires emits about 12 Mt CO₂e a year, about 30 percent from the transport sector. Under the 2020 Climate Action Plan, the Argentinian capital established sustainable mobility as one of the three pillars. To support the implementation of the plan, World Bank provided financing to the Ministry of Transport in Argentina for the Buenos Aires–Mitre Passenger Railway Line Modernization Project.

With the electrification and upgrade of the railway system on the Retiro–Progreso branch, the project will promote low carbon transport by discouraging the use of private vehicles, and will also support the integration of different modes of sustainable transport, such as bicycles and the Metrobus, resulting in estimated reductions of 5,000 tCO₂e per year. It will also adopt standards for the design of more than 30 km of climate-resilient infrastructure and will incorporate disaster risk management systems. Overall, it seeks to improve urban transport for more than 2.4 million citizens and to benefit low-income users who regularly use public transport to travel to work or for other activities.

E-mobility programs are gaining momentum in most countries in LAC, with a great potential to reduce emissions from transport of passengers. LAC countries have deployed several e-mobility initiatives; 11 have developed charging station corridors, and electric bus systems are either functioning or forthcoming in 13. However, the region still faces challenges to facilitate a successful transition to e-mobility, including the adoption of regulatory frameworks to align incentives for private investment and to boost the purchase and use of electric vehicles. Examples of regulatory incentives for broader e-mobility include tax exemptions for purchase or import of electric vehicles, reduction of subsidies for fossil fuels, and tighter emissions standards. As discussed above, sector coupling considerations should form an important element of e-mobility strategies, which should carefully consider the country's electricity generation matrix and the additional pressure on electricity demand.¹¹⁶

Fossil-fueled road transport is the predominant freight mode in the region, with a minimal presence of cleaner modes or clean-fuel trucks. Nearly 75 percent of domestic freight in the region

¹¹⁶ Fransen, T., et. al. 2019. "Enhancing NDCs: Opportunities for Transport." Working Paper. Washington, DC: World Resources Institute.

is transported by fossil-fueled trucks, with limited penetration of cleaner modes such as railways, inland waterways, or electric freight vehicles, and just a few countries consolidated railways systems, such as Mexico or Brazil. Decarbonizing the freight transport system should include infrastructure investments in cleaner transport modes (railways, waterways, EVs), while improving the existing road infrastructure may support the reduction of emissions of the freight transport sector by reducing traffic congestion, fuel consumption, and trade logistics costs. The participation of the private sector through PPPs, results-based concession agreements, and investments in maintenance and rehabilitation will be critical in a context of generalized budget constraints and can bring efficiency gains in the management of the countries' transport infrastructure.

Recent reforms in railways have proven successful and increased their potential as an alternative to road transport, but they remain underutilized and underdeveloped in most LAC countries. Few have consolidated railway systems, with regional rail freight transport representing less than 20 percent of the total freight transport in the region, mostly in Mexico and Brazil. Although rail freight transport has more than doubled in the past 20 years, thanks to liberalization reforms of the 1990s, railways in LAC are mostly underutilized, with low density and low traffic, challenging the financial sustainability of the capital investment. Investment and further reforms are still needed in the sector to support the transition to green logistics. This may include establishing commercial exclusivity, improving multimodality, and developing financial mechanisms to ensure the viability of small and medium operators.

Fluvial and inland waterway transport is the most energy efficient method of freight transportation for moving bulk raw materials. It is much more efficient to move goods over water than over land. An analysis of rail and waterway fuel efficiency indicates that the average energy used per ton-mile is about 38 percent lower for water transport. Some countries (for instance, Colombia, with its Magdalena River traversing the country from south to north) have a significant unutilized capacity for water transport. The cargo capacity of a barge is 15 times greater than a rail car and 60 times that of a tractor-trailer. Water transport also has lower accident rates than trucks or railways, does not suffer from congestion problems, and involves less urban exposure, all factors that reduce the number and environmental impact of waterway incidents.

Decarbonizing the trucking industry in LAC is complex but necessary to decarbonize the freight transport sector. The trucking sector in LAC involves a large number of informal operators. The fleet is generally old (averaging 14–17 years, compared with 11.7 in the EU), and there are inefficiencies, as reflected in empty truck rates of 40–50 percent. This translates into high emission rates and a complex sector to decarbonize. Measures to mitigate emissions in the trucking industry may include fleet renewal programs, stringent emissions standards, programs for eco-driving, and incentivizing of the digitalization of the sector. Such measures have multiple co-benefits, including increased efficiency, productivity, and improved road safety. In Argentina, the “Plan Canje Camiones” estimates a reduction of 300 Mt CO₂ a year.¹¹⁷ Even in countries with consolidated railway systems, the decarbonization of the trucking industry is necessary to reduce the emissions of the entire supply chain, as trucks ensure last-mile connectivity and transfer between modes. In the longer term, the development of new fuels, such as hydrogen or ammonia, may accelerate the decarbonization of the trucking sector.

¹¹⁷ República Argentina, Ministerio de Ambiente y Desarrollo Sustentable de la Nación. Plan Nacional de Mitigación del sector Transporte. Octubre 2017.

This effect would be further reinforced by greening of transport fleets across the region through support for the manufacture of green-powered trucks and barges. Truck manufacturers (e.g., Volvo in Curitiba, Brazil) are interested in converting to electric vehicles if a local manufacturing and supply chain of electric vehicle batteries could be integrated, representing an important opportunity to enable such an industry and support regional transformation. Supporting agricultural-based biofuel development in countries such as Haiti, the Dominican Republic, and Jamaica could support existing transport and energy needs while greatly reducing imports (and the balance of trade and current account benefits) while revitalizing degraded lands and creating local jobs and industry.

In the near term, improving the existing road infrastructure will support the reduction of emissions of the freight transport sector by reducing traffic congestion, fuel consumption, and trade logistics costs. Indeed, ensuring high quality road networks can serve as an intermediate step toward the adoption of cleaner transport systems. The participation of the private sector through PPPs, result-based concession agreements, and investments in maintenance and rehabilitation will be essential in a context of generalized budget constraints and can bring efficiency gains in the management of the countries' road infrastructure. At the same time, rehabilitating road infrastructure can include important climate adaptation characteristics to account for changing climate or heavy precipitation conditions.¹¹⁸

3.8. The Circular Economy Transition for Sustainable Manufacturing

With industrial processes, manufacturing, and construction contributing some 10 percent of GHG emissions in LAC, engagement in the manufacturing sector can make a significant contribution toward achieving pathways to net zero. Targeting larger manufacturing hubs with significant GHG emission profiles, such as heavy industries in Brazil and Mexico, the cement sector in Colombia and Peru, and agro-production and processing in Argentina or Central America, may lead to a material reduction in manufacturing's carbon footprint across the region. A transition to a circular economy (CE) based on reducing, reusing, recycling, reprocessing, redesigning, and resource recovery can save valuable materials, energy, and water resources and cut waste, while reducing GHG emissions. Such a transition requires the development of an efficient, inclusive, and sustainable solid waste management system that supports circularity.

As well as being a climate imperative, sustainable manufacturing is also increasingly demanded by consumers and can make good business sense. In LAC, in addition to national strategies, a Regional Coalition on Circular Economy was announced in 2019 by environment ministers to develop a common vision and strategy on circularity. Shifts are apparent in the growing share of consumers willing to pay for circular goods, with the sharing economy market expected to grow twenty-five-fold between 2015 and 2025.¹¹⁹ In addition, technology and automation are changing production and service models—for example, by allowing the use of recycled content or production of advanced materials that do not require virgin extraction of natural resources.¹²⁰ Bank lending, project finance, and insurance also show evidence of increasing circular activity, with several global banks incorporating CE principles as core to their business and starting advisory services for their clients. Venture capital has become active as well, with startups developing plastic alternatives raising more than US\$850

¹¹⁸ As targeted, for example, through IFC's recent municipal finance support of pluvial drainage infrastructure for the road network in the City of San José, Costa Rica.

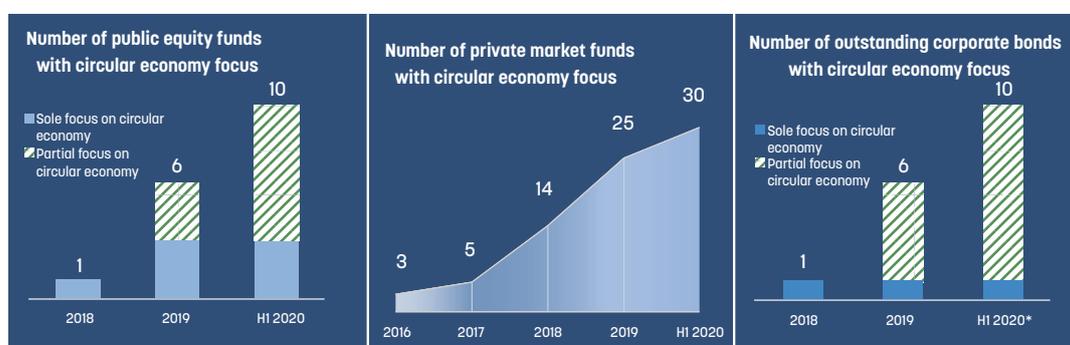
¹¹⁹ Sharing or Paring—Growth of the Sharing Economy, PwC, 2015.

¹²⁰ BMW is producing dashboards from recycled bottles.

million in funding in the last three years. The number of public equity funds investing globally in CE has grown from one to ten between 2018 and 2020, representing US\$300 million of assets under management (figure 19).¹²¹ Further, in the first one-half of 2020, on average these funds performed 5 percentage points better than their Morningstar category benchmarks, indicating how the circular economy can deliver excess returns.¹²²

The smart use of digital technologies can serve as a key enabler for climate action and environmental sustainability. In addition to their role in building climate resilience by monitoring weather events and providing warnings of extreme events,¹²³ information and communication technologies (ICTs) can play an important role in improving energy and resource efficiency, facilitating CE solutions.¹²⁴ ICTs can help drive down GHG emissions by improving efficiency in networks and equipment. They could reduce GHG emissions by up to 20 percent by enabling companies and consumers to use energy more intelligently.¹²⁵

FIGURE 19: Financing the Circular Economy



Source: Financing the Circular Economy, Ellen MacArthur Foundation.

3.9. Contribution to Recovery and Development: Employment and Competitiveness through Investment in Resilient, Low Carbon Infrastructure

Investments to decarbonize energy and transport systems and increase their resilience can generate job opportunities in the near term, supporting pandemic recovery while building the foundation for longer-term growth. The maintenance of infrastructure assets to build resilience to climate shocks can catalyze job creation,¹²⁶ and recent evidence indicates that renewable energy could generate more jobs per unit of public investment than fossil fuel sectors.¹²⁷ Fiscal stimulus measures for COVID-19 recovery are expected to globally generate investments in renewables and other energy transition technologies worth US\$2 trillion in 2021–2023, reaching an annual investment of US\$4.5 trillion by 2030, with 25 jobs in renewables and 10 in efficiency created for every US\$1 million invested.¹²⁸

¹²¹ Financing the Circular Economy, EMF.

¹²² Future research will be required to see whether outperformance persists over time.

¹²³ WB. 2021. Promoting Climate Change Action in Latin America and the Caribbean.

¹²⁴ European Commission. 2020. A green and digital transformation of the EU.

¹²⁵ Inter-American Development Bank (IDB). 2018. Technology for Climate Action in Latin America and the Caribbean: How ICT and Mobile Solutions Contribute to a Sustainable, Low-Carbon Future.

¹²⁶ The World Bank. 2021. "Well maintained: Economic benefits from more reliable and resilient infrastructure." May 2021. Available at: <https://library.pppknowledgelab.org/documents/6031/download>.

¹²⁷ Saget, Catherine; Vogt-Schilb, Adrien; Luu, Trang (2020) : Jobs in a Net-Zero Emissions Future in Latin America and the Caribbean, ISBN 978-92-2-133158-2, Inter-American Development Bank and International Labour Organization, Washington D.C. and Geneva. <https://doi.org/10.18235/0002509>.

¹²⁸ El papel de la transición energética en la recuperación sostenible de América Latina y el Caribe, IADB.

Energy efficiency measures for appliances, industries, buildings, and transport can be rapidly deployed and scaled up, attracting private sector investment while delivering job creation and industrial productivity. Energy efficiency investments are among the cheapest and cleanest energy resources available, allowing the deferral and displacement of other costlier options to meet energy demand, provide fiscal savings, and reduce energy use and emissions. Energy efficiency has a central role to play in governments' clean energy stimulus spending in post COVID-19.¹²⁹ In addition, the gains in energy efficiency in the region will contribute to fiscal savings through reductions in energy and fuel subsidies, including fiscal transfers to distressed public utilities. These freed-up resources can be utilized to finance socioeconomic development and programs for the most vulnerable populations.

Climate-adaptive and resilient infrastructure is cost-effective and critical to support competitiveness and growth. Investing in the climate resilience of energy and transport infrastructure systems can reduce the life-cycle cost of assets by reducing needs for rehabilitation and repair, provide more reliable services to households and access to essential services such as health, and enable firms to be more productive.¹³⁰ The energy transition is an investment and employment opportunity for LAC. Low carbon solutions are becoming increasingly cost-effective and attractive as an investment opportunity, with the IFC estimating that the market for lowcarbon investments in Argentina, Brazil, Colombia, and Mexico, mainly focused in the energy sector, could reach US\$1.3 trillion between 2020 and 2030, with the potential to create 27.1 million new direct jobs.¹³¹

Clean electricity and transport systems also have high social co-benefits. Decarbonization of transport by promoting cleaner modes such as mass transit, electric buses, or nonmotorized transport have high health and social co-benefits, especially in urban areas, by reducing local air pollution, congestion, poor accessibility, road accidents, and social exclusion.

In countries that import fossil fuels, decarbonizing the energy system and transport will improve the balance of payments and reduce currency risks associated with fossil fuel price volatility. Caribbean countries, and particularly the members of the Organisation of Eastern Caribbean States (OECS), are heavily dependent on imported oil. This imposes macroeconomic, fiscal, and household-level burdens that reduce competitiveness and welfare. In 2012, average electricity costs in the Caribbean represented 9.0 percent of GDP, compared with 2.5 percent in the United States. Moving away from fossil fuels will also reduce the scale of and demand for fuel subsidies, releasing resources to fund social programs in line with long-term development goals. Across the LAC region, countries are exploring different options to reduce the fiscal impact of fuel subsidies, target them better, and steer them away from fossil fuels and toward cleaner energy sources.

129 Sustainable Recovery Plan. IEA.

130 Hallegatte et al. 2019. "Lifelines: The Resilient Infrastructure Opportunity." Available at: <https://openknowledge.worldbank.org/handle/10986/31805>.

131 A green reboot for emerging markets. IFC.

3.10. Priority Actions for Energy and Transport Systems

Table 3 highlights, by country, potential areas for new WBG support in LAC's energy and transport systems under five entry points identified based on the assessment presented above: (i) building the resilience of energy and transport systems; (ii) decarbonizing power; (iii) catalyzing private investment in renewables; (iv) supporting the transition to green transport; and (v) leveraging transition opportunities, in particular in the form of development of low carbon fuels (including hydrogen and ammonia) and lithium resources. More details on country-specific actions (of which there may be several for each country for a given entry point) are provided in the country climate change snapshots that accompany the LAC Roadmap.

The table distinguishes between these actions in three dimensions:

1. between those already incorporated in the WBG portfolio (either under implementation or included in the pipeline of operations) or that are adequately supported by non-WBG programs, and those that would be new (either under discussion or aspirational, including potential operations to scale up existing initiatives);
2. between those new actions that would be aligned with current government priorities and those that would not; and
3. also highlights those new actions that are urgent, in the sense that delay would significantly increase their cost. In the context of energy and transport systems, urgent actions are identified as those necessary to avoid the lock-in of carbon-intensive infrastructure or to reduce the vulnerability of infrastructure already highly exposed to climate-related extreme events.

The impact of extreme climate events on infrastructure costs more than 1 percent of GDP annually in Costa Rica, the Dominican Republic, Guatemala, Haiti, Honduras, Panama, and Paraguay. In Bolivia the impacts of intense rainfall events are becoming increasingly severe. As table 3 indicates, new WBG support is urgently needed in these countries to reduce infrastructure vulnerability and build resilience.

New WBG support to decarbonize power is a priority in Mexico and Brazil, which account for more than one-half of regional emissions from this sector, as well as in Bolivia, Colombia, the Dominican Republic, and Peru. These countries are among the top 10 regional emitters from the power sector, and the need for action is urgent to avoid the lock-in of carbon-intensive systems. Enhancing private renewables investment is also an urgent priority in Brazil, Colombia, Ecuador, and Paraguay.

New WBG engagement to support the greening of transport is a priority in Brazil, which accounts for a one-third of regional emissions from this sector, as well as in Argentina, Colombia, the Dominican Republic, Ecuador, Guatemala, and Paraguay. These countries are among the top 10 regional emitters from the transport sector, and urgent action is required to avoid the lock-in of carbon-intensive transport systems.

New WBG support to seize opportunities associated with the development of low-carbon fuels and lithium resources is a priority in Argentina, Bolivia, Brazil, Costa Rica, Ecuador, Guyana, Panama, Peru, and Uruguay.

Table 3: Priority Actions for Energy and Transport Systems¹³²

	Build System Resilience	Decarbonize Power	Catalyze Private Renewables Investment	Transition to Green Transport	Leverage Transition Opportunities
Argentina	●	●	●	*	●
Belize	●	●	●	—	—
Bolivia	*	*	●	●	●
Brazil	●	*	*	*	●
Colombia	●	*	*	*	—
Costa Rica	*	●	●	●	●
D. Republic	*	*	●	*	—
Ecuador	—	●	*	*	●
El Salvador	●	●	●	—	—
Guatemala	*	●	—	*	—
Guyana and Suriname	—	—	—	—	●
Haiti	*	●	●	●	—
Honduras	*	●	●	—	—
Jamaica	—	●	●	●	—
Mexico	—	*	●	*	—
Nicaragua	●	●	●	●	●
Panama	*	●	●	—	●
Paraguay	*	●	*	*	—
Peru	●	*	●	—	●
Uruguay	●	●	●	●	●
Caribbean SIDS*	●	●	●	—	—

Source: WBG LAC Roadmap team development.

Note: SIDS = small island developing states, which include Saint Vincent and the Grenadines, Dominica, Grenada, St Lucia St Maarten, and Barbados.

Key:

- * Urgent area for new WBG engagement aligned with government priorities
- Area for new WBG engagement aligned with government priorities
- * Urgent area for new WBG engagement not aligned with current government priorities
- Area for new WBG engagement not aligned with current government priorities
- Existing WBG or adequate other engagement

¹³² Actions reflect the input from a consultative process with WBG Country Management Units and sector experts.



4. Cities

Latin America is one of the most urbanized regions in the world, so its decarbonization and resilience agendas are closely tied to urban climate action. As of 2020, an estimated 81 percent of people in the LAC region lived in urban areas, which produced one-third of regional GHG emissions.¹³³ Urban areas thus concentrate the causes of climate change as well as its impacts, particularly on poor and marginalized people. The priority is to make cities more resilient to climate shocks and to reduce GHG emissions by decarbonizing urban systems and making them more efficient, contributing to growth and well-being.

4.1. Climate Change Impacts

Across LAC, most asset and human losses from flooding and hurricanes happen in cities. Estimates suggest that as much as 80 percent of total losses caused by disasters in Latin America occur in urban areas.¹³⁴ Coastal cities and urbanized areas are also threatened by sea level rise, and 60 of the 77 most densely populated cities in the region are coastal. In the Caribbean, where beach resorts are major tourist attractions, 13 percent of hotels near the shore are projected to experience beach loss in a moderate climate scenario, which would reduce tourism revenue by 17 percent by 2050.¹³⁵ In many cities in LAC, rapid urbanization has led to the emergence of large, densely populated informal settlements, often in areas that are highly exposed to the impacts of climate change and that lack infrastructure for basic services such as water, sanitation, and electricity. Inadequate strategic planning or land-use management heighten the risks.¹³⁶

Climate shocks and stresses in rural areas also cause vulnerable communities to migrate to cities, putting further pressure on city services and land availability. With rural livelihoods threatened by land degradation, loss of agricultural productivity, drought, and rainfall variability as a result of climate change, traditional livelihoods are becoming unviable. Migration to urban areas can be gradual, as a result of long-term stress, or sudden, after a shock such as a flood. An example is Uru Chipaya, an Indigenous community in Bolivia that has lived for 4,000 years in the southwest highlands, but is now affected by reduced river flow, forcing people to migrate to urban areas to survive, leaving fewer than 2,000 people in the current settlement.

4.2. Emissions Reduction Challenges

Cities in LAC consume 80 percent of the region's energy¹³⁷ and produce one-third of its GHG emissions. GHG emissions in cities come from vehicles, the use of energy for heating and cooling buildings, electric lighting for streets and buildings, industrial processes, waste and wastewater management, and embodied carbon in urban infrastructure. Transport is one of the highest emitting sectors in urban areas,

¹³³ United Nations Population Division. World Urbanization Prospects: 2018 Revision.

¹³⁴ Max Watanabe. N.d. "URBAN DISASTER RISK MANAGEMENT IN LATIN AMERICAN CITIES." Available at: https://assets.publishing.service.gov.uk/media/57a08a08e5274a31e00003b2/130617_ENV_DisRisManCit_GUIDE.pdf.

¹³⁵ Rozenberg, J, Browne, N, De Vries Robbé, S, Kappes, M, Lee, W, and Prasad, A. 2021. 360° Resilience: A Guide to Prepare the Caribbean for a New Generation of Shocks. Washington, DC: The World Bank.

¹³⁶ Regionally, 27 percent of urban dwellers live in slums.

¹³⁷ IPCC, AR5 "Climate Change 2014: Mitigation of Climate Change". 2014. Available at: <https://www.ipcc.ch/report/ar5/wg3/>.

ranging from 61 percent of emissions in São Paulo,¹³⁸ 38 percent in Bogotá,¹³⁹ and 30 percent in Buenos Aires.¹⁴⁰ Urban expansion may also reduce green cover that would otherwise act as a carbon sink. As cities continue to expand, with demand for passenger transportation and emissions from waste both growing even faster, the urban share of regional emissions is expected to increase.

However, the agglomeration benefits of urban concentration offer economies of scale that can make investments in urban emission reductions more cost-effective than in rural settings. This is particularly true for measures to decarbonize transport, improve the energy efficiency of buildings, and reduce emissions from waste. Continued high rates of urbanization offer an opportunity to ensure that new urban planning and investment take full advantage of these possibilities, which also offer a range of health and quality of life co-benefits.

4.3. Avoiding Irreversibility: Urban Sprawl Can Increase Climate Risks and Lock-In Emissions

Irreversibility is a significant consideration in urban planning, with land-use and infrastructure decisions affecting growth patterns for years to come. With such long-term consequences in mind, urban planning and investment need to avoid locking in risks of flooding, landslides, and other climate shocks, while reducing the energy intensity of buildings and infrastructure, establishing patterns of mobility that prioritize low emission public transit and nonmotorized transport, and incorporating green spaces to act as natural flood buffers and reduce the impact of extreme heat. In fast-growing cities, investing in mass transit infrastructure early on as part of a comprehensive climate change action plan may help contain urban sprawl and create cities with positive agglomeration benefits, reducing dependence on private vehicles and curbing the demand for motorized transport. The result would be greener, lower emission, healthier urban areas.

4.4. Building Urban Resilience to Reduce Asset and Well-Being Losses

Land-use and urbanization plans need to be risk sensitive and prioritize compact urban development. The large spatial scale of some risks, such as hurricanes, droughts, and earthquakes, makes it difficult to avoid development in exposed locations. However, land-use regulations can help reduce exposure to more concentrated risks, such as floods and landslides, by ensuring that new development occurs in places that are relatively safe or can be protected at a relatively low cost. They can also avoid unchecked urban development that leaves too little green space, as large impervious areas increase runoff and flood risks.¹⁴¹ Good urban planning, with high density and accessibility, can also deliver large co-benefits in the form of lower infrastructure costs.

Implementing risk-based land-use plans requires strong institutions that can ensure that land-use plans are enforced. The asymmetry between the costs and benefits of risk-sensitive land use planning makes this challenging, however, with the costs of zoning being immediate, visible, and concentrated in the form of reduced land values, while the benefits are invisible, delivering avoided

¹³⁸ PLANCLIMASP —Plano de Ação Climática do Município de São Paulo 2020–2050. Prefeitura do Município de São Paulo, 2021.

¹³⁹ Proyecto de implementación de un sistema de transporte de bajas y cero emisiones para Bogotá y la región. https://www.movilidadbogota.gov.co/web/sites/default/files/Paginas/20-05-2020/proyecto_de_implementacion_de_un_sistema_de_transporte_de_bajas_y_cero_emisiones_para_bogota_y_la_region.doc.pdf.

¹⁴⁰ *Plan de Acción Climática 2050*. Ciudad de Buenos Aires, 2020.

¹⁴¹ Lall V, Somik and Uwe Deichmann. 2012. "Density and Disasters: Economics of Urban Hazard Risk." February 2012. Available at: <https://academic.oup.com/wbro/article-abstract/27/1/74/1725874>.

losses for broad groups of people.¹⁴² Framing zoning in a positive way and making risk information widely and freely available can help overcome these political economy issues by mapping safe underdeveloped areas, ensuring that public and private decision-making draws on the best available risk information, and steering development toward the safer areas through provision of infrastructure and other services. Beyond emergency alerts and response planning, security of tenure is needed to promote investment in the physical resilience of homes. Where tenure is secure, building regulations are important in guiding resilient construction, with effective approaches combining national frameworks and processes for updating building codes with local implementation mechanisms—capacity that is also required to update building codes for energy efficiency enhancements to deliver emissions reductions.

Building urban resilience cost effectively will often entail combinations of green and grey infrastructure. Examples of green infrastructure solutions include catchment management to regulate runoff (reducing both flooding and drought), revegetation to stabilize steep slopes, creation of urban wetlands and other green spaces to serve as buffers from flooding, and reestablishment of mangroves and other coastal vegetation to protect against storm surges. For example, Panama City relies on a fragile coastal ecosystem of mangroves and green buffers as part of its resilience strategy, but protection against urban sprawl and rising sea levels will be key for future-proofing the city. A strategic flood risk assessment carried out for the Tocumen River basin, located to the east of Panama City, suggests that climate change impacts under a business-as-usual scenario, with uncontrolled urban expansion continuing to encroach upon mangrove areas and river flood plains, would lead to total annual losses due to floods increasing more than sevenfold by 2050. This scenario can be avoided through targeted conservation and restoration measures for coastal and riparian floodplains, which would mitigate the impacts of future planned developments in the basin.¹⁴³ Investing to protect the most vulnerable also means refocusing cost-benefit assessments to take into account the well-being effects of asset losses, rather than focusing investment solely on areas of high asset value.

Integrating nature into mainstream infrastructure systems can result in lower costs while contributing to resilient services and mitigating climate change risks. Nature-based solutions (NBS) is an umbrella concept covering a range of ecosystem-based approaches that provide human well-being and biodiversity benefits. A hierarchy can be used to prioritize the NBS investments: first, strengthen the protection of the existing ecological structure of a city, sustaining benefits and biodiversity; second, restore and rehabilitate existing NBS, such as abandoned, encroached, or polluted green spaces; and third, develop green or natural infrastructure by creating new NBS, providing resiliency benefits and co-benefits to communities. NBS offer an opportunity to deliver services at a relatively low cost while reducing risks related to extreme events, reducing pollution, protecting ecosystems, and often reducing GHG emissions. In the case of water services, NBS can increase water retention, storage, and drainage, depending on the risks that the municipality is trying to address. The NBS approach can tap into many different solutions spanning from efficiency improvements to increased productivity, and includes solutions such as green roofs, retention ponds, natural parks, bio-retention areas, and urban farming.

¹⁴² Viguie Vincent, and Stephanie Hallegatte. 2012. "Tradeoffs and synergies in urban climate policies." March 4, 2012. Available at: <https://www.nature.com/articles/nclimate1434>.

¹⁴³ Sanahuja et al. 2021. "Urban planning and nature-based solutions, keys for reducing flood risk in Panama." February 23, 2021. Available at: <https://blogs.worldbank.org/latinamerica/urban-planning-and-nature-based-solutions-keys-reducing-flood-risk-panama>.

In addition to zoning and investment to reduce exposure to hazards, early warning systems and disaster preparedness have important roles to play in building urban resilience to residual risks. National preparedness funds are important to incentivize and finance preparedness actions at the local level. A good regional example is Mexico's National Preparedness Fund, FOPREDEN, which supports preparedness activities as part of a comprehensive national disaster risk management strategy.

4.5. Leveraging the Emission Reduction Opportunities of Urban Concentration

Many dimensions of the built environment can affect urban GHG emissions, including population density, land-use patterns, the configuration of street networks, and the materials and orientation of buildings.¹⁴⁴ Denser cities generate lower per-capita emissions by reducing the length of vehicular trips and enabling more trips to be made using nonmotorized transport. Greater density around public transportation nodes makes mass transit more viable. Density also requires less infrastructure per capita (such as buildings, roads and bridges, pipes for water and sewage, and electric transmission infrastructure), generating lower embodied emissions per capita. Density in the form of lower consumption of floor space per capita also reduces energy used in heating and cooling buildings. In Latin America, it is estimated that the impact of higher density in reducing energy demands for heating and cooling is about equivalent to the impact of improvements in building energy efficiency.¹⁴⁵ Mixed use development also increases proximity between residences, jobs, retail, and other destinations, which reduces vehicular trip length and encourages walking and bicycling, in turn reducing vehicular emissions.

Local governments can encourage urban density through zoning and building regulations, and strategically locating public infrastructure and amenities such as roads, schools, and parks, as well as through policy tools, such as incentives for infill development taxation, applying a vacant land tax, and varying property taxes by building type. Compared to cities with limited access highways, large blocks, and cul-de-sacs, a city with a grid-like street network with frequent intersections reduces the length of routes between origins and destinations, lowering vehicular emissions. Buenos Aires and São Paulo are good examples of cities that prioritize densification and walkability in their urban development plans. An analysis carried out in Mérida, Mexico, to gauge the impact of inefficient land-use plans and urban sprawl on GHG emissions found that compact urban growth with infill development, public transportation investments, alignment between jobs and housing, densification, and scaling down of blocks, could reduce GHG emissions by 40 percent by 2030.¹⁴⁶ Tools, such as the IFC's Advanced Practices for Environmental Excellence in Cities (APEX) application, harness data insights from green practices around the world to help cities chart paths to a carbon neutral future, assisting planners in making cities more sustainable in key dimensions, including energy, water, waste, and public transport.

Significant new construction and efforts to improve the quality of housing offer opportunities to build energy efficiency into the design of new and improved buildings. Energy efficiency investments are among the cheapest and cleanest energy resources available, allowing the deferral and displacement of other costlier options to meet energy demand, providing fiscal savings, and

¹⁴⁴ World Bank. 2021. City Climate Finance Gap Fund— Primer on Urban Form and Greenhouse Gas Emissions. Draft Technical Note.

¹⁴⁵ Burak Güneralp et al. 2017. "Global Scenarios of Urban Density and Its Impacts on Building Energy Use through 2050." Proceedings of the National Academy of Sciences 114, no. 34 (August 22, 2017): 8945–50, <https://doi.org/10.1073/pnas.1606035114>.

¹⁴⁶ Mario Molina Center. 2014. "Sustainable Cities: Merida Growth Scenarios and Sustainable Urban Development Models." http://centromariomolina.org/english2/wp-content/uploads/2014/08/1.-Sustainable-cities_Merida_EN.pdf.

reducing energy use and emissions. Mexico stands out as a leader in incorporating energy efficiency standards through its public housing support programs. INFONAVIT, the region's largest mortgage lender, introduced the "Green Mortgage Product" in 2009, which incorporates the use of energy efficient appliances, solar water heaters, minimum isolation requirements, and compact fluorescent lamps in the purchase of the home and has since become an industry-wide standard. Initiatives in support of a green construction market (box 7) can lead to reduced electricity bills for low-income families, healthier homes, and lower emissions.

Box 7: Supporting a Green Construction Market

In Buenos Aires, the transformation of Villa 31, an iconic settlement in the heart of the city to provide adequate and affordable housing, incorporated energy efficiency measures to reduce consumption and emissions. It lowered electricity use—and households' costs—by modernizing insulation, heating, and cooling systems. Street lighting was also made more energy efficient. The Center for Entrepreneurial and Labor Development, an integral part of this upgraded neighborhood, and several upgraded homes for low-income people financed under a World Bank operation, received the EDGE green building certification¹ for using 20 percent less energy, water, and embodied energy in materials than the benchmark standard buildings in the city.²

Investments to increase access to financing for affordable housing (such as those supported by the WBG in Mexico) can also contribute to reducing CO₂ emissions by funding mortgages with energy savings potential, while investments directly financing housing developers and commercial property owners in the region that adhere to global green building standards, combined with training for EDGE certification, can support development of the green construction market.

Financial institutions have a key role to play in mobilizing resources for the development of green buildings. Successful examples include IFC's efforts to develop the green building and mortgage market in Colombia through a multistakeholder approach that included the design of green building regulations in partnership with the local Chamber of Construction, the promotion of the EDGE certification for developers, and collaboration with commercial banks to leverage the business opportunity through differentiated value propositions. This holistic approach enabled financial institutions to mobilize green funding from the capital markets to finance green buildings and mortgages.

- ¹ An innovation of IFC, the Excellence in Design for Greater Efficiencies (EDGE) is a green building certification system focused on making buildings more resource efficient.
- ² Bosi Martina, and Beatriz Era Puig. 2017. "From slums to neighbourhoods: How energy efficiency can transform the lives of the urban poor." May 25, 2017. Available at: <https://blogs.worldbank.org/energy/slums-neighborhoods-how-energy-efficiency-can-transform-lives-urban-poor>.

IFC estimates a climate investment potential of US\$5 trillion in LAC cities to 2030, representing the second highest regional potential in a global climate investment opportunity of US\$29.4 trillion across six urban sectors in emerging market cities (table 4). The lion's share of the opportunity is in green buildings (US\$4.1 trillion), covering both new construction and retrofits, as cities race to accommodate their growing populations.¹⁴⁷ With roughly one-fourth of the region's urban population living in informal settlements,¹⁴⁸ there is a huge imperative for cities in Latin America to invest in affordable housing. This presents a significant opportunity for green housing construction. Cities in the region are already acting on this. Bogotá, for instance, has implemented a Sustainable Urban Planning and Buildings Policy; a Green Building Code; incentives for greening new and existing residential and commercial buildings; and policies for green schools, green municipal buildings, energy benchmarking, and data transparency.¹⁴⁹

Table 4: Climate Investment Potential in LAC Cities Is the Second Highest Globally

	East Asia Pacific	South Asia	Europe & Central Asia	Middle East & North Africa	Sub-Saharan Africa	Latin America & Caribbean	Total
Waste	\$82 billion	\$22 billion	\$17 billion	\$28 billion	\$13 billion	\$37 billion	\$200 billion
Renewable energy	\$266 billion	\$141 billion	\$88 billion	\$31 billion	\$89 billion	\$226 billion	\$842 billion
Public Transportation	\$135 billion	\$217 billion	\$116 billion	\$281 billion	\$159 billion	\$109 billion	\$1 trillion
Climate-smart water	\$461 billion	\$110 billion	\$64 billion	\$79 billion	\$101 billion	\$228 billion	\$1 trillion
Electric vehicles	\$569 billion	\$214 billion	\$46 billion	\$133 billion	\$344 billion	\$285 billion	\$1.6 trillion
Green Buildings	\$16 trillion	\$1.8 trillion	\$881 billion	\$1.1 trillion	\$768 billion	\$4.1 trillion	\$24.7 trillion
Total	\$17.5 trillion	\$2.5 trillion	\$1.2 trillion	\$1.5 trillion	\$1.5 trillion	\$5 trillion	\$29.4 trillion



Source: IFC. 2018. *Climate Investment Opportunities in Cities*.

The materials used in the construction of buildings and infrastructure also affect urban GHG emissions. The steel and cement industries are responsible for an estimated 7 percent and 5 percent of global carbon emissions, respectively. The use of natural materials, such as sustainably sourced wood or earth, in construction reduces embodied carbon. For example, Chile is exploring the potential for industrialized timber construction to help overcome the social housing deficit. This could also revitalize growth and lessen the construction sector's impact on climate change, while stimulating demand for sustainably sourced timber. That, in turn, would incentivize investment in forestry, delivering further resilience and mitigation benefits.¹⁵⁰ Urban areas tend to have higher temperatures

¹⁴⁷ IFC. 2018. *Climate Investment Opportunities in Cities*.

¹⁴⁸ World Economic Forum. 2018., *Latin America's Cities are Ready to Take Off. But Their Infrastructure is Failing Them*. Available at: <https://www.weforum.org/agenda/2018/06/latin-america-cities-urbanization-infrastructure-failingrobert-muggah/>

¹⁴⁹ C40 Cities N.d. *Green Building City Market Briefs*. Available at: <https://www.c40.org/researches/c40-usgbc-andwgbc-green-building-city-market-brief-compendium>.

¹⁵⁰ World Bank. 2020. *The Construction of Timber Houses in Chile: A Pillar of Sustainable Development and the Agenda for Economic Recovery*. World Bank, Washington, DC. © World Bank. <https://openknowledge.worldbank.org/handle/10986/35237> License: CC BY 3.0 IGO.

because of the use of heat absorbing artificial materials, lack of tree shade, and restricted airflow due to tall buildings, as well as heat emitted from vehicles, air conditioners, and other mechanical sources. Besides its negative impact on human health, the urban heat island effect also increases the demand for energy for cooling and associated CO₂ emissions. Studies from several countries show that electricity demand for air-conditioning increases by about 1–8 percent for every 1°C increase in temperature. The use of natural materials and materials that reflect heat (such as green roofs, cool roofs, and cool pavements¹⁵¹) can reduce the urban heat island effect and thus reduce emissions. Orienting buildings so they provide shade and allow cooling breezes to flow can help further reduce the intensity of the urban heat island effect.

By concentrating waste generation and thereby reducing unit costs of collection and treatment, urban density provides an important opportunity to reduce GHG emissions from waste, which contributes 6 percent of regional emissions, rising to about 10 percent in many Central American countries and in Ecuador. In addition to enabling methane capture from landfills, better management of municipal solid waste can promote circular economy initiatives through recycling and waste-to-energy investments. In Buenos Aires, the *Complejo Ambiental Norte III* plant produces energy based on waste, and includes a composting plant and recycling programs with a focus on the inclusion of informal waste pickers. Receiving some 90 percent of the city’s waste, the plant reduces emissions by more than 1 Mt CO₂e per year and generates 15 MWh of energy, enough to electrify about 25,000 homes.¹⁵²

Circular economy and resilience perspectives can help municipalities to address multiple challenges. These are systemic and transformative approaches that foster the sustainable and responsible use of water, energy, food, and other resources; preserve and regenerate natural ecosystems; reduce waste and pollution; and deliver resilient and inclusive services. The reuse of wastewater has attracted a lot of attention in urban settings. Wastewater can be treated to achieve different qualities to satisfy demand from different sectors, including industry and agriculture. It can be processed in ways that support the environment—and can even be reused as drinking water. The wastewater treatment plant in Atotonilco (Mexico) is an innovative project that uses wastewater as a resource, giving value to all its byproducts: reusing wastewater for irrigation, producing electricity and thermal energy from its sludge, and providing suitable quality biosolids for beneficial use. The rediscovered value of waste identifies a new source of revenue that attracts the participation of the private sector, while making services more financially sustainable.

Despite being one of the most urbanized regions in the world, LAC only has 10 km of mass transit lines per million inhabitants, while the regional average in Europe is 35 km per million. Most cities in LAC have some form of mass transit system, but the COVID-19 crisis has put them under acute financial stress, making investment in decarbonization more challenging. Public transport systems in LAC include bus rapid transit (BRT) networks, metro systems, light rail, and cable cars that move around 20 million citizens per day across the region.¹⁵³ Keeping these systems affordable, accessible, and efficient is necessary to avoid their collapse, which would significantly delay the transition to low carbon transport by pushing citizens toward higher emitting modes. The most widely available

151 Cool roofs and pavements have lighter color and chemical properties to turn sunlight back toward the atmosphere, which can help reduce the use of energy for building cooling and mitigate the urban heat island effect.

152 “Perspectiva de la Gestión de Residuos en América Latina y el Caribe.” Available at: https://www.magconsultorias.com/wp-content/uploads/2018/10/UN_Manejo-de-residuos-PREVIEW19-ilovepdf-compressed.pdf.

153 Global BRT Data. Available at: <https://brtdata.org/panorama/region>.

services, however, are buses and minibuses, often run by small informal operators. Improving the efficiency of the informal sector (for example, by incentivizing the establishment of formal transport cooperatives, digitization of the sector, or better route structuring) would be beneficial. It would generate significant emissions reductions, road safety and accessibility improvements, and help avoid the social exclusion of vulnerable groups, such as women, the elderly, or Indigenous Peoples. Public-private financing modalities have proven successful in the electrification of the public transport fleet. For example, in Chile, 700 electric buses are running in Santiago thanks to such agreements. Investment in public transit should also extend beyond city boundaries to become a core element of metropolitan and regional mobility,¹⁵⁴ including the development of commuter rail and long distance passenger rail services that support low carbon growth across the region.

Investment needs for urban transport systems are huge, and enhanced participation of the private sector will be needed to close infrastructure and service gaps. Investments in low-carbon public transportation systems not only have large social and environmental returns, but they are also profitable from a purely economic return perspective due to their ability to generate fuel savings. While the provision of formal public transit in LAC cities has been dominated by public sector agencies, the participation of the private sector is growing. Several modalities have been adopted, from PPPs, to the concessions (for example, Brazil's metropolitan public transport services are mostly operated by private companies). However, entry barriers, including high initial capital costs, longer development and payback periods, and low direct user fares due to social affordability goals, limit the attractiveness for private sector investment. More importantly, market and government failures, including the lack of carbon prices, subsidies to fossil fuels, and lack of congestion charges, still prevent recognition of the full benefits of a shift toward more sustainable urban transport modes. Alleviating these entry barriers would enhance participation of the private sector. Financing and risk sharing mechanisms to improve the risk return profile of projects, including PPPs, guarantees, and temporary subsidies, can help. On the demand side, education and public awareness campaigns can support the shift toward more sustainable transport systems. Another promising area for private sector involvement is the provision of infrastructure for charging EVs.

Digital solutions can play a role in optimizing urban transport systems, reducing congestion and emissions. For instance, in China, Hangzhou's local government teamed up with Alibaba to launch the City Brain project, with the objective of improving transportation energy efficiency. They reduced congestion by 10 percent. A system of connected street cameras sends their images to a cloud platform that analyzes them and obtains information that is used to optimize smart traffic lights. The same project is implemented in 23 other cities across Asia, while similar approaches are being applied around the globe. Such solutions rely on a well-developed digital infrastructure, highlighting the importance of establishing adequate legal and regulatory frameworks for data management.¹⁵⁵

Enabling safe nonmotorized mobility has substantial emissions reduction potential, especially when combined with policies to disincentivize the use of private vehicles. Moving people from their cars and motorcycles to walking or biking can save up to 62 percent of life-cycle CO₂ emissions for each trip. Successful initiatives include large investment in biking infrastructure in Bogotá that led to

¹⁵⁴ Mehrotra, Shagun, Lincoln L. Lewis, Mariana Orloff, and Beth Olberding, eds. 2020. Volume I of Greater Than Parts: A Metropolitan Opportunity. Washington, DC: World Bank.

¹⁵⁵ IEA. 2021. Better energy efficiency policy with digital tools, IEA, Paris. <https://www.iea.org/articles/better-energy-efficiency-policy-with-digital-tools>.

an 8 percent increase in the biking modal share. Ongoing projects and policy dialogues in Colombia, Mexico, Peru, Panama, and Brazil (box 8) highlight the significant potential to scale up nonmotorized transport initiatives. Cities may combine investments in mass transit and nonmotorized transport with policies to restrict and disincentivize the use of private vehicles (referred to as “push” measures), including the definition of low-emission zones, congestion pricings, parking management, or vehicle restrictions, among others. In Mexico City, Bogotá, and Santiago de Chile, congestion pricing reduced motorized travel by as much as 29 percent. More innovative solutions include the introduction of a cable car system in Panama City to improve urban connectivity through a PPP project.¹⁵⁶

Box 8: Improving Mobility and Urban Inclusion in the Amazon Corridor in Belo Horizonte

Belo Horizonte has a population of 2.7 million and is the main city in a metropolitan region (MRBH) of 5.1 million people. The MRBH faces multiple risks from natural hazards, such as severe rains, landslides, and floods. In the beginning of 2020, the city faced its worst rainy season in 110 years. At the same time, population and economic growth have fueled higher motorization rates, congestion, and pollution in recent years, with the share of trips made by car growing from 23 to 37 percent and expected to rise to 45 percent by 2030 in a business-as-usual scenario. In 2019, about 60 percent of the GHG emissions generated in Belo Horizonte came from the transport sector.

In order to reverse this trend, in 2011 the city approved an Urban Mobility Plan (PlanMob) that aims to reduce road fatalities, increase public transport and the nonmotorized transport share, and reduce GHG emission from transport. With support from the World Bank, PlanMob includes the development of the Amazon Express Bus Rapid Transit system, as well as pedestrian and bicycle infrastructure, while strengthening the resilience of the transport system by improving urban drainage.

4.6. Contribution to Recovery and Development: Urban Job Creation, Efficiency, and Quality-of-Life Co-Benefits

Cities face a unique set of challenges in terms of their enabling environment and access to financing for ambitious climate action, especially so in the context of the COVID-19 recovery. The constraints cities face relate to institutional, intergovernmental, and political coordination problems; limited authority to plan and regulate urban spaces; capacity constraints to prepare project pipelines; and significant limitations in the type and amount of revenue they are able to capture through own source revenue collections (taxes and fees), as well as through intergovernmental transfers from the higher-level government. More recently the COVID-19 pandemic added further financing strain to cities and municipal governments, many of which saw their revenues reduced by up to 20 percent.¹⁵⁷ At the same time over 90 percent of total COVID-19 cases were recorded in urban areas, with poor and more densely populated areas being the most affected.¹⁵⁸ The economic slowdown

¹⁵⁶ Advised by the IFC providing a low emissions system with significant air quality and congestion-reducing co-benefits.

¹⁵⁷ World Bank. 2021. Impact of COVID-19 Pandemic on Municipal Finance. Draft.

¹⁵⁸ World Bank. 2021. State of Cities Climate Finance 2021.

caused by the pandemic brought financial distress to subnational governments in the region. In Colombia, for example, in the first one-half of 2020, the collection of property taxes, the key source of revenue for municipalities, declined by 38 percent nationwide.¹⁵⁹ Impacts cut across sectors, but tourism and transport were particularly badly impacted. Several mass transit operators experienced a sharp decline in users associated with lockdown measures, along with higher operating costs due to COVID-19–related safety measures. The potential collapse of mass transit systems could have severe consequences for continued emissions reductions if users are displaced toward higher emission transport modes, such as cars, motorcycles, or informal transport.

In the near term, investments to improve urban resilience and reduce urban emissions can support recovery from the COVID-19 pandemic. They can do so directly, through job creation, and indirectly, by ensuring that urban infrastructure and systems are more robust after the pandemic. Infrastructure maintenance and public works to increase urban resilience and accelerate the transition to a low carbon economy can directly create many jobs to provide income support during the recovery period. Many nature-based solutions in particular can be implemented in the short term as part of large-scale public employment programs.¹⁶⁰ Similarly, investment in the retrofitting of infrastructure and buildings for energy efficiency and resilience can directly create many low and medium skilled jobs. Support to urban transport operators that is linked to emission reduction measures will not only maintain momentum toward decarbonization, but also help avoid the potential collapse of mass transport systems, facilitating economic recovery and indirectly contributing to the regeneration of employment.

Investment in both urban resilience and emissions reductions can yield dividends in terms of both economic efficiency and quality of life enhancements, contributing to growth and the achievement of development goals. By reducing risks to assets, measures to strengthen resilience can open up new economic opportunities and incentives for investment in safer areas.¹⁶¹ By promoting a more efficient use of resources, compact urban planning, investment in low carbon construction, energy efficient buildings, and waste minimization, LAC cities can not only reduce GHG emissions, but also enhance productivity. Improved waste management also raises the value of adjacent land. Mandatory climate risk assessments and management will enhance climate resilience in the real estate finance and mortgage sector. Evidence from implementation pilots supported by the United Nations Environment Programme (UNEP) Task Force on Climate-Related Financial Disclosures indicates that the experience of extreme events can reduce property values by 5–20 percent. Financial institutions with exposure to this sector may be willing to manage that risk by promoting and financing green and resilient buildings and phasing out riskier assets in this sector.

LAC cities have not reaped the full benefits of agglomeration effects due to high levels of congestion and pollution and poor accessibility to jobs. More compact and connected urban development, combined with improved public transit systems, can start to change that. There are also important co-benefits, such as improved health outcomes due to reduced pollution and avoided road accidents, as well as time saved from reduced congestion, which generates positive long-term effects on growth. Prioritizing climate-smart investments in the built environment and transport

¹⁵⁹ Alexandra et al 2020. "How to finance Colombian cities during the COVID-19 pandemic." December 22, 2020. Available at: <https://blogs.worldbank.org/latinamerica/how-finance-colombian-cities-during-covid-19-pandemic>.

¹⁶⁰ Del Pino et al. 2020. Nature Hires: how nature-based solutions can power a green jobs recovery. WWF/ILO Technical Report.

¹⁶¹ Tanner, T.M., Surminski, S., Wilkinson, E., Reid, R., Rentschler, J.E., and Rajput, S. (2015) The Triple Dividend of Resilience: Realising development goals through the multiple benefits of disaster risk management. Global Facility for Disaster Reduction and Recovery (GFDRR) at the World Bank and Overseas Development Institute (ODI), London. www.odi.org/tripledividend

sectors can help cities generate jobs quickly, leveraging scarce public funding with significant private sector investment, while addressing other vital issues such as pollution, congestion, flooding, and energy access. Financial institutions have a key role to play in supporting municipalities to plan and implement bankable infrastructure projects that can leverage commercial capital to complement scarce public sector resources, increasing total investment in urban adaptation and mitigation of climate change.

4.7. **Priority Actions for Cities**

Most countries have so far missed the opportunity to leverage the capacity of cities to meet their national commitments for GHG emissions reductions, with only 20 of 164 NDCs globally highlighting climate mitigation in urban areas. A relatively higher proportion of NDCs focus their urban content on adaptation measures (75 out of 164) although this still leaves around one-half of NDCs that make no significant reference to urban adaptation/resilience actions.¹⁶² To fully take advantage of urban agglomeration, city climate action must go beyond individual green investments and set in motion systemic change in energy consumption and transportation emissions. Climate change action planning for cities also requires good horizontal and vertical collaboration across levels and sectors of government to establish priorities and make resource allocation decisions. A recent World Bank stocktaking exercise showed that although a number of cities in the region have city climate action plans, only 5 of 29 studied are considered “actionable,” and in almost all cases, significant additional technical assistance is needed to establish investment plans, including cost estimates, financing sources, a delivery roadmap, policy actions, and a project pipeline. Initiatives such as the C40 network (box 9) are playing a valuable role in supporting cities to collaborate effectively, share knowledge and drive meaningful, measurable, and sustainable action on climate change.

Table 5 highlights, by country, potential areas for new WBG support in LAC’s cities under five entry points that were defined based on the assessment presented above: (i) low carbon urban design; (ii) decarbonizing urban mobility; (iii) cutting emissions from waste; (iv) adaptation through planning and preparedness; and (v) investing in urban resilience. More details on country-specific actions (of which there may be several for each country for a given entry point) are provided in the country climate change snapshots that accompany the LAC Roadmap.

The table distinguishes between these actions in three dimensions:

1. between those already incorporated in the WBG portfolio (either under implementation or included in the pipeline of operations) or that are adequately supported by non-WBG programs, and those that would be new (either under discussion or aspirational, including potential operations to scale up existing initiatives);
2. between those new actions that would be aligned with current government priorities and those that would not; and
3. also highlights those new actions that are urgent, in the sense that delay would significantly increase their cost. In the context of cities, urgent actions are identified as those needed to avoid the lock-in of carbon intensive urban form, and to reduce the vulnerability of urban infrastructure already highly exposed to climate-related extreme events.

¹⁶² UN Habitat. 2020. Enhancing Nationally Determined Contributions through Urban Climate Action.

Box 9: City Climate Leadership

Recognizing that cities' leadership on climate is fundamental, particularly in the absence of strong national-level action, city governments around the world have been forging ahead with tremendous ambition to mitigate the risks of climate change. Since 2005, the C40 network has convened mayors from large cities around the world committed to driving meaningful, measurable, and sustainable action on climate change. By the end of 2020, every C40 city should have developed and begun implementing a climate action plan to deliver action to become carbon neutral by 2050 or earlier, consistent with the objectives of the Paris Agreement.

LAC cities that have completed their C40 City Climate Action Plans include Buenos Aires, Mexico City, Guadalajara, Curitiba, Salvador, and Medellín. At the same time, 6,150 cities participating in the Global Covenant of Mayors and representing 20 percent of urban residents globally have developed climate action plans. National governments, and public and private financial institutions are also increasingly acknowledging the importance of cities to climate action and launching initiatives to address barriers to accessing finance.

Thanks to networks such as C40 and the Global Covenant of Mayors, impactful programs and policies instituted at city levels are documented and widely shared with other activist city leaders around the world to replicate good practices and generate measurable results. Subnational governments often have a good sense of how the different sectors and elements that make up urban systems can collectively address specific climate risks on the ground and are in a position to support integrated local sustainable development and local citizen well-being.

As table 5 indicates, in Costa Rica, the Dominican Republic, Guatemala, Haiti and many Caribbean nations, where cities are at high risk from climate-related extreme events, new WBG support for investment in urban resilience is an urgent priority. Additional WBG support for low carbon urban design and the decarbonization of urban mobility is an urgent priority in Argentina, Bolivia, Brazil, Colombia, Ecuador, Haiti, Mexico, and Peru. As some of the countries with the largest urban populations in the region, such action is urgent to avoid the lock-in of carbon intensive urban form, encompassing measures such as support for EDGE certification of buildings, energy efficiency in the residential sector, and compact city planning. Opportunities are also identified for new WBG support to cut GHG emissions from municipal waste in Argentina, Brazil, Colombia, Ecuador, El Salvador, Haiti, Honduras, and Peru.

Table 5: Priority Actions for Cities¹⁶³

	Low Carbon Urban Design	Decarbonize Mobility	Cut Waste Emissions	Adaptation through Planning and Preparedness	Invest in Resilience
Argentina	*	*	●	●	●
Belize	—	—	—	—	●
Bolivia	*	*	—	●	●
Brazil	*	*	●	●	●
Colombia	*	*	●	●	●
Costa Rica	●	●	—	●	*
D. Republic	●	●	—	●	*
Ecuador	*	—	●	●	●
El Salvador	—	●	●	●	●
Guatemala	—	●	—	●	*
Guyana and Suriname	—	—	—	●	●
Haiti	●	*	●	●	*
Honduras	—	—	●	●	—
Jamaica	●	●	—	—	●
Mexico	*	—	●	●	●
Nicaragua	—	●	—	●	—
Panama	—	—	—	●	—
Paraguay	●	*	—	●	●
Peru	*	*	●	●	●
Uruguay	●	●	●	●	—
Caribbean SIDS*	●	●	●	●	*

Source: WBG LAC Roadmap team development.

Note: SIDS = small island developing states, which include Saint Vincent and the Grenadines, Dominica, Grenada, St Lucia St Maarten, and Barbados.

Key:

- * Urgent area for new WBG engagement aligned with government priorities
- Area for new WBG engagement aligned with government priorities
- * Urgent area for new WBG engagement not aligned with current government priorities
- Area for new WBG engagement not aligned with current government priorities
- Existing WBG or adequate other engagement

¹⁶³ Actions reflect the input from a consultative process with WBG Country Management Units and sector experts.



5. Cross-Cutting Areas

5.1. Financial Sector, and Institutional Actions

Fiscal policies that support and enable decarbonization are crucial to achieving LAC countries' climate and sustainable development ambitions. Given the fiscal constraints of the post-pandemic recovery, it will be important to maximize opportunities to redirect rather than increase public spending to achieve national climate goals. In the face of low regional growth forecasts and rising inflation, with post COVID-19 debt levels high and made harder to finance internationally by higher US interest rates, countries across the region are moving from fiscal expansion to adjustment.¹⁶⁴ Consequently, national priorities for climate action will favor initiatives that reorient rather than expand subsidies while maximizing productivity enhancing co-benefits, focusing on no-regret policies that strengthen competitiveness and innovation, and mobilize private sector investment for resilient, low carbon growth.

By using pricing as a tailwind to accelerate transitions, fiscal measures can build on sector policies and investment to encourage the adoption of low carbon alternatives and to overcome resistance to change. Costs of moving toward cleaner production models need to be offset by incentives that better reflect the climate and other benefits associated with such investments. For example, reducing gasoline subsidies and introducing carbon pricing will encourage the electrification of transport systems, while failure to ensure users pay the full costs associated with fossil fuels will discourage such investment.

Several LAC countries are already working to price carbon and use market mechanisms to promote climate action. Eight countries are members of the Partnership for Market Implementation (PMI) that supports countries in preparing and implementing carbon pricing and domestic credit systems (box 10), with a number of other LAC countries preparing PMI applications. Mexico, Argentina, Colombia, Chile, and Uruguay are implementing or have scheduled carbon taxes.¹⁶⁵ Mexico has a functioning emissions trading system (ETS), including a trading platform, and several other countries are considering ETSs. Several countries, including Mexico, Chile, and Colombia, have developed carbon offset schemes that allow companies, nongovernmental organizations (NGOs), or communities to develop emissions reduction projects and receive credits. Others, such as Peru, are developing crediting systems. Such credits can be purchased by companies with carbon tax liabilities to offset some costs and may eventually help countries access international offset funds.

Significant challenges still lie ahead, and existing carbon prices are low (often around US\$3–5/tCO₂e) and cover only some economic sectors. Many countries still subsidize fossil fuels, which encourages pollution and makes it more difficult for green alternatives to compete. In addition, subsidies represent public resources that could be used to protect poorer citizens through education, health, job training, and infrastructure investment. Few countries have developed carbon credit schemes that encourage mitigation efforts in areas such as forestry. Similarly, while some countries have fiscal risk units, others are still in the process of establishing them. Despite recent progress with

¹⁶⁴ World Bank. 2022. Consolidating the Recovery, Seizing Opportunities in a Greening World: Semi-annual Report for LAC.

¹⁶⁵ <https://carbonpricingdashboard.worldbank.org/>

Box 10: Partnership for Market Implementation¹

The Partnership for Market Implementation—formerly the Partnership for Market Readiness—supports countries in preparing and implementing climate mitigation policies, with a focus on carbon pricing and related instruments. Members can work together to share ideas, peer review, learn from one another, and provide technical support to implement cost-effective climate mitigation. Since 2011, the partnership has provided funding and technical assistance to 23 countries that produce nearly one-half of global GHG emissions. There are eight members from LAC: Argentina, Brazil, Colombia, Chile, Costa Rica, Mexico, Panama, and Peru. Their activities under the partnership include:

- » **Brazil:** Undertaking analytical studies on alternative policy design options and modelling their potential impacts;
- » **Chile:** Supporting the preparation and implementation of a carbon tax, and building capacity in the public and private sector to implement a monitoring, reporting, and verification (MRV) framework and GHG registry;
- » **Colombia:** Supporting the development of a hybrid pricing system under which an ETS will complement the existing carbon tax (in place since 2017); and
- » **Costa Rica:** Supporting the development of a domestic carbon credit market through promotion of voluntary actions and regulatory instruments.

In addition to working directly with countries and facilitating direct knowledge/experience exchange, the PMI produces user-friendly guides and manuals based on global experience. These are a first step for countries interested in implementing carbon pricing and accompanying policies (such as carbon credits—see box 11).²

1 More details available from: <https://pmiclimate.org/>. Countries interested in applying for membership/support can complete the form available on the website.

2 The guides are available from: <https://pmiclimate.org/knowledge-centre>.

social safety nets in LAC, few countries have social assistance mechanisms that can be quickly scaled up in the face of climate or other shocks, instead they rely mainly on ad hoc measures.

Financial sector regulations play an important role in encouraging investment in green technologies while reducing the financial and economic risks associated with climate change. For example, requiring reporting of stranded asset risks in public and private fossil fuel companies raises investor awareness and encourages finance to shift to alternative energies. Similarly, a better understanding of the investment opportunities associated with low carbon transition will encourage the financial sector to provide financing for green investments, helping to spur economic growth and employment.

LAC countries are making progress on key financial sector reforms. Eleven LAC finance ministers are members of the Coalition of Finance Ministers for Climate Action, of which Chile was the first co-chair, demonstrating significant support for economy-wide enabling reforms to combat climate change. Some countries have made breakthroughs by enacting environmental, social, and governance (ESG) risk regulations for the financial sector. Between 2014 and 2019, financial sector regulators in Brazil, Honduras, Paraguay, and Peru enacted ESG risk resolutions.

Explicit prudential regulations for climate-related and environmental risks in LAC are still absent—though some countries’ supervisory authorities (e.g., Brazil, Colombia, Mexico) have recently made plans to assess the financial risks stemming from climate change and environmental degradation, and potentially take regulatory action. Many countries remain without long-term climate strategies, and only one in six LAC countries currently screens public investment projects for climate risks and impacts. Fiscal and administrative measures are lacking in most countries to support subnational government action, which would benefit from access to regularly produced subnationally disaggregated risk and vulnerability information. There is ample space for institutionalizing public participation in climate policy design and evaluation, as well as enhancing the role of oversight institutions such as supreme audit institutions, parliaments, and the courts.

Institutional reforms and capacity building are needed to enable governments to develop ambitious policies, sustain climate commitments in the long term, and drive implementation through national planning, budgeting, and public investments. For example, targets enshrined in climate laws provide clear signals to government entities, households, and businesses, encouraging green and climate resilient investments from both the public and private sector. Similarly, climate-informed public investment management systems weed out projects at risk from climate change impacts and the decarbonization transition. LAC countries have made significant progress in establishing institutional enabling conditions, with many ahead of the curve in approving climate change framework legislation, and most have established interinstitutional coordination mechanisms on climate change.

i. Fiscal Reforms for Low Carbon Growth

Governments in LAC subsidized consumption of fossil fuels by an estimated US\$43.67 billion in 2020, though subsidies have declined in some countries in recent years.¹⁶⁶ For example, Panamanian electricity subsidies declined from 0.7 percent of GDP in 2014 to 0.3 percent in 2019, and in Ecuador, fossil fuel subsidies equivalent to 2.0 percent of GDP as of 2017 are being reduced by more than one-half by 2022. Reducing fossil fuel subsidies can help to contain fiscal deficits without cutting key public services. Redirecting resources away from fossil fuel subsidies not only aligns incentives with climate and sustainability goals, but also frees up funds for more productive, pro-poor purposes. They can be used to improve public services, reduce inequality—for instance, by expanding social assistance—and boost growth and economic opportunities by improving infrastructure, education, and health care.¹⁶⁷ This is particularly important in the tight fiscal landscape that the region now faces due to the pandemic.

Similarly, the reorientation of coupled agricultural subsidies (estimated at US\$5.05 billion across LAC in 2019)¹⁶⁸ toward the adoption of sustainable practices can discourage further expansion of the agricultural frontier. Replacing coupled subsidies with decoupled payments can reduce political opposition and be used to encourage environmental and agricultural good practices while raising farm revenues (see above: “Reducing emissions from food systems, and land-use change and deforestation”).¹⁶⁹

¹⁶⁶ This figure refers to explicit subsidies, reflecting differences between the amount consumers actually pay for fuel use and the corresponding opportunity cost of supplying the fuel, including direct and indirect producer subsidies. A broader measure of implicit subsidies, reflecting how much consumers would pay if prices fully reflected supply costs plus the taxes needed to reflect environmental costs and revenue requirements, is estimated at US\$210 billion for LAC in 2020. I. Parry et al. 2021. *Still Not Getting Energy Prices Right: A Global and Country Update of Fossil Fuel Subsidies*. IMF WP/21/236.

¹⁶⁷ For excellent analysis of how electricity subsidies could be better directed to assist poorer families rather than wealthier ones, see <https://openknowledge.worldbank.org/handle/10986/28504>.

¹⁶⁸ IADB calculations from Agrimonitor initiative.

¹⁶⁹ Morris, M., et al. 2020. *Future Foodscapes— Re-imagining Agriculture in Latin America and the Caribbean*. World Bank Group.

Decarbonizing industry and shifting to more sustainable production models will require new incentives, as well as fiscal policies that better reflect the climate change costs of GHG emissions.

Governments can promote a switch to greener production by providing targeted support for the adoption of low emissions technologies and disincentivizing the use of high carbon methods of production. Opportunities also exist to support private companies to develop internal carbon pricing to guide their future investments and support decarbonization. Incentives to encourage circularity in the economy include banning single use plastics, requiring a percentage of recycled materials in new goods produced, and encouraging greater recycling, including separation at source. One way to achieve this is to incorporate end-of-life costs of a product in its initial price.

Internalizing the cost of fossil fuel use through carbon pricing or environmental taxes could have multiple benefits for LAC countries. Even after eliminating subsidies, the full costs of fossil fuels, including climate change and air pollution, are not borne by those who use them, but by society as a whole. Carbon pricing corrects this imbalance and has numerous benefits. First, as an economy-wide policy, it provides a tailwind for reforms and investment across the priority systems discussed above. For example, decarbonizing manufacturing, power, and transport systems will be easier if the cost of fossil fuel-based systems is not artificially low, so clean technologies are more competitive. Second, fiscal policy, combined with regulatory tools and certification processes can support sustainable forestry. For example, a “feebate” system can be used to tax forestry exports, with a certain rebate awarded to exporting firms whose forestry products are accompanied by sustainable certification.

Carbon pricing can be an efficient, and potentially administratively simple, additional source of fiscal revenue. The composition of fiscal revenue has economy-wide impacts. Taxing a good or service will tend to increase its price and reduce its consumption. By taxing “bads” such as pollution, governments can discourage behaviors that have negative social effects. This is more socially just than taxing “goods” such as work (especially lower-income people’s wages) or products (especially the necessities that consume most lower-income households’ budgets). Revenues from a carbon tax could typically reach around 1 percent of GDP (box 11, figure 20) and can be used to reduce other distortionary taxes (such as labor taxes), to boost public investment, or provide lump sum transfers to citizens to assist in COVID-19 recovery. They can also help reduce fiscal deficits and public debt, which, for many countries, increased significantly during the pandemic. Finally, carbon taxes can be levied upstream (on production or imports of fossil fuels—typically involving only a few companies) rather than downstream (for example, at the fuel pump), often using existing taxation systems, making them comparatively easy to administer.

Box 11: The Carbon Pricing Assessment Tool

The carbon pricing assessment tool (CPAT) is a tool developed by the World Bank that allows countries to simulate carbon pricing scenarios and estimate their impacts. This includes impacts for greenhouse gas emissions as well as fiscal receipts and other variables.

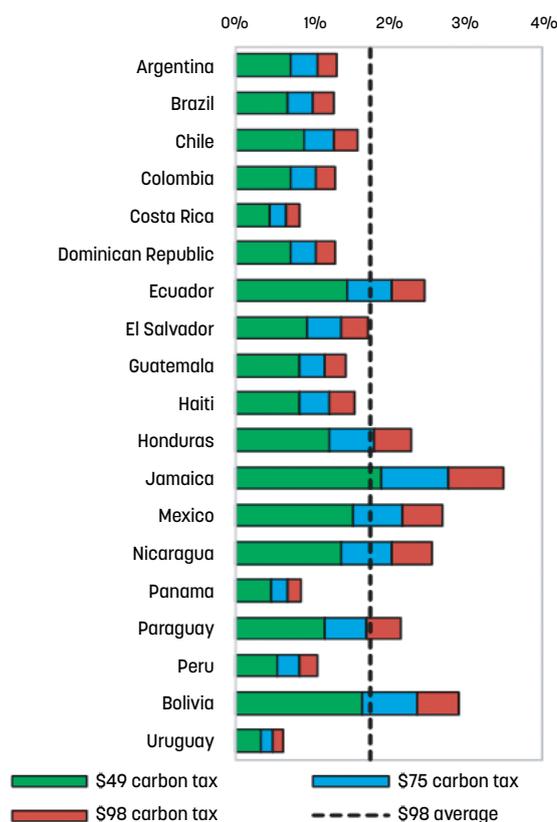
Using a carbon price of between US\$40–80/tCO₂ by 2020 and \$50–100/tCO₂ by 2030 (which is estimated as consistent with the “well below 2°C” target from the Paris agreement,¹ we estimate the impacts of three economywide carbon tax scenarios, in the low, middle, and high end on the range:

- » US\$41/tCO₂ carbon tax in 2022, increasing to \$49/tCO₂ by 2030
- » US\$50/tCO₂ carbon tax in 2022, increasing to \$75/tCO₂ by 2030
- » US\$82/tCO₂ carbon tax in 2022, increasing to \$98/tCO₂ by 2030

These taxes could raise revenues equivalent to 0.3–3.5 percent of GDP in 2030, depending on the country and scenario considered (see Figure 20).

FIGURE 20: Revenues from a Carbon Tax Could Typically Reach around 1 Percent of GDP

Fiscal revenues by scenario (% of GDP), compared to a baseline, in 2030

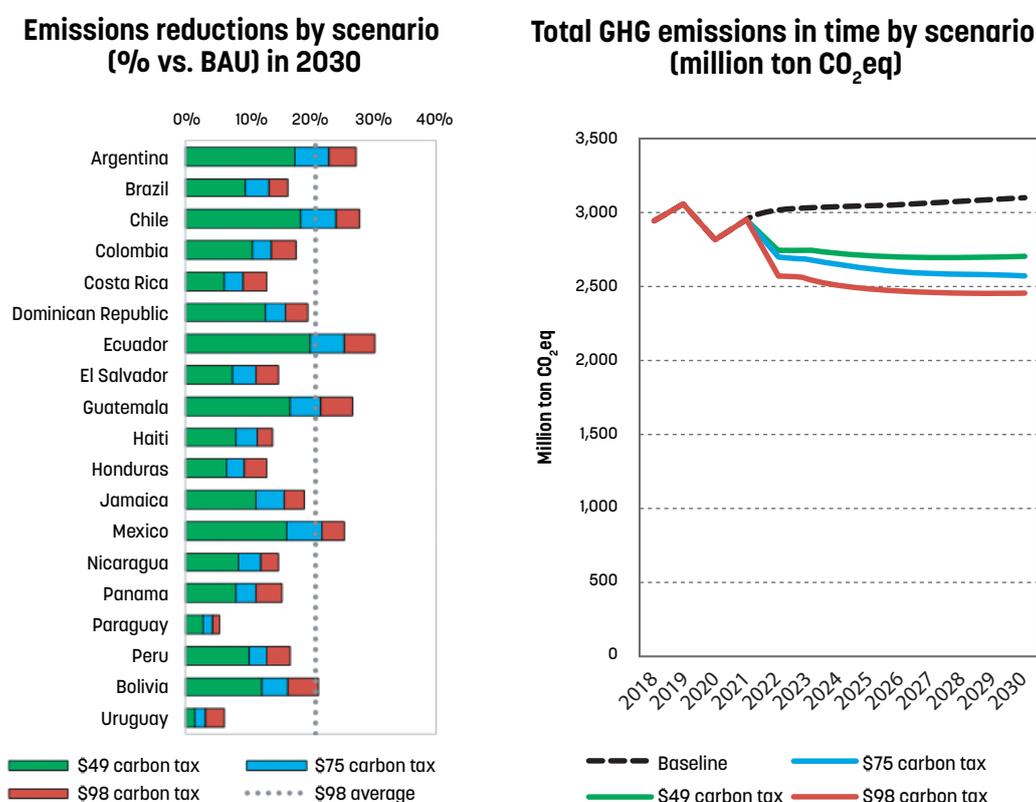


Source: CPAT and WDI.

1 Report of the High-Level Commission on Carbon Prices. Carbon Pricing Leadership Coalition. World Bank, 2017.

Carbon pricing in LAC countries could reduce total GHG emissions from fossil fuel use by 2–30 percent in 2030 relative to a baseline scenario (see figure 21, left). Note that countries cannot achieve net-zero emissions just by imposing a carbon tax set at those levels (see figure 21, right); a mix of policies covering all sectors will be needed to achieve full decarbonization targets. Initially, in the context of emerging markets that seek fast economic growth and poverty reduction, the carbon price is likely to be set at a level that slows emissions growth but does not reverse it. As consumers and firms respond to the price and social signals embodied in the carbon price, their behavior will hopefully change, spurred also by improvements in the cost and ease of adopting clean energy and efficiency measures. At the same time, higher fossil fuel prices help “even the playing field,” making it more viable to invest in or deploy greener technologies at the household, factory, or system level. For some countries, the combined impact can make a considerable contribution to meeting international commitments as defined by their NDCs.

FIGURE 21: Carbon Pricing Would Reduce GHG Emissions in LAC by an Average of 20 Percent by 20

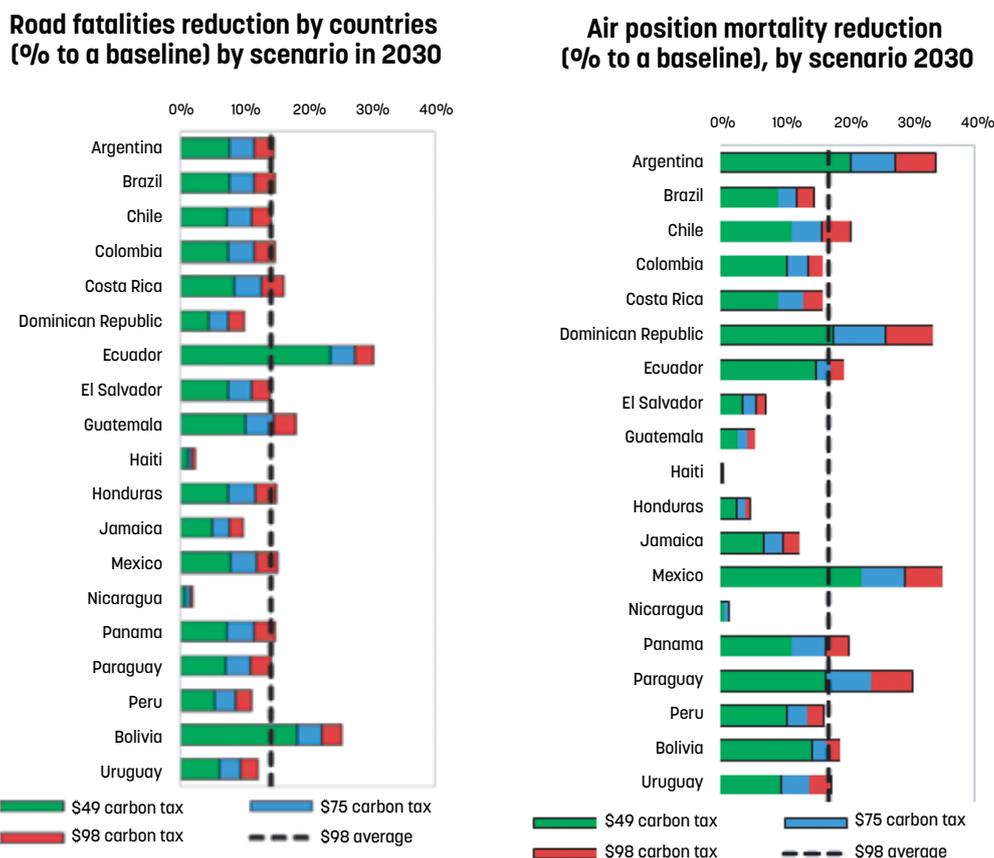


Source: CPAT.

Carbon pricing would also yield co-benefits from reduced road fatalities, congestion, and air pollution. Road accidents are a leading cause of premature deaths, especially among young males, and include not only motorized transport but also pedestrians and cyclists. Even though road externalities can and should be addressed with sectoral policies, carbon taxes can also help by reducing vehicle use (figure 22 shows the estimated impacts for countries in the region). Road congestion and travel times in rush hours could also be decreased by up to 7 percent by 2030. Air pollution and its health effects are a particularly serious concern for most LAC countries, linked to more than 214,000 deaths

in 2019.¹⁷⁰ Fossil fuel use is responsible for a large share of this pollution,¹⁷¹ so policies that reduce it can also be beneficial for public health (figure 22, right).

Figure 22: Carbon Pricing Would Reduce Deaths from Road Crashes and Air Pollution in LAC by 2030 (by 14.0 and 3.4 percent, on average, respectively, with a price of US\$98/tCO₂)



Source: WBG calculations using carbon pricing assessment tool (CPAT)

An additional motivation for introducing carbon pricing is the proposed introduction of Carbon Border Adjustment Mechanisms (CBAMs) in key export markets, with the EU leading the way, having announced plans to introduce pilot CBAM tariffs on cement, iron and steel, aluminum, fertilizers, and electricity imports from 2023. These are designed to prevent carbon leakage from the transfer of domestic production to jurisdictions with laxer GHG emission restrictions, and to protect domestic producers from unfair competition from firms producing in such countries. Governments that would like to protect their exporters from such mechanisms will need to consider the need for measures to lower GHG emissions from the targeted sectors, including possible carbon pricing regimes, noting that whereas carbon pricing will generate domestic revenues, CBAM tariffs would generate revenues in the export markets.

170 GBD 2019 Risk Factors Collaborators. 2020. "Global Burden of 87 Risk Factors in 204 Countries and Territories, 1990–2019: A Systematic Analysis for the Global Burden of Disease Study 2019." *The Lancet*. Vol. 396. Elsevier.
 171 Karn Vohra, Alina Vodonos, Joel Schwartz, Eloise A. Marais, Melissa P. Sulprizio, and Loretta J. Mickley. 2021. Global mortality from outdoor fine particle pollution generated by fossil fuel combustion: Results from GEOS-Chem, *Environmental Research*, Volume 195. 110754, ISSN 0013-9351.

Addressing the risks posed by climate change will help countries adjust to export markets as they begin to implement trade regimes that reflect embedded GHG emissions. In addition to CBAMs, deep trade agreements¹⁷² increasingly consider environmental standards as an important factor in opening export markets. Implementing carbon pricing along with other relevant environmental standards or regulations will reduce the risks that firms may face increased barriers in these markets.

Even with higher prices for polluting fuels, people and firms need alternatives if they are to shift their consumption patterns, requiring complementary fiscal measures and public investments. While increasing fuel prices are an essential component of a whole-economy shift to lower emissions, the ability of consumers to react to changing prices depends on the availability of alternatives. For example, if the design of a city necessitates long commutes to work and public transport service is limited, car owners will continue to drive to work. Similarly, in countries where natural gas is widely used, a shift to hydrogen or other options is only feasible after investments make them readily available. Reducing air-conditioning use will be easier if there are programs to improve home insulation and to address the urban heat island effect. Recycling revenues from carbon pricing into investments that facilitate switches to low pollution options is also an opportunity to make fiscal and environmental policies more pro-poor. Wealthier families tend to benefit more from fuel subsidies and will pay more carbon taxes in absolute terms, but poorer families may pay more as a share of their income. Well-designed fiscal environmental policies can help those families access energy saving technologies, and they can also enhance social safety net programs and services to improve their lives overall.

Fossil fuel producing countries may face significant impacts as a result of global efforts to decarbonize. For fossil fuel-exporting countries, revenues associated with these resources often make up a significant proportion of government budgets. As markets decarbonize, up to 40 percent of oil reserves might be unburnable in Argentina, Brazil, and Ecuador, up to 70 percent in Colombia and Mexico, and up to 90 percent in Peru and Venezuela, resulting in significant revenue losses for those governments.¹⁷³ Stringent global climate action could reduce fiscal revenues in LAC to US\$1.3–2.6 trillion by 2035, compared with US\$2.7–6.8 trillion if reserves were aggressively exploited.¹⁷⁴ In addition to losing revenues, the burden of stranded assets of state-owned oil companies will likely fall on the public finances.

ii. Financial Sector Reforms for Resilience and Green Growth

LAC countries' banking systems are exposed to risks from both climate change and climate policies. The banking sector is the critical infrastructure for financial intermediation in LAC, with commercial banks providing on average more than 90 percent of the credit granted by regulated financial intermediaries. Banks' exposure to climate and environmental risks arises largely from their clients' and investees' exposure to those risks. They include (i) transition risks, which are typically associated with changes in public policy—such as climate policies that promote technological changes, shift consumer preferences, and disrupt business models; (ii) physical risks, such as from

¹⁷² Deep trade agreements are reciprocal agreements between countries that cover not just trade but additional policy areas, such as international flows of investment and labor, and the protection of intellectual property rights and the environment. (Hofmann et al. 2017. "Horizontal Depth: A New Database on the Content of Preferential Trade Agreements." World Bank Group Policy Research working paper; no. WPS 7981).

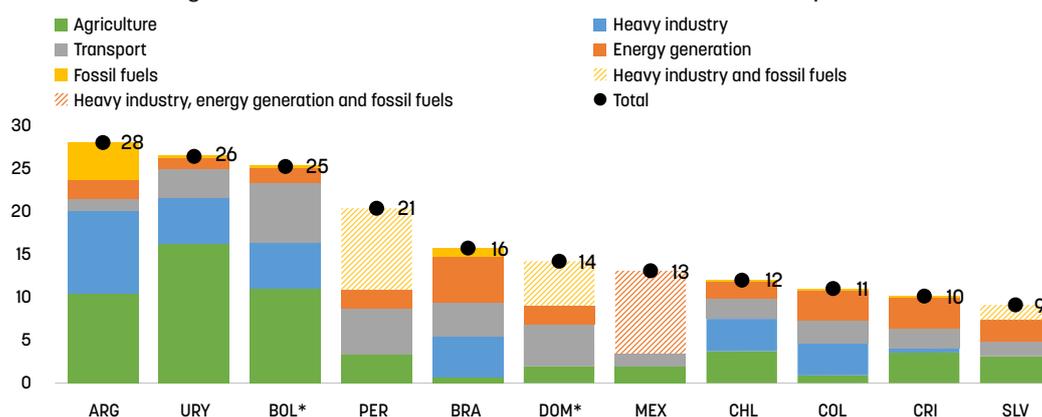
¹⁷³ The share of unburnable resources varies by country depending on a number of factors, including the scale of the resource and the cost of commercial exploitation.

¹⁷⁴ Baltazar Solano-Rodríguez et al., 2019. Implications of climate targets on oil production and fiscal revenues in Latin America and the Caribbean. IDB, Discussion Paper No. IDB-DP-00701.

extreme weather events, sea level rise, and water scarcity; and (iii) environmental risks (the possibility of losses resulting from environmental degradation, including the excessive consumption of natural resources). Overall, banks and regulators are increasingly focused on such risks and are seeking to reduce their exposure as loans mature. They are also engaging in more prudent provisioning and other risk management, even though the quantification of risks is still ongoing, especially considering feedback loops, nonlinearities, and tipping points, and the fact that shocks might only become material beyond the risk management horizons typically used by banks and supervisors.

More than a quarter of banks' credit portfolios in Argentina, Uruguay, and Bolivia is in high-emitting and transition-sensitive industries (Figure 23). The relatively higher exposure to transition risks in these countries is driven by the agricultural sector. In addition, some banks in LAC may face significant exposure to stranded assets related to climate change—for example, through lending to oil companies or to power generators using heavy fuel oil. This context offers an opportunity to expand work on the taxonomy of green investments to include transition finance as a new asset class in the market, which can help address financing toward industries in their climate transition journey.

FIGURE 23: More than One-fourth of Banks' Credit Portfolios in Argentina, Uruguay, and Bolivia Are in High Emitting and Transition-Sensitive Industries (share of total credit portfolios)



Source: Calice Pietro, and Miguel, Faruk 2021. "Climate-Related and Environmental Risks for the Banking Sector in Latin America and the Caribbean: A Preliminary Assessment."

Note: *Estimated shares for heavy industry. In the cases of Bolivia and the Dominican Republic the credit outstanding information does not allow us to identify the transition-sensitive sectors within manufacturing.

LAC banks are also significantly exposed to physical risks arising from sudden, high impact natural disasters, with potential exposures to floods the most significant physical risk for the LAC banking sector. More than 10 percent of the banking sector credit portfolio has a high hazard mapping to floods in Brazil, Mexico, Colombia, Argentina, Bolivia, and the Dominican Republic (table 6). The Dominican Republic banking sector has a high potential exposure to cyclones, affecting 20 percent of the total loan portfolio. Hazards also have an impact on bank asset quality, with nonperforming loans in provinces affected by natural disasters increasing up to 1.4 percentage points four quarters after the event.¹⁷⁵ The sector can benefit from integrating climate within the risk assessment models in banks, aligning climate risk as a strategic underwriting tool.¹⁷⁶

175 Calice Pietro and Miguel, Faruk 2021. "Climate-Related and Environmental Risks for the Banking Sector in Latin America and the Caribbean: A Preliminary Assessment." Available at: <https://openknowledge.worldbank.org/handle/10986/35764>.

176 One example of a knowledge and advisory solution that builds bank capacity and lowers information barriers in terms of adding climate in bank risk assessments is the IFC Green Banking Academy.

Table 6: The Banking Sector Credit Portfolio Has a High Hazard Mapping in Many LAC Countries

Hazard	Hazard level	BRA	MEX	CHL	COL	PER	ARG	ECU	BOL	DOM
Wildfires	Very low				0.0			–		
	Low				0.1			0.0		
	Medium	0.0			0.9			0.4		
	High	0.4	1.9	0.3	2.2	3.8	0.0	0.5	0.2	2.0
Floods	Very low	0.5		0.4	0.0	1.4		0.6		0.0
	Low		0.4	0.5		12.5	0.0	2.5	2.5	0.2
	Medium		0.2	15.1		1.4	0.0	15.5	1.1	0.1
	High	28.6	10.7	0.6	26.9	1.0	15.2	17.4	50.3	19.5
Landslides	Very low		0.1				1.7		0.0	
	Low	0.3	0.0	0.0	0.1	0.0	0.1		0.2	1.2
	Medium	3.1	2.5	0.2	1.0	0.2	0.0	2.3		0.7
	High	1.1	1.0	2.7	9.5	6.2	0.1	5.4	4.5	0.7
Earthquake	Very low	17.2	1.3		0.0		0.1		0.3	
	Low	2.7	0.1		0.1		0.4		1.0	
	Medium	1.9	5.5	0.1	8.7	0.6	1.6	3.5	39.8	12.5
	High		0.3	13.4	4.4	5.5	0.1	24.2		
Cyclone	Very low	1.4			18.0	0.1		35.7		
	Low				7.3					
	Medium				2.5					
	High		18.1		0.3					19.8
Drought	Very low	2.0		1.1	1.6	0.8	0.6	6.7	9.1	
	Low	1.7	0.3		1.6	2.8	1.9			
	Medium	1.7	1.3	0.1			7.7		1.9	2.0
	High		0.3	2.1		0.2	0.3		0.1	

Source: Calice Pietro and Miguel, Faruk 2021..“Climate-Related and Environmental Risks for the Banking Sector in Latin America and the Caribbean: A Preliminary Assessment.” Available at: <https://openknowledge.worldbank.org/handle/10986/35764>.

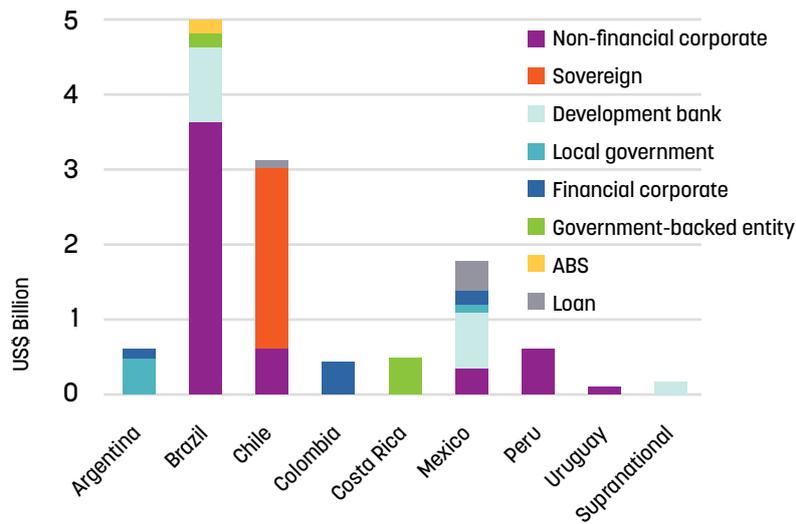
Note: Percentage of first-level geographical units with very low, low, medium, or high hazard mapping by hazard and country (colors) and share of bank assets potentially exposed to physical risks (figures).

Recovery from the COVID-19 crisis and a transition to a low carbon economy present a tremendous investment opportunity for LAC economies. How countries across LAC respond to their investment needs will be a major factor in whether they can deliver on their GHG reduction commitments. Public investment can only cover about one-fourth of estimated investment needs,¹⁷⁷ with a small share coming from multilateral banks and the rest requiring funding from private investors. Recent legal rulings in Europe and shareholder actions in the United States may encourage increased investment in renewable energy—rather than fossil fuels—from oil majors. For example, a Dutch court recently ordered Shell to make significant reductions in its emissions, while activist shareholders placed board members at Chevron and ExxonMobil who will encourage the companies to adjust their portfolio

177 International Monetary Fund, October 2020. Chapter 2. Public Investment for the Recovery.

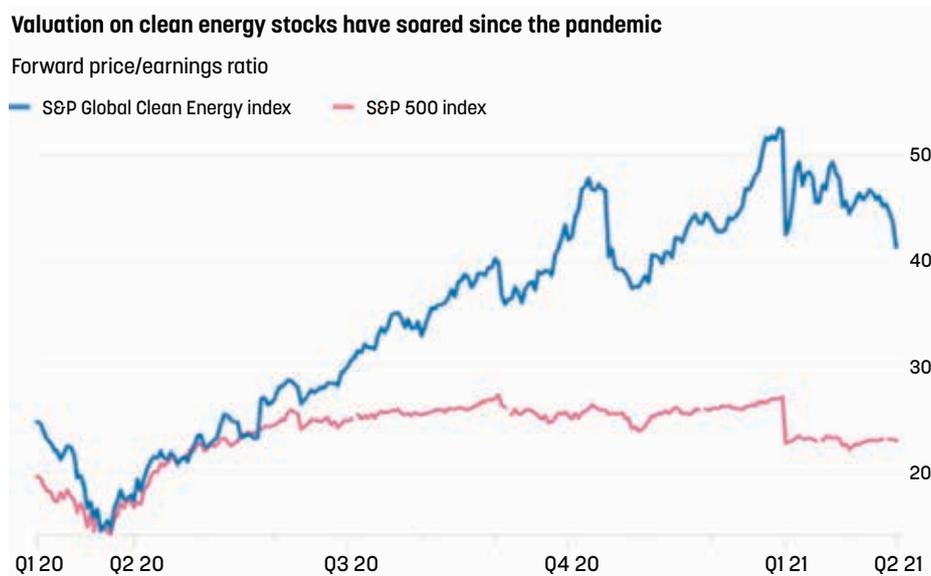
toward green energy and reduce stranded asset risks.¹⁷⁸ Green finance in LAC, while growing significantly in recent years and exceeding US\$1 billion over the last five years in Brazil, Chile, and Mexico (figure 24), falls short of what is required to meet climate and environmental objectives. The development of LAC’s capital markets presents substantial opportunities to scale up investment in green projects, and the demand is strongly visible in market pricing (figure 25).

FIGURE 24: Green Bond Issuances in LAC, 2014–2019 Green finance has grown significantly, but still falls short of what is needed to meet climate objectives



Source: Latin America and Caribbean: Sustainable Finance State of the Market 2021. Climate Bonds Initiative, 2021.

FIGURE 25: Demand for Investment in Green Projects Is Strongly Visible in Market Pricing



Source: Bloomberg.

178 See, for example: <https://www.economist.com/business/2021/05/23/what-a-proxy-fight-at-exxonmobil-says-about-big-oil-and-climate-change>

While some LAC countries have made breakthroughs by enacting ESG risk regulations, financial regulators could further integrate climate and environmental risks into their regulatory and supervisory frameworks. Between 2014 and 2019, financial sector regulators in Brazil, Honduras, Paraguay, and Peru enacted ESG risk resolutions. The Central Bank of Brazil (BCB) enacted a series of regulations compelling banks to integrate climate-related risks into the management of traditional risks by clarifying supervisory expectations for financial institutions' climate strategy, governance, risk management, and disclosure. The disclosure rules are inspired by the Financial Stability Board's Task Force on Climate-related Financial Disclosures (TCFD) but are not limited to climate-related risks. The scope was enlarged to include ESG issues. Since 2017, social and environmental risks are also included in the process of the internal capital adequacy assessment by Brazil's systemically important banks, which may result in allocating capital above the regulatory minimum. Across LAC, supervisors' integration of climate-related or environmental risks into financial system surveillance and micro- or macroprudential supervision is gathering pace, as more financial authorities join the Network for Greening the Financial System (NGFS)¹⁷⁹ and adopt a more proactive stance toward climate-related and environmental risks. NGFS membership should help LAC financial authorities develop action plans tailored to their needs. This should be aligned with their mandate and based on their capacity, including (i) identifying the channels through which climate-related risks are transmitted to the financial sector and determining the materiality of those risks for financial institutions; and (ii) quantifying financial institutions' exposures to climate-related and environmental risks, and stress testing their vulnerability.¹⁸⁰

Initiatives to address remaining institutional barriers inside and outside the financial system that prevent the full development of green financial markets will help achieve LAC's climate action potential. In the absence of best practices or guiding principles, international experience can be useful in sketching out a plan for market development. Typical barriers to green finance include, among others, a lack of alignment of financial sector policies and incentives with climate and environmental objectives; a lack of transparency and labeling of green assets; and low penetration and availability of insurance products. Authorities in LAC can tailor the following options to country characteristics: (i) foster transparency by introducing a sustainability taxonomy and labeling of economic activities, and advancing climate-related financial disclosure; (ii) building capacity in the financial sector, including setting up a national platform on green finance and expanding the role of national development banks in providing green finance; (iii) stimulating long-term investments in green and sustainable projects by issuing sovereign green bonds, which may set an important precedent for the country's public and private issuers, introducing incentives to stimulate corporate green bond uptake; and (iv) expanding disaster risk insurance coverage, including by adopting a Disaster Risk Financing and Insurance Strategy. In addition, increasing the relative returns of green projects by pricing externalities and decreasing political risk by defining a long-term transition path would further raise demand for green finance.¹⁸¹

¹⁷⁹ The NGFS's objective is to strengthen the global response required to meet the goals of the Paris Agreement and enhance the role of the financial system to manage risks and to mobilize capital for green and low carbon investments. To this end, it defines and promotes best practices to be implemented within and outside of its membership. The NGFS was established at the Paris "One Planet Summit" in December 2017 by eight central banks and supervisors. The Bank of Mexico is one of the founding members of the NGFS. As of March 2021, other LAC supervisory and regulatory bodies joined the network, including the central banks of Costa Rica, Paraguay, Uruguay, Colombia, and Brazil; the *Comisión Nacional Bancaria y de Valores* (Mexico); the *Comisión para el Mercado Financiero de Chile*; and the *Superintendencia Financiera de Colombia*. See <https://www.ngfs.net/en/about-us/membership>.

¹⁸⁰ See also Guide for Supervisors: Integrating climate-related and environmental risks into prudential supervision. Network for Green the Financial System - Technical Document

¹⁸¹ See, for example, China Green Finance Task Force (2015), European Commission (2018), and Government of the United Kingdom (2019).

The banking sector is well positioned to promote decarbonization and sustainability by directing capital flows toward greener projects and companies.¹⁸² Banking activities should be aligned with a country’s environmental objectives, incorporating voluntary practices that can demonstrate the potential for the financial sector and then be scaled up, such as (i) financial instruments that promote the development of projects with positive environmental impacts; (ii) sustainable procurement and efficient use of resources; (iii) environmental and social risk management systems, starting with compliance with local environmental and social regulations; and (iv) dissemination of good practices and knowledge sharing.¹⁸³

Many LAC countries are only starting to green their financial sector, yet Latin American banks are taking steps to adopt more sustainable banking models and green banking strategies. Some of the leading banks in the region have already begun to access new financing mechanisms in parallel with the development of their business models and green portfolios. In many cases they are being supported by multilateral institutions such as the World Bank and the IFC. Additionally, the IFC Green Banking Academy (GBAC) in Latin America and the Caribbean provides specialized advice and training to accelerate banks’ green transformation, strengthen their business, and enable them to contribute to a more sustainable world. The IFC’s GBAC was launched in 2018. Since then, it has trained over 5,000 bankers and facilitated US\$1.1 billion in climate loans (FY2019–FY2020).¹⁸⁴

Finance will play a critical role in enabling the private sector to transition to the provision of climate friendly goods and services. Climate finance and finance raised by carbon market mechanisms can play important roles in narrowing the large-scale capital gap for a low-carbon transition. Global carbon markets grew by 20 percent in 2020, to US\$272 billion (figure 26). Article 6 of the Paris Agreement

FIGURE 26: Global Carbon Markets Grew by 20 Percent in 2020



Source: Bloomberg.

¹⁸² “Green Finance Latin America 2017 Report”. 2017. Available at: https://www.ifc.org/wps/wcm/connect/0a419cfa-2959-403c-8403-044f6b3be04b/Green+Finance+Report+2017_2019.pdf?MOD=AJPERES&CVID=mGxjRRO.

¹⁸³ “Green Finance Latin America 2017 Report”. 2017. Available at: https://www.ifc.org/wps/wcm/connect/0a419cfa-2959-403c-8403-044f6b3be04b/Green+Finance+Report+2017_2019.pdf?MOD=AJPERES&CVID=mGxjRRO.

¹⁸⁴ IFC. N.d. “IFC Green Banking Academy (IFC-GBAC).” Available at: https://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/financial%20institutions/priorities/climate_finance_sa/gba.

provides for market-based approaches, including the trading of “mitigation outcomes.” The goal is to achieve emission reductions as cost-effective as possible by focusing investments where costs are lower. Over one-half of NDCs reference the use of market mechanisms to reach their targets. Research by the International Emissions Trading Association shows that the potential benefits of emissions trading under Article 6 are substantial, potentially reducing the cost of meeting climate commitments by US\$250 billion by 2030. This means market mechanisms would allow another 5 Gt CO₂ per year to be reduced at no additional cost. However, market mechanisms require clear rules and implementation arrangements.¹⁸⁵ For LAC, the introduction of robust emissions trading could present an opportunity to attract investment and generate income by exporting environmental benefits.

Emissions trading requires a more harmonized, transparent global system. Carbon credits are an emerging asset class already in use in some markets. The three major schemes, the EU Emissions Trading Scheme, the Regional Greenhouse Gas Initiative in the US Northeast, and the California Cap and Trade Program, traded more than US\$250 billion in emissions certificates in 2019. A recent study by Vivid Economics predicts the carbon offset market could reach US\$1.4 trillion per year within 20 years (see box 12 for more information on carbon credit schemes). Mexico, Colombia, and Chile have advanced carbon pricing policies and are in the process of launching carbon markets.

One of the main obstacles to expanding carbon markets is fragmented, heterogeneous standards. To be scalable, carbon markets need generally agreed baseline standards and definitions that allow for consistent monitoring, reporting, and verification (MRV) and processes to qualify, quantify, and monetize. The World Bank is uniquely placed to help establish standards, and is currently testing the concept of a Climate Warehouse for mitigation outcomes to underpin the development of a carbon market infrastructure in Chile, Peru, and Costa Rica. The World Bank is facilitating dialogue to create an enabling environment that would underpin the development of regulatory frameworks and market infrastructure with associated sound governance arrangements in member countries. LAC requires the introduction and scale-up of a carbon market that is integrated into a broader global market.¹⁸⁶ By establishing a market norm, carbon credits can break out of regionally limited ETSs and binary voluntary carbon markets, and provide proper market signaling and an open asset trading infrastructure. Such monetization can then cascade down to all carbon credit generating programs, creating a financing tool and profit generator that is currently missing.

New regulatory guidance and tools are needed to support the mobilization of private capital for climate-oriented activities. Some LAC countries, such as Colombia, are beginning to lay the foundations for growth in certified “green” instruments in their domestic capital market. Key areas of focus include: (i) the development of a sustainable finance taxonomy to guide market understanding of what activities and products can be considered green and/or sustainable in each country context; and (ii) the introduction of policies to better integrate ESG into the investment mandates of financial institutions, including pension funds. On the supply side, defining the “green bond” label for use in domestic capital markets will be important, as is providing instruction on the minimum information to include in the issuance prospectus to qualify the instrument as a green bond. This will serve to bolster confidence in these instruments and prevent the issuance of labeled instruments that do not meet

¹⁸⁵ Esmonds et al. 2019. “The Economic Potential of Article 6 of the Paris Agreement and Implementation Challenges.” September 2019. Available at: https://www.ieta.org/resources/International_WG/Article6/CLPC_A6%20report_no%20crops.pdf.

¹⁸⁶ IFC is working on this initiative, as well as leading an initiative to establish a global benchmark for MRV.

Box 12: Carbon Credit Schemes

Carbon credits are credits issued to projects or activities that reduce emissions or remove emissions from the atmosphere by a quantifiable amount, that can be verified by relevant agencies. Examples include energy efficiency and renewable energy projects, waste management, reforestation and cultivation of sea algae (which removes emissions from the atmosphere), and prevention of deforestation or carbon capture and storage (which prevents emissions from entering the atmosphere).

Carbon credits are issued to the organization implementing the activity. These organizations could return the credits to a government to reduce a carbon tax bill. For example, a power plant that installs filters that reduce carbon emissions can receive credits from the certifying public (or private) authority. These can then be used to offset a tax bill—effectively acting as a subsidy for installing the filters. An NGO that receives credits for a reforestation project can sell the credits to finance reforestation costs. A company that purchases those credits can use the credits to offset its tax bill. Similarly, companies or individuals may choose to voluntarily purchase carbon credits to offset, for example, flight emissions.

Establishing mechanisms to implement carbon credits on a national level can be a challenge. For example, the institution must gain the capacity to verify the amount of emissions reduced. In addition, carbon credits should only be issued for activities that would not otherwise have taken place. For example, it should be verifiable that without a specific project, an area would not have been reforested. Establishing this requires adequate processes and training and can often be contestable—especially when credits are issued for the avoidance of harm, which requires quantifying a counterfactual.

While challenging, carbon credit schemes have benefits. First, they can encourage efforts in sectors of the economy that might be difficult to reach through other means, such as regulations or carbon pricing. For example, they can establish an incentive to protect forests or to invest in energy efficient equipment and infrastructure. Second, they may also stimulate innovation—such as finding alternative ways to extract carbon from the atmosphere or developing new low carbon technologies. Third, they can attract financial resources to poorer areas of a country or—when connected to global certification schemes—they can attract financial resources to flow from wealthier to poorer countries. For example, if a US company is able to meet ETS requirements more cheaply by purchasing offsets in Mexico, the right linkages could enable it to do so. This could help the global North achieve some of the promised financial flows to support climate change activities. Several LAC countries are establishing crediting schemes, which are also becoming common in other parts of the world. For example, in Mexico and Colombia, companies can reduce their carbon tax bills by purchasing credits from approved projects. Several other countries, including Brazil, Peru, and Chile, are considering such schemes. Outside of LAC, schemes are under development or already implemented in Spain, South Africa, China, Japan, Australia, several US states, and Canadian provinces.

the highest global “green” standards available. Issuers in emerging markets, such as Brazil, have also begun to introduce sustainability linked bond instruments, which link financial characteristics of the instrument to the achievement of key green or sustainability oriented performance indicators. These instruments hold promise for corporates who appreciate the flexibility of using bond proceeds for general purposes, while investors also benefit by being able to hold issuers accountable for not

meeting specific green or sustainability oriented performance targets. Sovereigns can support the green debt capital market by issuing sovereign green bonds in local currency, with the proceeds allocated to fund climate-related activities and investments. This would help to build a “green yield curve” in local currency and further support green capital market issuance by corporates.

Some concrete actions have been already identified that could help to scale up capital in climate technologies. Risks can be mitigated through a variety of instruments, including publicly backed guarantees, credit, and liquidity risk. Guarantees, which accounted for 3.8 percent of multilateral development banks’ climate finance commitments in 2019, are suitable for facilitating investment flows to high risk sectors in emerging economies and mobilize additional financial resources for climate activities, as they provide the necessary backstop to ensure the repayment of loans.¹⁸⁷ However, these represent either a contingent liability or a direct cost on governments. Blended climate finance, on the other hand, has been successful in catalyzing private sector investment that would otherwise not happen under prevailing market conditions, by compensating for the higher cost of newer and riskier technologies. Among alternative sources of financing to support climate innovation, private equity funds have been successful in some countries, such as India. Developing new financial instruments and supporting capital markets is crucial to scale up investments in climate technology, but there is also a need to educate investors (such as angel investors and venture capitalists) on the nature of climate technology development (e.g., long payback times, type of market demand, and broader benefits and returns). Venture capital investment opportunities exist in climate tech, including agri-tech and food tech, electrified transportation, the circular economy, and earth observation (satellites and data) in LAC.

iii. Institutional Reforms for Effective Climate Action

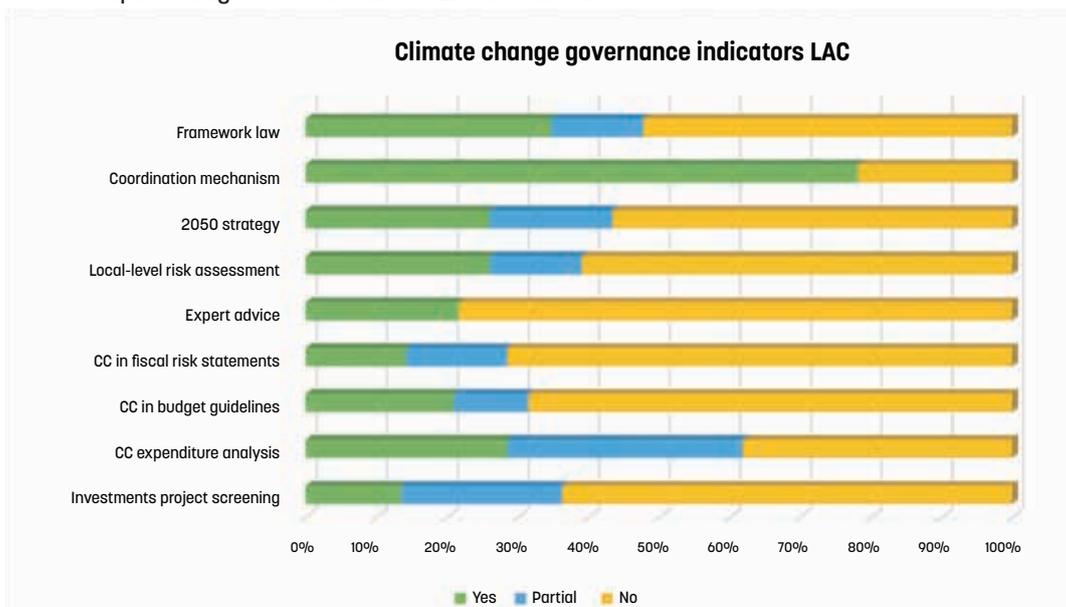
LAC countries have taken important steps in enabling their public institutions to respond effectively to climate change. LAC is ahead of other regions in adopting climate framework legislation, though fewer than one-half of the countries have done so to date (figure 27). Six countries have developed long-term climate change or decarbonization strategies, and four more are currently under preparation or discussion. Nearly all countries have established formal mechanisms for intergovernmental coordination on climate change, but coordination remains a challenge, as mechanisms often lack convening and decision-making power. While ministries of finance are showing a growing interest in climate change—for instance, through membership of the Coalition of Finance Ministers for Climate Action—their technical capacity requires strengthening, and they rarely play a leading role in policy design, implementation, and coordination.

There is significant room for improvement in the region in the use of public finances to translate climate policy into action. There are significant weaknesses in the incorporation of climate change into public finance management (PFM) systems, with less than 30 percent of countries including climate change in their fiscal risk statements and budget guidelines. Countries do somewhat better on tracking climate spending, but the analysis and use of this information is still a work in progress. Few countries have tailored their PFM systems to respond quickly and effectively during disasters. Public investment management in particular needs attention, as less than 15 percent of countries are screening public

¹⁸⁷ IDB. 2019. Joint Report on Multilateral Development Banks’ Climate Finance ([link](#)).

investment projects for climate impacts and risks. State-owned enterprises (SOEs) play important roles in key public service and infrastructure sectors in many countries, and there is ample scope for SOEs to adopt more sustainable approaches, take climate risks into consideration, and transition to low carbon technologies. Climate informed public procurement also presents a growth opportunity by directing the sizable portion of GDP comprised by government spending toward climate goals and creating incentives for the private sector to innovate and serve this new market.

FIGURE 27: Fewer than One-Half of LAC Countries Have Adopted Climate Framework Legislation (percentage refers to share of LAC countries)



Source: WBG analysis, 2021 – unpublished.

Subnational governments will need to play key roles in meeting regional and national climate objectives, especially in large countries such as Brazil, Argentina, Mexico, Colombia, and Peru, where they control more than one-third of public spending. There is a lack of actionable risk and vulnerability information disaggregated for use by subnational governments, with less than 40 percent of countries producing this information. There is also considerable scope to adapt intergovernmental transfers to incentivize action by subnational governments—for instance, through payments for ecosystem services. Geographically disaggregated climate risk information is needed to allow subnational governments to make informed decisions. Most subnational governments need technical capacity support to ensure that climate impacts are accounted for in local development plans, budgets, and public financial management systems. Subnational governments could also play greater roles in the development of national plans, given their important role in responding to national disasters and supporting changes in citizen behavior in response to climate change.

Sustaining commitments to ambitious climate policies requires political support and effective systems of accountability. While civil society groups are generally aware of climate issues and exert influence on policy makers, climate change is rarely a top priority for citizens.¹⁸⁸ LAC is ahead of other regions in making climate information available to the public, including through innovative online

188 LatinoBarómetro 2018. Informe Annual, Corporación Latinobarómetro, 2018.

platforms such as Colombia's *MRV de Financiamiento Climático* (an interactive platform providing information on domestic and international climate finance) and Chile's State of the Environment Platform (with easily accessible data on environmental and climate indicators). However, in terms of formal accountability institutions, only five LAC countries have a system for providing independent expert review of climate targets, policies, and actions, and legislative bodies and supreme audit institutions rarely assess executive actions on climate. The existence of climate legislation in many countries means there is an opportunity for courts to play a more active role to ensure the sustained commitment of executives and legislatures to climate action.¹⁸⁹ Mechanisms that support private sector participation and consultation in the climate policy making process can also play an important role in building collective action and mobilizing resources for impact, such as the initiative led by the Brazilian Federation of Banks and the Chamber of Construction (CBIC), with support from the IFC to highlight opportunities for banks, real estate developers, and other economic agents in low carbon, resilient development.

The multifaceted nature of climate change requires different governance actors to collaborate and plan multisectoral interventions, especially for the water sector. Water governance tends to be highly fragmented, with conflicting and overlapping responsibilities between national and subnational actors. In water resources management, coordinated planning is needed at the basin level, guided by a holistic approach. Investments in hydrometeorological data are required to build consensus, inform decision-making, and prioritize investments. Understanding the timing and spatial distribution of the water resource and its availability in terms of quality is essential for decision-making for energy, agriculture, transport, and other industrial sectors. Monitoring and prediction of water resources is especially relevant in the face of demand growth and climate uncertainties. This requires first integrating different sector databases on water balances and quality, then expanding these databases to include projections under different climate scenarios to support the development of decision-making tools.

Digital infrastructure will play a major role in enabling the green transition in LAC, including in critical sectors that are major sources of GHG emissions. This report has highlighted a variety of tools and applications that can help countries adapt and become more resilient to climate change. Deploying them at scale will require universal connectivity, together with an appropriate legal framework for data management. For instance, smart-grid technologies can be implementable only if countries rely on a well-developed digital network and users can access fast, reliable, and affordable internet service. Public and private investments in infrastructure are needed to close the digital gap in the region and make universal connectivity a reality for LAC. At the same time, resources must be focused on increasing digital skills and raising awareness of the role of these technologies in addressing climate change. Countries also need appropriate legal and regulatory frameworks for data management to leverage the full potential of digital technologies while minimizing risks such as data privacy erosion and cyberattacks. A regional effort in this sense is needed to adopt common rules for data sharing and data protection, so that activities like deforestation monitoring can be jointly undertaken by multiple countries.

¹⁸⁹ Two recent court rulings in Europe challenged governments and firms to do more to follow national climate change legislation: (i) on April 29, 2021, Germany's Constitutional Court ruled that the lack of specificity in climate change targets meant they were unconstitutional and required the government to be clearer about the expected adjustment burden falling on future generations which has led to the government introducing a law to adopt more ambitious targets; and (ii) on May 26, 2021, a Dutch court ordered Shell to cut its emissions by 45 percent by the end of 2030 compared with 2019 levels.

iv. Priority Actions

Table 7 highlights, by country, potential areas for new WBG support in LAC for economy-wide actions under four entry points, which were identified based on the assessment presented above: (i) restructuring subsidies and taxes; (ii) anticipating transition risks; (iii) safeguarding the financial sector and catalyzing green finance; and (iv) strengthening institutional leverage for climate action. More detail on country-specific actions (of which there may be several for each country for a given entry point) is provided in the country climate change snapshots that accompany the LAC Roadmap.

The table distinguishes between these actions in three dimensions:

1. between those already incorporated in the WBG portfolio (either under implementation or included in the pipeline of operations) or that are adequately supported by non-WBG programs, and those that would be new (either under discussion or aspirational, including potential operations to scale up existing initiatives);
2. between those new actions that would be aligned with current government priorities and those that would not; and
3. also highlights those new actions that are urgent, in the sense that delay would significantly increase their cost, which in this context relates primarily to the need to safeguard the financial sector from physical and transition-related climate risks.

As table 7 indicates, priority economy-wide actions for new WBG support include initiatives to restructure subsidies and taxes to accelerate the low carbon transition, including through the potential expansion of carbon pricing in Brazil, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, and Paraguay. Additional support to anticipate risks associated with climate policy transitions in export markets, primarily for fossil fuels and agricultural products, is a priority in Bolivia, Colombia, Ecuador, Honduras, and Paraguay. New WBG support for the urgent analysis and management of financial sector exposure to physical and transition-related climate risks is a priority in Brazil, Colombia, Costa Rica, Ecuador, Nicaragua, and Peru, while additional WBG engagement for institutional strengthening is a priority for more effective climate action in Bolivia, Colombia, Costa Rica, the Dominican Republic, El Salvador, Guatemala, Haiti, Mexico, Paraguay, and Peru.

Table 7: Priority Cross-Cutting Actions¹⁹⁰

	Restructure Subsidies and Taxes	Anticipate Transition Risks	Safeguard Financial Sector and Catalyze Green Finance	Strengthen Institutional Leverage for Climate Action
Argentina	●	●	●	●
Belize	—	—	—	—
Bolivia	—	●	—	●
Brazil	●	●	*	●
Colombia	●	●	*	●
Costa Rica	●	—	*	●
Dominican Republic	●	●	●	●
Ecuador	●	●	*	●
El Salvador	●	—	●	●
Guatemala	●	●	●	●
Guyana and Suriname	—	●	—	●
Haiti	●	—	●	●
Honduras	●	●	●	●
Jamaica	—	●	●	●
Mexico	●	●	●	●
Nicaragua	●	—	*	—
Panama	●	—	●	●
Paraguay	●	●	●	●
Peru	●	—	*	●
Uruguay	●	—	●	●
Caribbean SIDS*	—	●	●	●

Source: WBG LAC Roadmap team development.

Note: SIDS = small island developing states, which include Saint Vincent and the Grenadines, Dominica, Grenada, St Lucia St Maarten, and Barbados.

Key:

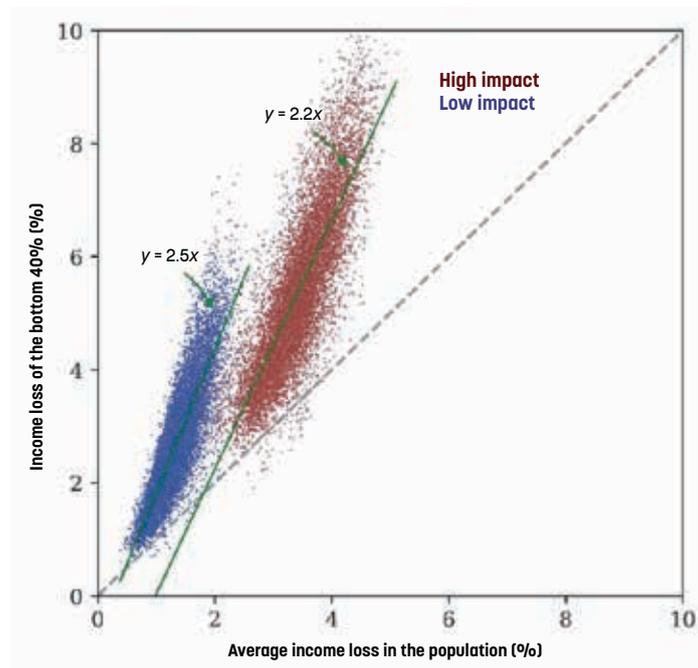
- * Urgent area for new WBG engagement aligned with government priorities
- Area for new WBG engagement aligned with government priorities
- * Urgent area for new WBG engagement not aligned with current government priorities
- Area for new WBG engagement not aligned with current government priorities
- Existing WBG or adequate other engagement

¹⁹⁰ Actions reflect the input from a consultative process with WBG Country Management Units and sector experts.

5.2. Protecting Vulnerable Populations

Economically disadvantaged people and groups struggle to cope with both climate shocks and slow onset climate-induced changes, amplifying already high inequalities in LAC, and are also more vulnerable to changes in energy and food prices. Particularly vulnerable groups include women and children, the elderly, persons with disabilities, Indigenous peoples, and ethnic and racial minorities, as well as the rural poor. The latter often depend on agriculture and other activities that are closely linked to natural resources, so climate change directly threatens their livelihoods and food security. They also typically live in places with limited public infrastructure and services in rural areas, or on the edges of cities on marginal land that is at a high risk of flooding and landslides. They are also often employed informally, with limited legal protections and little or no access to safety net programs. As a result, the bottom 40 percent of the population in LAC loses more than twice as large a share of its income after climate shocks as the population as a whole (figure 28). In addition, the poor and middle-class households spend a larger share of their income on food, housing, and transport services, so they are more sensitive to increases in energy and food prices that may occur during the low carbon transition.

FIGURE 28: The Income Loss of the Bottom 40 Percent of the Population in LAC Following Climate Shocks Is More than Double That of the Population Average



Source: Jalino et al. 2020. Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030— World Bank Policy Research Working Paper #9417.
Note: Income loss of the bottom 40 percent compared to average income loss in LAC for high and low impact climate change projections. Each dot represents one scenario representing a combination of future conditions that drive households' income by 2030 (structural change, productivity growth, redistribution, education, etc.) and future climate change impacts.

i. Impacts of Climate Change and Climate Policy

Without action to build resilience, the direct impacts of climate change will slow economic growth and increase poverty, exacerbating the consequences of the COVID-19 pandemic. Economic growth is key for poverty reduction, reflecting increased productivity and stimulating job creation as well as facilitating better access to basic goods and services. Yet the impacts of climate change will slow economic growth¹⁹¹ and make it more difficult to achieve development goals. In addition to indirect impacts through slower economic growth, climate change could push an estimated 2.4–5.8 million people into extreme poverty in LAC by 2030,¹⁹² with the percent increase in poverty headcount a result of climate change higher in LAC than any other region (in part because extreme poverty would largely be eradicated by 2030 in most baseline scenarios).¹⁹³ Climate change affects the ability of the poor to escape poverty through interacting channels related to agricultural and ecosystem impacts, natural disasters, and health shocks,¹⁹⁴ with health impacts and natural disasters the most significant contributing factors in driving additional people into extreme poverty (figure 1).

Changing climate patterns can catalyze health deterioration through impacts on the quantity and quality of water resources, heat stress, and changes in exposure to disease. The COVID-19 pandemic has highlighted the fact that most LAC countries are not sufficiently prepared to respond to large-scale health emergencies. While progress has been made in access to health care, important regional disparities remain; for example, the WHO index of Universal Health Coverage (UHC)¹⁹⁵ ranks Uruguay 25th globally, while Haiti ranks 136 (out of 180). The COVID-19 pandemic has further exacerbated inequities in access and outcomes and has reversed some of the progress achieved toward UHC. Expected increases in the prevalence of vector-borne diseases due to climate change are a concern in many LAC countries, where morbidity and mortality from mosquito-borne diseases such as the Zika virus, Chikungunya virus, dengue, and malaria could increase. Heat stress can also affect labor productivity, with particularly detrimental impacts on poor and subsistence-farming rural workers and on the informal construction sector. Climate-related health shocks and poor health contribute to poverty through loss of income, health expenses, and increased caring responsibilities, presenting an additional obstacle to the reduction of poverty and inequality.¹⁹⁶ Deterioration of health is projected to be the main driver behind a climate-related poverty increase in the region, potentially pushing 4.7 million more people into extreme poverty in LAC by 2030.¹⁹⁷

Climate change impacts, such as environmental degradation, loss of livelihoods, and unemployment, can lead to displacement and migration. Without proactive measures to address climate and development challenges, by 2050, more than 17 million people in LAC (some 2.6 percent of the population) could be forced to move within their own countries to escape slow-onset climate

191 Hallegatte et al. 2016. Shockwaves - Managing the impacts of Climate Change on Poverty.

192 Jafino et al. 2020. "Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030". World Bank Policy Research Working Paper #9417, September 2020. Available at: <https://documents1.worldbank.org/curated/en/706751601388457990/pdf/Revised-Estimates-of-the-Impact-of-Climate-Change-on-Extreme-Poverty-by-2030.pdf>.

193 Jafino et al. 2020. "Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030". World Bank Policy Research Working Paper #9417, September 2020. Available at: <https://documents1.worldbank.org/curated/en/706751601388457990/pdf/Revised-Estimates-of-the-Impact-of-Climate-Change-on-Extreme-Poverty-by-2030.pdf>.

194 Hallegatte et al. 2016. Shockwaves - Managing the impacts of Climate Change on Poverty.

195 The index measures the average health coverage of essential services based on tracer interventions that include reproductive, maternal, newborn, and child health, infectious diseases; noncommunicable diseases; and service capacity and access, among the general and the most disadvantaged population.

196 Hallegatte et al. 2016. Shockwaves - Managing the impacts of Climate Change on Poverty.

197 Jafino et al. 2020. "Revised Estimates of the Impact of Climate Change on Extreme Poverty by 2030". World Bank Policy Research Working Paper #9417, September 2020. Available at: <https://documents1.worldbank.org/curated/en/706751601388457990/pdf/Revised-Estimates-of-the-Impact-of-Climate-Change-on-Extreme-Poverty-by-2030.pdf>.

change impacts, such as reduced and irregular rainfall.¹⁹⁸ By the time they leave, they may be seriously impoverished or even in crisis, which would compound their vulnerability as they go into unfamiliar environments, away from their livelihoods, and without social support networks. Furthermore, the prevalence of smallholder farming across many parts of LAC increases displacement risks, as these groups often have no capital reserves or technical capacity to turn to alternative livelihoods once disconnected from their land, markets, and natural resource supplies. In addition to increasing inequality, forced migration and displacement heightens the potential for social unrest, exacerbating existing tensions around exclusion and inequality, and undermining social cohesion.

Vulnerable people in Central America and the Caribbean are among the most exposed in the world to natural disasters. These countries suffer from high exposure to storms, flooding, and landslides, which often result in high economic losses. The significant presence of smallholder farming and subsistence production elevates vulnerabilities, as agricultural activities are particularly susceptible to these disasters. Part of the region (the *Corredor Seco* in Central America) is also vulnerable to severe droughts exacerbating food insecurity, particularly among vulnerable communities with already higher than average rates of stunting and malnutrition.¹⁹⁹

In rural areas, Indigenous peoples are particularly vulnerable to climate change because of their reliance on natural resources and poor access to infrastructure and technology.²⁰⁰ In addition, some Indigenous and traditional communities have been pushed to the most fragile lands as a consequence of historical, social, political, and economic exclusion. Consequently, they are at even greater risk.²⁰¹ At the same time, people living in marginal areas have long been exposed to many kinds of environmental changes, and traditional coping systems and knowledge of Indigenous groups can be supported and drawn on as a source of resilience and adaptation to the impacts of climate change.²⁰²

The poor and middle class are vulnerable to changes in energy and food prices. In the absence of compensation, carbon taxes and other climate policies can deepen poverty by increasing the prices of basic goods and services, such as food, heating, and transport. An equitable distribution of the climate change mitigation burden is particularly relevant in the LAC region where, as of 2019, 22.4 percent of the population lived below the extreme poverty line,²⁰³ and the middle class was relatively small (38.0 percent of the population) and precarious.²⁰⁴ The 2019 protests in Ecuador and Chile in response to reductions in fuel subsidies and increases in transport costs, respectively, underline the importance of ensuring a just and equitable transition, as well as of good communication around needed reforms. This social fragility is further exacerbated by the economic stress imposed by the COVID-19 pandemic. As a result, fairly distributing the costs of climate actions, including support for the most impacted segments of society, is paramount to ensure the acceptance and feasibility of climate policy implementation in the region.

198 Clement, Viviane, Kanta Kumari Rigaud, Alex de Sherbinin, Bryan Jones, Susana Adamo, Jacob Schewe, Nian Sadiq, and Elham Shababat. 2021. "Groundswell Part 2: Acting on Internal Climate Migration." Washington, DC: World Bank, September 2021. <http://hdl.handle.net/10986/36248>.

199 World Development Indicators, World Bank, 2021. Available at: https://data.worldbank.org/indicator/SH.STA.STNT.ZS?locations=ZJ&most_recent_value_desc=true.

200 Turn Down the Heat. 2014. WBG., p.41.

201 IUCN. 2018. Indigenous and Traditional Peoples and Climate Change.

202 Examples of such traditional and innovative adaptation practices include shoreline reinforcement, improved building technologies, rainwater harvesting, supplementary irrigation, traditional farming techniques to protect watersheds, changing hunting and gathering periods and habits, crop and livelihood diversification, use of new materials, and community-based disaster risk reduction.

203 The World Bank."LAC Equity Lab: Poverty— Poverty Rate." Available at: <https://www.worldbank.org/en/topic/poverty/lac-equity-lab1/poverty/head-count>.

204 The World Bank."LAC Equity Lab: Poverty— Poverty Rate." Available at: <https://www.worldbank.org/en/topic/poverty/lac-equity-lab1/poverty/head-count>.

ii. Avoiding Long-Term Impoverishment and Job Losses

Climate and health shocks create poverty traps and can cause lifelong earnings losses, with consequences over several generations. There are several transmission channels that can transform climate impact into persistent poverty. A poor household does not have the ability to smooth consumption following a shock, and so may be forced to limit expenditure on education and health in the aftermath of a disaster, with irreversible impacts for children. Chronic malnutrition may worsen in the future with climate change, impacting productivity and earnings for generations. With less steady income and little to no insurance coverage, climate risk can also push poor households into low risk, low return strategies that keep them poor, and may force them to over extract resources and sell productive assets as short-term survival strategies in the climate crisis.²⁰⁵

Poorly managed economic transitions can leave entire regions with high unemployment rates for decades. Historical examples from deindustrialization in the United States or transitions away from coal in Europe demonstrate that entire regions can be left behind after major industries close if governments do not intervene to boost the competitiveness of the region or retrain workers. Labor markets are seldom fully flexible, such that structural economic changes or trade liberalization often lead to a rise in unemployment, as skill and institutional challenges prevent workers from moving from old to new sectors. Governments have long used policies to create regional balance, generating jobs where unemployment is higher or the population poorer, or to smooth economic transitions. However, after trade liberalization displaced workers from industries that Brazil had stopped protecting,²⁰⁶ it took several years for the growth sectors to absorb them.²⁰⁷

The transition to a low carbon economy will destroy some jobs, even if more will be created in other sectors. Jobs will be exposed to transition risks in high emission activities such as fossil fuel extraction and land clearance for agriculture. According to one estimate, in the transition to a net-zero carbon economy, 7.5 million jobs will be lost in LAC: in fossil fuel electricity, fossil fuel extraction, and animal-based food production.²⁰⁸ While it is projected that job losses will be more than offset by new employment opportunities, governments need to implement policies that facilitate the reallocation of workers, promote sustainable rural livelihoods and low carbon business models, and support displaced workers and their communities. Policies to foster green growth may induce a skill-biased shift in labor demand. If the supply of green skills cannot quickly adjust, labor market bottlenecks may follow. For example, some firms may struggle to find the specialists required to implement technologies that meet international green business certifications. Accordingly, a national carbon tax (or carbon border adjustment tax) may reduce the competitiveness of dirty sectors leading to the displacement of workers that lack the skills for jobs in the green economy. These bottlenecks can have important distributional consequences. In particular, the scarcity of highly skilled green workers may lead to growing wage skill premiums and inequality; at the same time, the displacement of workers without the skills demanded in the green economy may lead to growing poverty and vulnerability.

²⁰⁵ Hallegatte et al. 2016. Shockwaves - Managing the impacts of Climate Change on Poverty.

²⁰⁶ Menezes-Filho Naercio Aquino, and Marc-Andreas Muendler. 2011. "Labour Reallocation in Response to Trade Reform" 2011.

²⁰⁷ Porto, Guido. 2012. The Cost of Adjustment to Green Growth Policies: Lessons from Trade Adjustment Costs. Policy Research Working Paper; No. 6237. World Bank, Washington, DC. © World Bank. <https://openknowledge.worldbank.org/handle/10986/12079> License: CC BY 3.0 IGO."

²⁰⁸ Saget, Catherine, Vogt-Schilb, Adrien and Luu, Trang (2020). Jobs in a Net-Zero Emissions Future in Latin America and the Caribbean. Inter-American Development Bank and International Labour Organization, Washington D.C. and Geneva.

Understanding where countries stand in terms of the development of green skills is crucial to assess the potential distributional consequences of green policies. In order to work, many of these changes will require behavioral change and buy-in from affected communities. This will require engaging vulnerable populations and local communities as partners in designing policies and actions, rather than simply as beneficiaries or victims. These populations can provide a unique, local perspective to address challenges, set priorities, and design and implement measures that are responsive to their specific needs. That, in turn, can result in better and more sustainable change.

iii. Strengthened Systems and Services to Reduce Vulnerabilities

A range of policy options exist to reduce climate risks at the national level and protect the most vulnerable. These efforts include the use of financial instruments such as CAT-Bonds, insurance, and disaster funds that help ensure governments have resources for post-disaster response, and scalable social safety nets to ensure that such resources are distributed in a timely manner to the victims most in need. In places with the greatest exposure, such as Central America and the Caribbean, resilience packages that incorporate all of these elements will be needed.²⁰⁹ In the near term, responding to disasters will require using and extending existing instruments, including direct cash transfers, social insurance (including pensions, unemployment insurance, and universal health coverage), private protections (including private savings and insurance), and labor market protections, such as mandated sick leave, to protect disadvantaged households against climate-related negative shocks such as illnesses, natural disasters, or food and energy price increases.

Despite recent progress, the social safety net in LAC has room to improve in terms of coverage and depth. In the lowest-income quintile, 61 percent of households are covered by social protection and labor programs,²¹⁰ which provide an average of 35 percent of covered households' incomes.²¹¹ Further expansion of social investment in the region has been limited by fiscal and political constraints. Social spending in LAC countries averages around 8 percent of GDP,²¹² while the average in the Organisation for Economic Co-operation and Development (OECD) is 20 percent.²¹³ Spending on social safety nets in particular averages around 1.5 percent of GDP in LAC countries and 2.7 percent across the OECD.²¹⁴ Moreover, labor market programs are usually not implemented on a large scale. Due to high informality rates, many workers in LAC countries are structurally excluded from labor market benefits, such as unemployment insurance and pensions. On average, only 12.2 percent of the unemployed in the region receive unemployment benefits.²¹⁵ Many LAC countries are carrying out reforms to expand coverage and reinforce the adequacy of social protection and labor programs, with a particular focus on protecting vulnerable households who have recently joined the middle class and preventing the loss of livelihoods due to technological advances. Chile and Colombia are incorporating such measures in their Climate Change Adaptation and Mitigation Plans, aiming to promote the creation of green jobs and facilitate the move to green industries for workers, including through training programs. In Brazil, a leading tech

²⁰⁹ Hallegatte, Stephane; Vogt-Schilb, Adrien; Bangalore, Mook; Rozenberg, Julie. 2017. *Unbreakable: Building the Resilience of the Poor in the Face of Natural Disasters*. Climate Change and Development; Washington, DC: World Bank. <https://openknowledge.worldbank.org/handle/10986/25335> License: CC BY 3.0 IGO.

²¹⁰ Social Protection and Labor systems deliver social assistance and insurance to the poor and vulnerable, link them to jobs, improve productivity, invest in health and education, and protect the aging population.

²¹¹ World Bank, ASPIRE. 2021. <https://www.worldbank.org/en/data/datatopics/aspire/region/latin-america-and-caribbean>

²¹² OECD. 2019. *Latin American Economic Outlook 2019: Development in Transition*. OECD Publishing, Paris.

²¹³ OECD. 2020. *Social Expenditure (SOCX) Update 2020: Social spending makes up 20% of OECD GDP*.

²¹⁴ World Bank. 2018. *The State of Social Safety Nets*. Washington, DC: World Bank.

²¹⁵ ILO. 2017. *World Social Protection Report 2017–2019: Universal social protection to achieve the Sustainable Development Goals*. International Labour Organization, Geneva.

company²¹⁶ is providing training for forcibly displaced populations to earn skills and knowledge to adjust to the changing labor market, especially to new opportunities in the technology sector.

Investments in resilient health systems, water supply, and sanitation are needed to anticipate future health impacts and respond to disasters. These include higher capacity for monitoring diseases, more coordination at the regional level, higher capacity to redeploy medical staff and supply between health facilities, and investments in more resilient infrastructure (health facilities, but also more resilient transport, water, and energy services for them). Ensuring adequate access to water and sanitation is fundamental to protecting the health of vulnerable households and building climate resilience. Climate change may increase water scarcity, which can affect water quality and hygiene habits. Low-income populations are the most vulnerable to this impact, which can affect livelihoods and health indices. The Global Burden of Disease 2019 study found that unsafe water, sanitation, and poor handwashing contributed, on average, 1.18 percent to the burden of disease in LAC: from 0.23 percent in Chile, to 6.60 percent in Haiti.²¹⁷

Investments in more resilient rural roads and transport systems can protect access in the face of climate change of rural populations and people living in peri-urban areas to essential goods and services such as education, health, jobs, food, and markets. Rural access remains low in the region, and climate change can exacerbate rural accessibility challenges. For example, in rural Haiti, loss of access due to heavy rains is a major challenge for women needing hospital services.²¹⁸ More generally, 12 out of 29 LAC countries have at least 20 percent of their transport network exposed to damage from natural disasters, with extreme vulnerability in countries of Central America and the Caribbean, such as Haiti (with an exposure of the 80 percent of its network), Honduras (60 percent), and Jamaica (55 percent) (figure 16). Tools are needed to help transport agencies identify the most critical and exposed transport assets in rural areas, and funding mechanisms are needed to invest in and maintain assets that will resist higher levels of flooding.

Access to financial services plays an important role in reducing vulnerability, and facilitating access to savings, remittances, and payments under social protection systems. There are several partnerships to provide much-needed financial access to underserved populations in LAC. For instance, a leading microfinance institution has a program to increase access to finance for small businesses and farmers in Haiti. There are also efforts to ensure adequate financing support and incentives to reduce emissions by Brazilian farms and firms, especially those in more remote regions, to increase support for carbon removal solutions in Brazil's biomes, and to support farmers impacted by the COVID-19 pandemic by investing in a leading input distributor in Chile.²¹⁹

It is also critical to recognize and capitalize on the role that local communities in LAC can and are already play to mitigate and adapt to climate change. Communities already have longstanding, autonomous adaptation and risk management strategies that have been built up over many decades, and even centuries in some cases. The traditional coping systems and knowledge of Indigenous peoples, for example, can be sources of strength, resilience, and adaptation strategies in the face of climate

²¹⁶ In partnership with the IFC.

²¹⁷ Institute of Health Metrics and Evaluation, Global Burden of Disease, 2021.

²¹⁸ World Bank Group. 2017. Perge and Touray estimates using EMMUS (2012) ("Transport and Poverty in Rural Haiti: Existing Evidence from Household Surveys," note prepared by Sering Touray and Emilie Perge from Poverty and Equity GP, World Bank, Washington, DC, December 201).

²¹⁹ These partnerships are supported by the IFC.

change. It is important to build upon and further disseminate the considerable body of knowledge that has already been collected on such systems, including by the Local Communities and Indigenous Peoples Platform (LCIPP) of the UNFCCC.²²⁰ It also requires engaging local communities as partners in designing policies and actions and promoting locally led climate action and devolved climate finance.

iv. A Just, Equitable Transition and Low Carbon Growth Can Be Mutually Reinforcing

A just and equitable transition is necessary if net-zero pathways are to be socially and politically feasible. While any given reform will have winners and losers, the overall package of policies and reforms that promote climate mitigation must be both inclusive, and socially and fiscally sustainable. Communicating how people put at a disadvantage will be supported and compensated is important, as is communicating the broader benefits associated with many reforms. A just and equitable transition presents opportunities to generate employment, expand access to public services, reduce exposure of poorer groups to pollution, and raise revenues that can be targeted to improve the well-being of the poor. The timing of subsidy reforms is also critical; for example, governments can take advantage of periods of low international oil prices to lift fuel subsidies to attenuate immediate impacts on household income and firms' cash flows.

Many emission reduction measures can benefit poor and vulnerable groups, such as better public transport, given that the poor are the biggest users. Vehicle electrification and measures that reduce traffic congestion also improve air quality, which tends to disproportionately affect poorer populations. Similarly, investments in improved solid waste management to reduce emissions are also likely to benefit the health and well-being of poor and vulnerable groups the most, as they are the likeliest to live near currently inadequate waste facilities. Less pollution also means less public health expenditure, releasing resources to directly compensate poor and vulnerable people for other climate change impacts, and fewer days of work or school lost to poor health.

Social investment of the revenues derived from carbon pricing instruments can facilitate a just transition. A carbon tax of US\$30/tCO₂ could generate additional resources to more than double current levels of social assistance in most countries, and even a lower carbon tax of US\$10/tCO₂ would make it possible to significantly scale up social assistance or other investments that benefit poor and vulnerable people, such as connections to sanitation and improved drinking water or access to modern energy.²²¹ More generally, equity enhancing alternatives cover a wide array of options, such as the reduction of firms' nonwage labor costs to support job creation, or the expansion of cash transfers to ensure that vulnerable households can meet basic needs. In addition to ensuring that the burden of climate change action does not fall disproportionately on the poor, a well-designed social protection scheme can support labor market restructuring toward jobs delinked from emissions in new industries.

Incentivizing inclusive job creation and reskilling of workers is key as the region embarks on a low carbon transition in the context of the post COVID-19 recovery. In addition to the short-term employment effects of natural disasters, jobs will be affected by slow-onset climate effects degrading

²²⁰ For example, see the activities planned as part of the "Initial two-year workplan of the LCIPP for the period 2020–2021." Available at: <https://unfccc.int/sites/default/files/resource/Initial%20two-year%20workplan%20of%20the%20LCIPP%20%282020-2021%29.pdf>.

²²¹ Hallegatte et al. 2016. Shockwaves - Managing the impacts of Climate Change on Poverty.

the natural capital on which much low skilled and informal employment depends. Some marginalized population groups, notably ethnic and racial minorities (such as Afro-descendants) and women, often do not benefit from job creation and reskilling to the same extent as others. The identification of policies that balance the impact of the transition while maximizing socioeconomic opportunities is key for a more inclusive transition that supports the most vulnerable groups of society.

A variety of policies can help countries prepare their workers for the green jobs of the future. While far from an exhaustive list of bottlenecks, gaps in the quantity and quality of education, social insurance coverage, efficient labor market regulations, and gender disparities contribute to the higher vulnerability of workers to the green transition among certain countries and socioeconomic groups (box 13). First, the share of green jobs is strongly linked to the Human Capital Index, suggesting that countries that are lagging in terms of green jobs today may not be making enough progress to prepare their future labor force for the green economy. Second, countries with a larger informal sector also tend to have a larger share of non-green jobs, implying that an important part of their labor force may not have access to social insurance when facing a negative shock. Third, some countries in the LAC region that are lagging in terms of green jobs also have very rigid labor regulations that would slow down shifts toward greener jobs. Fourth, large gender gaps in education fields more linked to the green economy contribute to existing gender gaps in green jobs. Addressing these disparities would help support the implementation of green policies while reducing inequalities both within and between countries.

Box 13: Green Jobs for a Just Transition in LAC¹

The share of green occupations exhibits a positive and strong link with income levels, both between and within countries (see figure B.13.1). This is particularly true for the high-skill green occupations. The share of green occupations in Latin America tends to be around the levels expected for their economic development, but some countries lag. In particular, the low fraction of green occupations in Honduras, Guatemala, Peru, and Ecuador suggest that their workers lack the skills needed for the green economy to a larger extent than their counterparts in other countries.

FIGURE B.13.1: Green occupations vs. GDP per capita, latest year available.

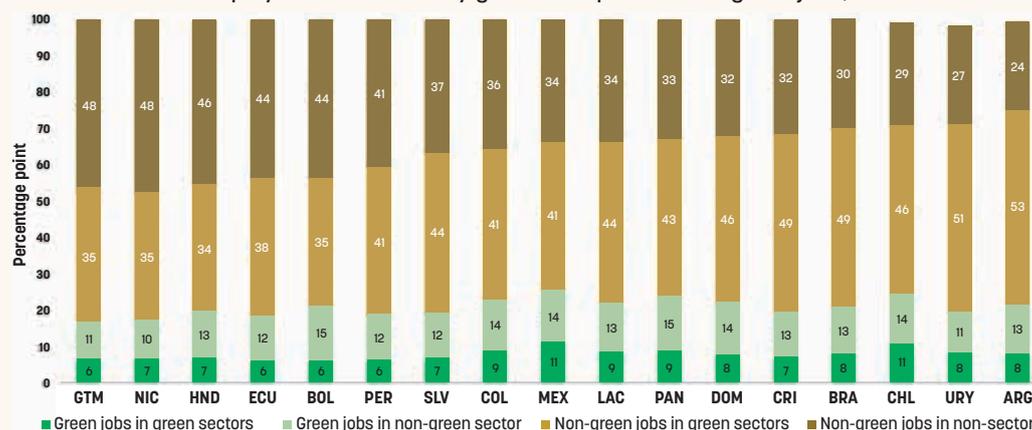


To analyze labor market vulnerability to green policies, it is important to consider both the skills of workers and the greenness of the sector. When combining both dimensions using household surveys, four groups of workers emerge. The most vulnerable are those in non-green sectors and in non-green jobs because a policy that increases the costs of GHG emissions would reduce the competitiveness of such sectors disproportionately, potentially increasing the likelihood

Continued →

of layoffs. Accordingly, workers' lack of green skills would reduce their reemployment chances.² The size of this group is significantly larger among the poorer countries of the region (figure B.13.2). In Guatemala, Nicaragua, Honduras, and Ecuador, between 44 to 48 percent of their workers are in the most vulnerable category. To a large extent, this is driven by their stage in the process of structural transformation, because the agricultural sector has very high levels of GHG emissions per worker and at the same time concentrates a high share of workers. In fact, changes in these shares have been negligible for the last 10 years in the region, suggesting that the greening of jobs through changes in the occupational and sectoral structure is rather slow.

FIGURE B.13.2: Employment structure by green occupations and green jobs, circa 2019



Source: "Green Jobs, Dirty Sectors and Economic Development: Evidence across countries", forthcoming. LAC Poverty and Equity GP (Emmanuel Vazquez, Hernan Winkler, Kelly Montoya, Sergio Olivieri and Diana Sanchez)

Note: Data for Argentina covers urban areas only.

- 1 "Green Jobs, Dirty Sectors and Economic Development: Evidence across countries", forthcoming. LAC Poverty and Equity GP (Emmanuel Vazquez, Hernan Winkler, Kelly Montoya, Sergio Olivieri and Diana Sanchez).
- 2 The other three groups of workers are (i) green occupations in green sectors: these are the least vulnerable workers since their sectors would be least affected by a policy penalizing GHG emissions, and they nevertheless have the green skills to navigate the green economy; (ii) non-green occupations in green sectors: these workers are not vulnerable in their current job, but they would lack the skills for a green job if they become unemployed; and (iii) green occupations in non-green sectors: while these workers may face a higher likelihood of job loss, they have higher chances of reemployment in the green economy.

v. Contribution to Recovery and Development: Synergies with COVID-19 Recovery and Long-Term Development Goals

The COVID-19 pandemic has resulted in an 8.1 percent drop from 2019 in GDP in Latin America, exacerbating social and economic challenges.²²² It has also increased climate vulnerability by depleting the public and private resources needed for resilience. However, this unprecedented crisis presents an opportunity to bring together poverty alleviation, social inclusion, and climate action in the region. In the context of the COVID-19 response, governments are already working on strengthening health and social protection systems, meaning that adapting and extending existing programs to include climate impacts can be done relatively quickly and with reduced transaction costs. Some health operations designed to respond to COVID-19 incorporate measures to address health emergencies more broadly, presenting an opportunity to prepare systems for the health impacts that follow climate-induced shocks.

222 International Monetary Fund 2020. Available at: <https://www.elibrary.imf.org/view/books/086/29365-9781513558264-en/ch001.xml>.

The expansion of social protection, retraining and skills development, rural access, and safe water and sanitation to reduce the vulnerability of the poor to climate change will also serve to boost achievement of long-term development goals. Measures to protect vulnerable populations against natural shocks and disease contribute directly to poverty reduction and social inclusion.²²³ Moreover, actions to protect vulnerable populations in rural areas can reduce migration to cities,²²⁴ which often pushes rural households to settle in high-risk zones, such as floodplains and landslide prone slopes in peri-urban areas, with little or no utility infrastructure, elevating health risks for already vulnerable people.

vi. Priority Actions to Protect Vulnerable Populations

Table 8 highlights, by country, potential areas for new WBG support in LAC for actions to protect poor and vulnerable populations under five entry points that were defined based on the assessment presented above: (i) strengthening knowledge and finance for climate impact response, including the development of disaster risk warning systems, identification of the distributional effects of slow-onset climate change, and the establishment of contingent sources of financing for climate impact response; (ii) measures to launch a just and equitable transition to support those most affected by the decarbonization of the economy; (iii) building the resilience of health systems to respond to the expected climate-related increase in vector-borne, water-borne, and heat stress-related disease, including through the expansion of access to water and sanitation; (iv) safeguarding the physical access of rural populations to markets and services by strengthening the resilience of rural roads; and (v) reinforcing adaptive social protection systems and access of the poor to financial services. More details on country-specific actions (of which there may be several for each country for a given entry point) are provided in the country climate change snapshots that accompany the LAC Roadmap.

The table distinguishes between these actions in three dimensions:

1. between those already incorporated in the WBG portfolio (either under implementation or included in the pipeline of operations) or that are adequately supported by non-WBG programs, and those that would be new (either under discussion or aspirational, including potential operations to scale up existing initiatives);
2. between those new actions that would be aligned with current government priorities and those that would not; and
3. also highlights those new actions that are urgent, in the sense that delay would significantly increase their cost. In the context of the selected entry points for the protection of vulnerable populations, this relates to the need to reinforce adaptive social protection systems to better respond to climate-related extreme events and slow-onset impacts on livelihoods.

As Table 8 indicates, new WBG support to identify the social and spatial distributional impacts of climate change and to prepare access to contingent finance for disaster response is a priority in Belize, Bolivia, Brazil, the Dominican Republic, Ecuador, Haiti, Paraguay, and Peru. Opportunities for new WBG support for just and equitable transition initiatives are priorities in Belize, Bolivia, Colombia,

²²³ Hallegatte et al. 2016. Shockwaves - Managing the impacts of Climate Change on Poverty.

²²⁴ Without effective climate and development action, 17 million people (2.6 percent of the LAC population) could be forced to move within their own countries to escape the impacts of climate change. See: Clement, Viviane, Kanta Kumari Rigaud, Alex de Sherbinin, Bryan Jones, Susana Adamo, Jacob Schewe, Nian Sadiq, and Elham Shabahat. 2021. "Groundswell Part 2: Acting on Internal Climate Migration." Washington, DC: World Bank, September 2021.

the Dominican Republic, Ecuador, El Salvador, Jamaica, Mexico, Nicaragua, Paraguay, and Uruguay, reflecting the broad range of potential climate transition impacts across a wide variety of sectors, including fossil fuels, agriculture, and tourism.

In protecting vulnerable populations, priorities for new WBG support include building health system resilience to climate-related changes in disease in Mexico, Peru, Uruguay, and the Dominican Republic, as well as investing in the resilience of rural roads in El Salvador, Honduras, and Peru where threats to rural infrastructure from climate-related flooding and landslides are particularly high. New WBG support for reinforcement of adaptive social protection systems is an urgent priority in Colombia. Based on their potential for climate-induced increases in extreme poverty and the limited coverage of their current social protection systems, reinforcement of adaptive social protection systems would also be important in Belize, Bolivia, El Salvador, Guatemala, Guyana, Mexico, Nicaragua, Paraguay, and Peru, but is not currently aligned with government priorities.

Table 7: Priority Actions to Protect Vulnerable Populations²²⁵

	Strengthen Knowledge/ Finance climate response	Launch a Just and Equitable Transition	Build Resilience of Health Systems	Safeguard Rural Access	Reinforce ASPs and Access to Financial Services
Argentina	●	●	●	—	●
Belize	●	●	●	—	*
Bolivia	●	●	●	—	*
Brazil	●	●	●	●	●
Colombia	●	●	●	—	*
Costa Rica	●	●	●	—	●
Dominican Republic	●	●	●	—	●
Ecuador	●	●	●	—	●
El Salvador	●	●	●	●	●
Guatemala	●	—	●	—	*
Guyana and Suriname	—	—	●	—	●
Haiti	●	—	●	●	●
Honduras	●	●	●	●	●
Jamaica	●	●	●	—	●
Mexico	●	●	●	—	*

²²⁵ Actions reflect the input from a consultative process with WBG Country Management Units and sector experts.

	Strengthen Knowledge/ Finance climate response	Launch a Just and Equitable Transition	Build Resilience of Health Systems	Safeguard Rural Access	Reinforce ASPS and Access to Financial Services
Nicaragua	●	●	●	●	*
Panama	●	—	●	—	●
Paraguay	●	●	●	—	●
Peru	●	●	●	●	*
Uruguay	—	●	●	—	—
Caribbean SIDS*	●	●	●	—	●

Source: WBG LAC Roadmap team development.

Note: SIDS = small island developing states, which include Saint Vincent and the Grenadines, Dominica, Grenada, St Lucia St Maarten, and Barbados.

Key:

- * Urgent area for new WBG engagement aligned with government priorities

● Area for new WBG engagement aligned with government priorities
- * Urgent area for new WBG engagement not aligned with current government priorities

● Area for new WBG engagement not aligned with current government priorities

● Existing WBG or adequate other engagement

