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Climate Change, Migration, and Conflict in the Amazon and the Andes

Rising Tensions and Policy Options in South America

Max Hoffman and Ana I. Grigera February 2013

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About the climate migration series

The intersecting challenges of climate change, human mobility, and national and international instability present a unique challenge for U.S. foreign policy and global governance in the decades to come. These three factors are already beginning to overlap in ways that undermine traditional understandings of national security and offer ample reason to revisit divisions between diplomacy, defense, and development policy.

This report is the fourth in a series of papers from the Center for American Progress examining the implications of the nexus of climate change, migration, and security. Our analyses highlight the overlays of these factors in key regions around the world and suggest ways in which U.S. policy must adapt to meet the challenges they present.

This third regional report builds on the foundation in our framing paper, "Climate Change, Migration, and Conflict." Our first regional report focuses on the implications of these trends in Northwest Africa, already one of the most volatile regions in the world. Our second regional report analyzes a similar dynamic in India and Bangladesh.

This series is closely linked to the Center for American Progress's longstanding Sustainable Security Project, which argues that our understanding of security must be broadened to meet the threats of the coming decades. Indeed, national security, human security, and collective security all have a part to play in achieving a safer and more equitable international environment. Our Climate, Migration, and Security Project discusses and analyzes a series of key regional test cases for a more comprehensive approach.

We are especially grateful to the policy planning staff in the German Federal Foreign Office for their support of this line of work at the Center for American Progress, and to the ZEIT-Stiftung Gerd und Ebelin Bucerius in Hamburg, Germany, for their continuing support of this project.

Contents

Introduction and summary

This report examines the interactions of climate change, environmental degradation, migration, and conflict in the Amazon; the tropical savannahs of Brazil—the Cerrado—and Bolivia; the Andean highlands of Peru and Bolivia; and the arid coastal plain of Peru.[1] These regions represent the major geographic and climatic regions of the continent, encompass the range of socioeconomic trends reshaping the region, and capture the new heartland of the continent's illicit economies, including the global cocaine trade.

The natural wealth of the Amazon and the Andes is a crucial strategic resource. The Amazon is central to the regional and global climate and contains priceless biodiversity. The mineral wealth and energy resources of the Amazon and the Andes are also important contributors to the global supply chain and the macroeconomic growth of the region. Further, the Amazon and the Cerrado have adopted a crucial role in regional and global food security. Finally, the rivers and glaciers of the region are fundamental to the energy security, water security, and agricultural health of much of South America. For all these reasons, the areas defined in this report demand attention.

There are two caveats about this report. First, the study of climate change, migration, and conflict or insecurity in this region is more predictive in nature, compared to the earlier reports in this series. While many people in the region are experiencing profound dislocation or human insecurity because of the trends outlined in this report, the prospects for massive humanitarian disasters or country collapse are remote, unlike in Northwest Africa or the Bay of Bengal—topics of previous reports. Nonetheless, the trends are worrying and deserve the focused attention of policymakers in the Hemisphere.

Second, in line with the Climate, Migration, and Security Project, and driven by the evidence, this report is concerned with the periphery—the geographic and sociopolitical margins of the region. These peripheral regions or hinterlands are immense, far from the political and financial hubs of their countries and overwhelmingly rural with deeply entrenched poverty. Yet the pressures of population

and global demand for commodities have driven the rapid growth of towns and cities on this periphery, cities that face the challenge of navigating a path of sustainable, stable development in difficult environments.

This report looks at the most vulnerable residents of this periphery, particularly small-hold farmers and indigenous populations, and on the ungoverned or undergoverned marginal areas of the three countries studied. While the major urban centers and agricultural areas of Brazil's Northeastern, Southeastern, and Southern regions make cameo appearances because of their role in the regional migratory picture and international drug trade, they are not the focus of this report. Instead we examine how, in the peripheral regions of the Amazon and the Andes, an effective government presence is absent, rural livelihoods have been undermined, illicit economies have flourished, drug trafficking organizations and nonstate actors have put down deep roots, and the unregulated exploitation of natural resources and vulnerable populations continues apace.

New strategies are needed to comprehensively address these sources of instability. We must account for the dislocation caused by climate change and human mobility and facilitate smart and sustainable security strategies. Combating organized crime and the international narcotics trade, providing sustainable development, and preparing for the effects of climate change are the central challenges for the region in the decades to come.

These challenges intersect in the peripheral areas described in this paper, and military or police approaches to combat the presence of transnational criminal networks will not succeed without a more fundamental strategy for porous border regions.

The peripheral populations of the Amazon and the Andes must have their basic livelihoods protected in order to guarantee the future social and political stability of the region. They must be provided with effective governance that is capable of responding to the needs of its residents, regulating development, and protecting basic human security.

Governments must rise to the challenge and play the role of fair arbiter, balancing macroeconomic growth and the interests of extractive industry with equitable, sustainable development. The region's stability can only be protected by fairly resolving fundamental questions related to the division and proper management of natural resources. Government involvement is also needed to adapt to and prepare for climate change, along with providing relief for inevitable sudden-onset disasters linked to climate change.

To the extent possible, regional governments should seek to incentivize sustainable development, for example, by shaping infrastructure planning to encourage development of climate-resilient areas, and provide disincentives for those who seek to exploit particularly vulnerable regions. Finally, effective regional approaches to hydropower and renewable energy sources should be continued and expanded, and a more comprehensive, nonmilitary response to drug trafficking established.

While these efforts are the responsibility of all regional governments and numerous international organizations, it is particularly incumbent upon both Brazil and the United States to lead these processes.

For Brazil, there are fundamental reasons for protecting and sustaining the Amazon, so crucial to the economic health of the country. For both Brazil and the United States, successful action against the international trade in narcotics—and the illicit economies that grow in conjunction with it—will strengthen social stability in both countries, particularly in large urban centers.

By leading such regional efforts, Brazil also has an opportunity to define its 21st century global role in a progressive, peaceful way. And for the United States these efforts provide a chance to revive and sustain its hemispheric standing, have a partner in assuring stability in the region, establish long-term, sustainable economic relationships, and avoid future crises.

Given Latin America's economic rise, the United States and its European partners will have to manage a new modus vivendi to help steer regional transitions. For the United States, the challenge is to adapt defense and development policy to a new environment while coping with imminent budget cuts—crucial if the United States is to remain at the center of hemispheric affairs. South America, with Brazil at its heart, should form the centerpiece of a renewed engagement in democratic partnerships for the United States and Europe.

We begin with an overview of the issues covered in this paper, which include:

- The major economic changes taking place in Latin America, particularly Brazil
- The regional geographies and how they affect climate, migration, and conflict
- How climate change is affecting the region
- Increasing social instability due to economic and environmental shifts

We then examine these issues at play in Brazil, Peru, and Bolivia before moving to our recommendations for U.S. and Latin American policies to address them.

A changing hemisphere

Latin America's economic boom

The end of the Cold War profoundly affected South America, speeding up economic development and sustaining democratization efforts in key countries such as Colombia, Brazil, and Peru. Brazil in particular has become an important actor in the international arena. Meanwhile, the growing importance of the Pacific to the global economy has put West Coast countries from Mexico to Chile in the spotlight and has substantially expanded demand for commodities produced throughout Latin America. Annual economic growth in the region has averaged about 5 percent, and per capita income could double by 2025 as a result.[2] Life expectancy in the region has reflected this change, rising from 56 years to more than 74 years in the last 50 years.[3]

These developments, along with the growing influence of the U.S. Latino population, have set the stage for renewed engagement with the continent. Latin American countries have become serious economic and political actors in their own right, deserving of increased attention.

Brazil's growth and challenges

Brazil has emerged from massive debt over the last two decades to become the world's eighth-largest economy. The country is energy independent and is becoming a major exporter of crude oil. This new self-confidence was expressed during the Copenhagen climate negotiations in 2009 when Brazil, India, and China successfully challenged the United States and Europe to block a binding agreement.[4]

Under the leadership of the Workers' Party, building upon the foundation begun by President Fernando Henrique Cardoso, Brazil's per capita gross domestic product doubled during the last decade while poverty was cut in half. Meanwhile, economic growth, though slowing, remained substantial through 2011.[5] In short,

Brazil under the Workers' Party has become a model for emerging democracies of what progressive politics and parties can achieve.

As a result of this economic transformation, more than 40 million Brazilians have been lifted out of poverty.[6] In addition, infrastructure investments have brought economic growth and opened up poor and long-neglected regions of the country, particularly in the Northeast and in the Amazon.

Brazil is leading the social and economic changes transforming the region. Cities like Curitiba and Porto Alegre are grappling with the need to develop integrated responses to the issues presented by rapid economic and population growth, increased pressure on natural resources, and massive demand for infrastructure. Brazil's medium-sized cities have become the focal points of development, centers of production, innovation, and economic activity.

But despite its success, Brazil faces many of the same dilemmas confronting other fast-growing developing countries. Preserving the environment and natural resources, particularly the Amazon rainforest, will require a strong government commitment and the willingness to prioritize environmental conservation within economic development policies. But, to stay in power, democratic governments must also continue to deliver growth. This will be a crucial balancing act in the coming decades—not only for Brazil, but also for the other countries profiled in this paper.

Meanwhile, grassroots environmental activism in Brazil has changed from an elite movement to a broader phenomenon encompassing the concerns of the urban poor, social justice issues, economic growth plans, and civil rights—indeed "environmentalism in Brazil functions as one path to increasing democratic participation, involving multi-sectorial alliances across Brazilian society."[7]

Brazil's unstable peripheral areas, across the Amazonian frontier, are both the frontline of environmental degradation and the heartland of illicit economies, including the drug trade. Sustainable development may provide a positive alternative to involvement in illicit activities among marginal populations. It is the fate of cities like Manaus, the capital of Amazonas, and Rio Branco, on Brazil's far-western frontier, which will largely shape the stability of Brazil's peripheral areas and border regions. Managing the rapid growth of previously peripheral areas while protecting sustainable development and basic human security will have repercussions beyond Brazil's periphery, reverberating through the large Atlantic urban centers and the region as a whole.

Defining regional geography

The Amazon

The Amazon has long been a cause célèbre for environmental activists but has also now become a highly strategic region crucial to the region and the world.

Beyond the Amazon's well-established importance in preserving the biodiversity of our planet, it is central to the regional climate and a major global carbon sink helping slow the process of climate change. The area is now central to global food supply and an important source of commodities for the voracious global market. The many rivers of the Amazon basin are also an essential source of hydropower, a foundation of the region's energy security, and help provide water for human and agriculture use throughout South America. Finally, the Amazon has today become a primary producer of cocaine and a transit hub for the global trade in narcotics.

The tropical savannahs of Brazil and Bolivia

The tropical savannahs and lowlands of Brazil's Cerrado and the Bolivian Chaco, savannah, and rainforest are a second geographic and climatic setting for the trends reshaping South America. The rapid growth of large-scale agribusiness, particularly soybean cultivation and cattle ranching, and extractive industry in this previously marginal area has transformed the socioeconomic fabric of the Brazilian and Bolivian hinterland.

Driven by strong global demand for protein, particularly for animal feed as the global demand for meat has grown, the savannahs of the region have undergone a dramatic transformation, passing from slash-and-burn clearing and agriculture to intense exploitation by large landowners and agribusinesses. This rapid growth has led to widespread deforestation, as a belt of development has expanded across the Cerrado and the Amazon to make way for ranching and farming.

The expansion of large-scale agribusiness, often at the expense of small-hold farmers or indigenous populations, has led to social tensions and growing inequality, as the benefits of rapid development often fail to reach the most vulnerable. The boom has also attracted migrants to work in the agricultural sector or stake their own claims to a piece of this frontier.

Bororo Indians, left, and Xavante Indians, right, both from the movement "Grito do Cerrado," or Scream of the Cerrado, race carrying logs in Brasilia, Brazil. The Grito do Cerrado is a peaceful movement by Indians and farmers who live in the Cerrado biome in Brazil's tropical savanna area, whose aim is to alert people about the destruction of the land due to deforestation, industrial agriculture and unplanned settlements.

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A lack of government oversight means that environmental degradation has accompanied this process, while the growth of soybean monoculture makes the region particularly vulnerable to climatic changes. The encroaching belt of development in the Amazon and the Cerrado will be a test case for the long-term sustainability of the region as the effects of climate change come to bear.

Andean highlands

To the west, the highlands of the Peruvian and Bolivian Andes present the most urgent challenges from climate change, migration, and security facing the region.

The Andes are home to some of the most marginal, vulnerable populations in South America. Andean rural society, largely indigenous and composed of smallhold subsistence agriculture, has been destabilized by scarcity and competition for natural resources—particularly water—and changing environmental conditions.

The increased penetration of extractive industry, particularly mining and energy interests, has increased competition for already scarce water. Changing climatic conditions have undermined livelihoods dependent on predictable precipitation, seasonal patterns, and dry season water from glacier melt.[8] These foundations of rural society have been shaken by the degradation and depletion brought by large-scale extractive industry and climate change. Highland cities are also facing increasing water competition as population growth and rural migrants drive demand and shrinking glaciers constrict supply. Volatile political situations and sharp competition for resources raise fundamental questions about the proper management of natural wealth, and the Andes have seen fiery political confrontations and social unrest linked to resources.

Peru's arid coastal plain shares many of the same challenges present in the Andean highlands. The dry coastal plain, where water scarcity is already a serious problem, is reliant on rivers fed by the Andean glaciers, a rapidly shrinking resource. In the decades to come, population growth in the coastal cities and the growth of large-scale agriculture in previously marginal coastal areas will sharpen competition for scarce and dwindling natural resources—particularly water—and heighten tensions already present between industry and a diverse collection of rural communities and small towns or cities.

Climate change and environmental degradation

Latin America faces a wide array of problems from climate change and environmental degradation.[9] The peripheral areas this study focuses on are particularly vulnerable due to poor populations, diverse and remote geographic settings, livelihoods that rely on natural environments, and weak state structures challenged by socioeconomic and criminal forces.

Responses to these challenges are complicated by the lack of infrastructure, absence of proper monitoring equipment and expertise, rough terrain, and the vast, remote territories involved.

The region's rural populations are largely poor and overwhelmingly dependent on small-hold, rain-fed agriculture—some 90 percent of Latin America's agriculture is reliant on precipitation.[10] This makes the sector—and the rural communities that rely on it—particularly vulnerable to shifting rainfall patterns, changing temperatures or seasonal schedules, and climate variability.

Firefighters try to put out a wildfire in Brazil in 2011. Drought, high temperatures and low humidity have caused wildfires at several places in Brazil.

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For the Amazon and the Cerrado, shifting rainfall patterns and temperatures due to climate change will lead to more frequent droughts and forest fires in the dry season and floods in the rainy season,[11] threatening the growth of monoculture agribusiness and small-hold farmers and ranchers. For the river communities of the Amazon, droughts can also undermine river transport and food security—essential to remote villages and towns.

Climate change has also contributed to the rapid melting of the Andean glaciers, central to feeding the rivers and aquifers of the region and sustaining countless human settlements. Current projections predict that by 2050 up to 50 million people in the vast lowlands fed by Andean glacial melt will be affected by the loss of dry season water for drinking, agriculture, sanitation, and hydropower.[12] Diminishing downriver water flow will also undermine hydropower, crucial to the economic health of the continent—Brazil, for example, derives 84 percent of its electricity from hydropower.[13]

The melting of the Andean glaciers and increasingly unpredictable seasonal patterns and rainfall are already undermining basic livelihoods in the highland regions. Andean rural residents—and, indeed, the urban centers of the highlands, such as La Paz, El Alto or Cusco—rely on glacial melt for dry season water supplies and are already facing dire shortages.

The story is repeated on the arid coastal plain of Peru. Water shortage has become a huge risk and source of tension in the capital of Lima, which is dependent on water from the Andes, and in agricultural regions such as the Ica Valley, which is key to the export-oriented growth of Peru's economy.

Additionally, climate variation caused by El Niño and La Niña can lead to stronger and more frequent storms, periods of intense heavy rainfall leading to landslides or flooding, or prolonged drought, respectively. Peru's coastal plain is particularly vulnerable to these climate patterns; while the exact links between the phenomena and climate change are the subject of scientific research, they are becoming more unpredictable, intense and frequent—increasingly threatening peripheral populations.

Across the region, climate change and climate variation are contributing to increased drought and flooding, more frequent and intense fires, destructive storms, and deadly landslides. In 2005, for example, during one of the Amazon's worst droughts in the past 100 years, the Brazilian state of Acre experienced 300 percent more forest fires, closing schools, businesses, and airports.[14] For those on the margins, socially and economically, such disruptions can undermine basic human security and livelihoods.

Finally, the rapid growth of extractive industry—large-scale agriculture in the Cerrado and along the Pacific coastal plain, mining and energy exploration in the Andes, and logging, mining and ranching in the Amazon—has added to the stress placed on peripheral areas and vulnerable populations. With minimal government presence or regulation, these industries—legal and illicit—contribute to deforestation, soil degradation, and the contamination of water supplies and fisheries.

Further, the rural poor often turn to illicit extractive activities because they lack legal or formal economic alternatives. Relatively small populations can therefore have a tremendous impact on the environment. Thus, peripheral rural economies are inextricably tied to the environmental degradation threatening the peripheral regions they inhabit.

Social instability and conflict

As mentioned in the previous section, the effects of climate change and environmental degradation, along with the rapid growth of extractive industry, take the greatest toll on the most vulnerable—small-hold farmers, indigenous populations, and the poor. The increased competition for resources—particularly water and land—and market pressure on landholders with tenuous legal tenure exacerbate existing inequities and tensions surrounding the proper, equitable allocation of the region's natural wealth.

Minimal state control, a lack of government resources or oversight, and serious problems with corruption mean that the state in these regions is often perceived as an unfair or biased actor, incapable of fairly arbitrating disputes. In a region with a long and violent history of social protest, political dissent, and inequity over issues of land and resources, the risk of serious political instability and violence is high.

At its heart, the region's political and social stability will increasingly rest on the successful arbitration and resolution of fundamental disputes over the division of natural resources. The parallel processes of rapid development and climate change have lent urgency to the process by undermining traditional rural order and causing widespread dislocation. This upheaval is compounded as basic livelihoods are undermined—by competition, environmental degradation, or deteriorating conditions—and people are forced or inclined to move.

Meanwhile, the growth of global demand for commodities and new infrastructure projects have opened up vast new areas of the Amazon to settlement and exploitation, defining another large-scale movement of people into previously peripheral areas.

Governments in the region have been unable to keep pace with these processes, either overwhelmed by the pace of change or unable or unwilling to balance macroeconomic growth with sustainability and stability. The absence of governance over these peripheral areas has allowed large illicit economies to take root and flourish. Alongside the environmental costs of this unregulated development, the absence of state presence has led to a culture of illegality and impunity. Unfortunately, poor and indigenous groups lacking formal economic opportunities often take part in these illicit economies and find themselves taken advantage of and disadvantaged through illicit activities.

Source: Center for American Progress (2012).

The political, environmental, and social stability of the region is at stake. Beyond the undermining of traditional rural livelihoods, the development of these peripheries will have profound long-term consequences. If they are allowed to continue developing without planning or regulation, to continue growing as a veritable "Wild West" of Latin America, it will become increasingly difficult to reassert control and establish long-term stability.

Already, coca cultivation and cocaine production and trade have flourished in these areas, avoiding the crackdown in Colombia by moving to peripheral areas of Peru, Brazil, and Bolivia. The remote terrain and easy river transport allow drug trafficking organizations to export from the Andes and remote Amazon to the urban centers of South America and the world. Thus, beyond the political stability of regional and local governments and the fate of rural residents, the social fabric of distant cities is affected by the Amazonian and Andean peripheries.

We now turn to how these trends are playing out on the ground in Brazil, Peru, and Bolivia.

The international narcotics trade

The Colombian example

The Colombian experience combating narcotrafficking demonstrates that a successful strategy against drug-related violence and organized crime must extend beyond hard security—international investment and social reform programs are necessary to curb the power of the cartels.[15]

Colombia has been the most important South American partner for the United States for several decades. It enjoys close economic and political relations with the United States and, under the leadership of President Juan Manuel Santos, has played a more active role in the central and southern parts of the continent.

The Santos administration has embraced "democratic security" to combat illegally armed groups and fight corruption—addressing the legacy of the longest and most violent drug war in the hemisphere.

The U.S.-assisted "Plan Colombia" is partially credited with stemming tremendous levels of violence. Since 2002, homicides have decreased by more than 50 percent, kidnappings have declined by 93 percent, terror attacks have fallen by 70 percent, and 45,000 former combatants have laid down their arms.[16]

Plan Colombia was designed to fight the illicit drug trade, increase the rule of law, and expand economic development.[17] Several hundred million dollars were used to train and equip Colombian counternarcotics battalions to protect the Colombian National Police during their counternarcotics missions and for development assistance, including technical and agricultural support to farmers in southern Colombia. Meanwhile, close to $50 million was put toward enhancing interdiction efforts in neighboring Peru, Bolivia, and Ecuador.[18]

The two-pronged approach—enforcement and development—worked. The United Nations reports that in the past decade, the number of coca crops grown in Colombia decreased by 50 percent and many drug laboratories were dismantled.[19] As a result of this success, crime rates in Colombian cities decreased substantially and foreign direct investment rose to $10.6 billion.[20]

But Colombia is no longer the only—nor the primary—focus of the global cocaine trade. According to the latest U.S. government estimates measuring cocaine production, Peru is the largest cocaine producer in the world, with 325 metric tons produced in 2010, compared to Colombia's 195 metric tons in 2011 and Bolivia's 265 metric tons in 2011.[21] Brazil's consumption is also increasing quickly, parallel to its role as a crucial transit zone and growing market. American and international involvement in the Andean heart of the coca cultivation zone is much less sophisticated.

Colombia's success stemming the trafficking of cocaine to Mexico and Central America should be shared and the lessons of Plan Colombia more widely implemented.

One of those lessons is the importance of social programs to help increase entrepreneurship and wean poor farmers off coca cultivation by incentivizing legal livelihoods.[22] Colombia has allocated considerable resources not only to fight against drug production and trafficking, but also to promote alternative development projects and drug prevention campaigns.

Shannon O'Neil, of the Council on Foreign Relations, and Sergio Fajardo Valderrama, the former mayor of Medellín, Colombia and a consultant to Mexico on the drug war, have both urged U.S. policymakers to take lessons from the Colombian experience and focus on providing legal employment for youth to decrease their participation in drug cartels.[23] It is commonly accepted that the turning point in Colombia arrived when wealthy elites agreed to pay an additional "public security tax"[24] to help finance the full range of antidrug activities. Colombia also has the potential to act as a mediator in current drug conflicts and should inform strategies to limit the international impacts of the drug trade.[25]

Brazil

Overview

Brazil's political, economic, and environmental importance is unparalleled in Latin America. As large as the continental United States, Brazil is home to nearly 200 million people and shares borders with nearly every country in South America. Along with its sheer size, Brazil's rich natural resources and rapidly growing economy make it increasingly influential in the region and the international system.

Despite its immense size, Brazil's population is largely concentrated along the Atlantic coast and a belt of populous Southeastern cities that contain nearly 80 million people. These concentrations make Brazil one of the most urbanized large countries in the world, with 85 percent of the population living in urban environments.[26]

While Brazil's population and industry are concentrated in these eastern regions, this report focuses on the peripheral areas to the west, specifically the Legal Amazon,[27] where migrants, itinerant populations, local populations, and rapidly expanding extractive industries are increasingly competing and contributing to degradation of the land and natural resources, increasing tensions with rural populations (such as the indigenous, rural poor, or *colonos*), and sowing the seeds of future environmental and social instability.

The rapid growth of extractive sectors driven by international demand for commodities has reshaped the Legal Amazon and outpaced the government's ability to provide sufficient oversight. The result is a region characterized by weak government, poverty, large-scale illicit economies, organized crime, vulnerable populations, porous borders, increasing violence, and social tensions.

A "gold rush"—literal and metaphorical—to tap the natural wealth of the Amazon has rapidly expanded the Brazilian frontier and tangled legal and illicit econo-

- Rapid development of peripheral areas of the Amazon and the Cerrado—tropical savannah—has brought migration, social tensions, and violence.
- Expansion of extractive industry and agriculture cause widespread environmental degradation, as well as compound social tensions.
- Amazon dieback shapes regional and global climate patterns; could significantly reduce a crucial global carbon sink and source of oxygen, water and vast biodiversity.
- Illicit economies and, increasingly, organized narcotrafficking threaten to undermine stability in the region and in distant urban centers.

A deforested area is seen near Novo Progresso in Brazil's northern state of Para.

ASSOCIATED PRESS/ANDRE PENNER

mies—logging, mining, soy production, and cattle ranching each have parallel shadow economies—both responding to international market demands and the absence of state control. This economic expansion has drawn locals and migrants to the belt of development, resulting in considerable environmental and social effects. Illegal deforestation, pollution, increasing violence, land conflicts resulting in displacement and deaths, and a growing culture of illegality are all serious problems. Meanwhile, this largely ungoverned area is facing growing security challenges from drug trafficking, organized crime, and human trafficking.

Many of these trends will be exacerbated as climate change presents additional pressures that further stress basic livelihoods and fragile ecosystems. Changing seasons, more frequent droughts and floods, altered precipitation patterns, Amazon dieback, degradation of soils, and pollution of water supplies are among the realities facing the Amazon. The cumulative effect of these processes will undermine the basic human security of many in the region, with the small-hold farmers and indigenous populations the most vulnerable.

The challenge for the Amazon in the coming decades will be to deliver regulated economic growth to prevent the worst excesses of extractive industry and protect the most vulnerable, while preserving an environment that is critical to the regional and global climate. Failure to provide effective oversight for this vast frontier region could increasingly have consequences outside the region—from the climatic repercussions of losing a large global carbon sink to the social costs of a burgeoning Amazonian drug trade, human trafficking, and other illicit economies.

While the complexity of the Amazon extends beyond Brazilian borders, as the steward of the largest portion of the Amazon, Brazil must provide more leadership in delivering comprehensive governance—beyond military might—to the region, collaborating with neighboring countries to secure border regions to rein in unregulated activities.

Brazil has made promising strides in this area through the slaughterhouse blacklist and soy moratorium, aimed at curtailing illicit activities like human trafficking and deforestation, but much work remains. Governance of the market, basic human security, and adaptation to climate change will be central to establishing a sustainable Amazon frontier for the 21st century.

The Legal Amazon

The Legal Amazon occupies 59 percent of national territory and holds 12 percent of Brazil's population, but the relatively low population density of the Legal Amazon—24 million people—belies its strategic importance to the economy and security Brazil and its importance to the world climate and food chain.[28]

The Legal Amazon is immensely rich in natural resources and provides large amounts of crucial commodities—such as gold, iron ore, natural gas, soy, cattle, and timber, along with electricity from hydropower. These resources underpin Brazil's export economy and are critical to the economic development of the country and the global supply chain.

But the region also presents significant challenges to Brazil's sustainable development and social and political security. Porous and rugged border regions harbor drug trafficking groups and large illicit economies, both of which provoke violence and lawlessness. Poor and indigenous populations are often marginalized by rapid

settlement and economic development, and are vulnerable to exploitation by illicit groups including drug traffickers—raising the prospect of social instability and endemic poverty.

Meanwhile, the Amazon's status as a massive carbon sink and crucial, but fragile, ecosystem raises serious environmental concerns and presents Brazilian authorities with the difficult responsibility of balancing economic development with the preservation of the Amazon biome and the Cerrado.

The Brazilian defense and security establishment views the Amazon as a central priority, but frames the issue in the archaic context of foreign occupation—an unrealistic scenario. The 2005 National Defense Policy and the 2009 National Defense Strategy state the Amazon as a national defense objective—certainly a perfectly acceptable policy statement.[29] More concerning is a 2007 poll that found 82.6 percent of the Brazilian military and 72.7 percent of civilians interviewed consider Amazonia at risk of being occupied by foreigners.[30] Indeed, the wealth of natural resources—freshwater, undiscovered organisms and medicinal remedies, and untapped natural resources—is considered to be a target for foreign actors.[31] This fear of outside attack or occupation is outdated; Brazil's power in the region is preeminent and unchallenged. Outward-looking strategies must be replaced by a plan to cooperatively confront nonstate actors—particularly those who control the illegal narcotics trade—and combat violence in peripheral regions in concert with neighbors in the region.

These challenges are likely to increase as surging global demand for commodities produced in or extracted from Brazil's periphery drives development and the new arrivals stake out their lives in the region. Climate change stands to increase these pressures, shifting the center of agricultural production away from the Northeast—increasingly threatened by recurrent drought—and further into the Cerrado[32] and the Legal Amazon.

This pushback and expansion of the frontier is accompanied by deforestation, the spread of large-scale agro-business, development projects, and new settlements that have profound sociopolitical ramifications. The "belt" of development has pushed further into the Amazon, increasing land conflicts, deforestation, migration, and violence in a fragile and vulnerable region. The security of the region cannot be assured through a military strategy but rather must respond to the region's complex development, social, environmental, and economic realities.

A man walks past a demolished house in Favela do Metro shantytown, Rio de Janeiro, Brazil.

ASSOCIATED PRESS/VICTOR R. CAIVANO

Controlling the vast expanses of the Legal Amazon and its nearly 7,000 miles (approximately 11,000 km) of border—nearly four times longer than the U.S.-Mexico border—is further complicated by extremely rugged terrain and limited infrastructure. These isolated regions often border countries confronting problems with paramilitary groups, rebels, terrorist organizations, and narcotraffickers. Porous borders mean that Brazil's Legal Amazon often sees "spillover" effects, and Colombia's war on armed groups and trafficking has pushed drug trafficking further into Brazil, Peru, and Bolivia. In addition to such groups, illegal miners, loggers, and poachers add to the lawlessness in a region where government presence is weak.

Organized crime

Drug traffickers exploit the endless waterways and dense jungle of the Amazon to avoid government interdiction efforts and bring cocaine into Brazil. The ease of river

transit and the difficulty of monitoring such a vast, remote area make the Amazon an optimal entry point for cocaine. Meanwhile, rising per capita wealth has led to a growing domestic Brazilian market for narcotics—the nation recently became the second-largest cocaine market in the world behind the United States.[33]

The role of the Amazon as an entry, distribution, and consumption point is visible in Manaus, where drug-related crime is increasing—the city saw a 9 percent increase in murders in 2010, with 70 percent of murders related to drug trafficking.[34]

This development is of serious concern for Brazil, where endemic drug-related violence in the *favelas* has long undermined urban development efforts and internal security. Recently, the appearance of "Cracolandias"—literally "crack lands"—where poor itinerant groups use crack in public areas has taken on epidemic proportions and can be found from remote towns in the Amazon to major cities such as São Paulo and Rio de Janeiro.[35]

This worrying anecdotal evidence is underlined by government statistics, which show seizures of cocaine rising from 8 metric tons in 2004 to 24 metric tons in 2009. The number of seizures rose from 25 in 2005 to 260 in 2009.[36] The government's options to combat this trade and its destabilizing effects are limited in urban environments, and the most effective interdiction efforts must be undertaken at the source of production.

Illegal migration is also commonplace in the Amazon. This traffic grew in the wake of the Haitian earthquake, when guides, known as "coyotes," would send Haitians to the Bolivian and Peruvian Amazon in order to enter Brazil. More than 4,000 Haitians entered Brazil illegally through the Amazon.[37] After granting amnesty to many Haitians, Brazilian President Dilma Rousseff promised to toughen border controls and deportation practices.

The wave of Haitian immigration points to a larger problem posed by Brazil's porous borders, as economic growth makes it an increasingly popular destination in neighboring countries. Brazil's strong economy attracts immigrants from around South America, as they can earn three to four times what they do back home. As Reuters reported, "More than 1.46 million foreigners were formally registered in Brazil in July 2011—a 50 percent increase from the previous year alone. … The total number of undocumented immigrants in Brazil may run into the hundreds of thousands."[38] Transnational migration has become a central concern for President Rousseff's government, which has identified securing the borders as Brazil's most important security challenge.[39]

To address this problem, in January 2012 President Rousseff launched the Sistema Integrado de Monitoramento de Fronteiras, or SISFRON, initiative, allocating 10 billion reals ($6.3bn) through 2019 to establish an integrated system of satellites, drones, and armored vehicles to monitor and secure the borders. Under the plan, the number of soldiers assigned to Special Border Platoons is set to increase from 25,000 to 48,000 by 2019. This commitment to cracking down on transnational crime along the nearly 10,500-mile border stresses cooperation with Brazil's 10 neighbors, between the federal government and Brazilian states, and between the military and other agencies.[40] Nonetheless, the initiatives also raise the concern that Brazil will adopt an overly militarized approach to problems with deep socio-economic and environmental roots.

Rapid development and the prospects of future instability

Brazil's hinterland has seen rapid development and intense resource extraction in the dense rainforest and more open Cerrado, much of it within the Legal Amazon. This belt and the interior hinterland play host to large-scale cattle ranching, hydro-power generation, mining, soy farming, and infrastructure activities. Driven by national and international markets, these industries generate environmental and social pressures that in many ways overwhelm government regulation.

This expansion is fundamental to national growth, as well as global energy and commodity demands, yet if this process is not properly monitored and managed there is the prospect of increasingly large illicit economic activities, powerful social tensions, and environmental degradation that could undermine the long-term future of the region.

The tensions over land already visible in the region—land grabbers, settlers, peasants, indigenous groups, and large-scale industries clashing over land and resources—point to the problems presented by rapid economic development, social tensions, and environmental degradation.

The Legal Amazon's agricultural sector is central to Brazil's trade balance and the world food chain. Brazil now ranks as the third largest agricultural exporter in the world, after the United States and the European Union.[41] Soy and beef, generally among the top exports for the world market, are closely tied to the Legal Amazon, which accounted for 39 percent of national soya production and 36 percent of national beef production in 2008, according to government sources.[42] In the Cerrado of Mato Grosso state alone, 8 percent of the world's soy is produced, and

the states of Maranhao and Tocatins, also part of Legal Amazon, have recently become areas of intense soy production.[43]

Growing global demand has brought large and capital-intensive industries to this sparsely populated—just 4.7 inhabitants per square kilometer—but highly urbanized region, with 80 percent of the Amazonian population living in urban settings.[44] The Amazon also remains overwhelmingly poor and has seen just 1 percent annual growth in per capita GDP from 2005 to 2007, 40 percent below the Brazilian average.[45]

The benefits of the large-scale development of extractive industry and agriculture in the region have failed to trickle down to workers, as the regional per capita income is just $6,128.[46] With 42 percent of the Amazonian population below the poverty line and 17 percent of the population living in extreme poverty, powerful market pressures are being brought to bear on a region ill-prepared to respond.[47]

In addition, Brazil has long been recognized as a country with an incredibly unequal distribution of land, especially with regard to the division of agricultural land. Despite renewed efforts at agrarian reform and a burgeoning movement for land ownership equality, some analysts still estimate that 10 percent of the largest farmers hold 85 percent of the farmland.[48]

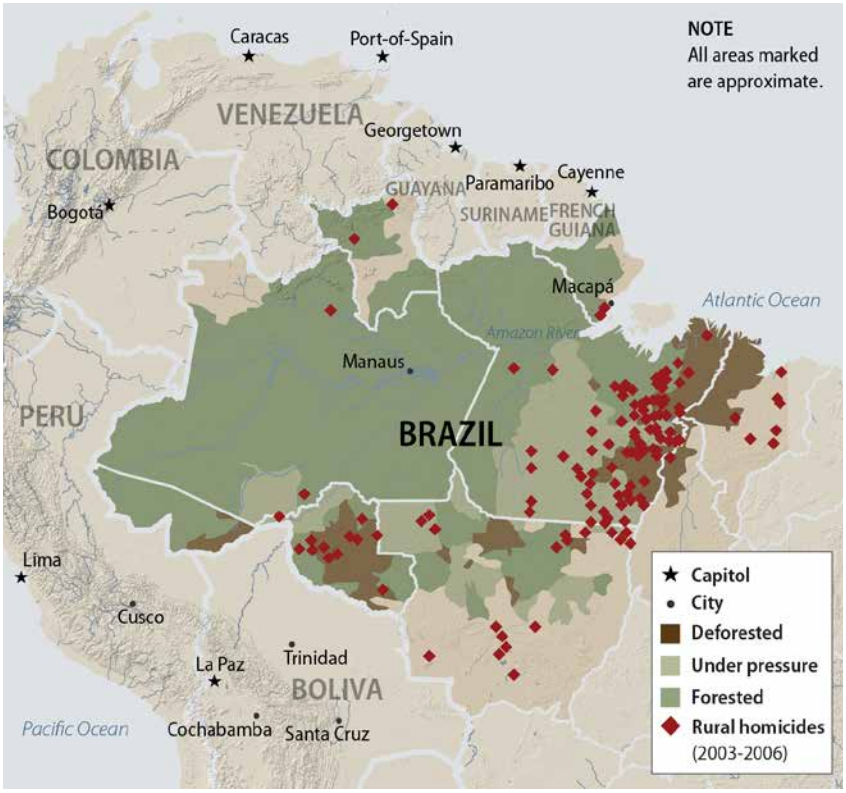
As is the case across much of Latin America, multinational agribusinesses have increasingly concentrated their land holdings to grow monoculture exports, while small- and some medium-scale farms occupy less of the total arable land but continue to produce the overwhelming majority of domestically consumed crops. Interestingly, large-, medium-, and small-scale farmers are concentrated in certain, relatively distinct regions of the country. In line with the narrative of large agribusiness developing swaths of the Amazon, large-scale farms predominate in Central and Northeastern Mato Grosso and in some areas of Southern Para—both within the Legal Amazon.[49]

Soy and beef production

The explosion of the soy market—Brazil is now the world's second-largest producer of soybeans—has changed the agricultural makeup of the country. Over the last 25 years, this transition has seriously jeopardized soil quality, degraded environmental conditions, threatened social cohesion, and sparked violence—as small farmers, new settlers, and large agribusinesses compete for access to lucrative land.

Rapid development and social tensions

Rural homicides and deforestation



Source: Center for American Progress (2012).

Land conflicts have led to numerous deaths in the Amazon region. According to the Brazilian land rights group Catholic Land Pastoral, an estimated 1,600 people have been murdered over land disputes in the Amazon state of Para over the past 25 years. The killings have largely been targeted at small subsistence farmers and indigenous people.[50]

Land ownership distribution in the soybean sector is particularly problematic. As of 2006, there were 215,977 farms producing soybeans in Brazil. Across these farms, the average size is 72.45 hectares. Of the 215,977 farms, 84.4 percent were family-operated, and only 15.6 percent were nonfamily-operated. Family-operated farms, however, held only 24.3 percent of all the land producing soybeans, while nonfamily-operated farms held approximately 75.7 percent,

A farmer holds soybean seeds ready to be planted at farm in Pulinopolis, southern state of Parana, Brazil. In the early 2000s, farmers raced to plant more soybeans from Brazil's rolling southern hills all the way to the Amazon, profiting handsomely as the nation prepared to surpass the United States as the world's top soy producer.

ASSOCIATED PRESS/ANDRE PENNER

illustrating the significant land-holding disparity between small- and large-scale soybean farmers in Brazil.[51]

The development of large-scale agribusiness has stimulated rapid, export-led economic growth, but it will have long-term consequences for sociopolitical stability and food production if family farms continue to be squeezed. While they may not be competitive on a global level, family farms produce 85 percent of Brazil's domestically consumed food and employ 74 percent of agricultural workers.[52]

There will also be long-term consequences for the environment and land. Export agriculture—and particularly soy cultivation—is an expensive undertaking, requiring machinery, pesticides, fertilizer, seeds, and land extensions of more than 500 hectares to be profitable.[53]

The Legal Amazon in particular has seen an influx of migrants and soy production, which has raised median income levels but increased levels of inequality and

pressured the rural poor. Wealthy, large-scale producers—particularly from more established agricultural areas like the South—have profited handsomely from local soy production, which has bred resentment and conflict. Many indigenous or longstanding residents of the Legal Amazon resent the new arrivals and there is a widespread perception that the gains from the development of the region have disproportionately benefited the wealthy, as well as the new arrivals.[54]

Dr. Diana Weinhold, an economist at the London School of Economics, has pointed out that many local inhabitants of the Amazon—as opposed to wealthier immigrant soy farmers from the South—perceive unequal gains from the soy industry and therefore oppose large-scale soy expansion. This opposition and the antipathy toward newcomers have increased social tensions.

The competing arguments over whether soy is a positive or negative for local populations require more research. While indicators present an associated increase in median income and reduction in poverty in the Legal Amazon it is not clear whether this is due to the influx of wealthy migrants or the improved condition of rural poor and small-land holders.[55]

The expansion of ranching is closely correlated with the soy frontier[56] and is directly correlated with deforestation, pressure on small-land holders, and land degradation. A quarter of Brazil's beef production comes from the Amazon. From 1990 to 2007 the total Brazilian herd expanded from 147 million to 200 million, a 36 percent increase. The Amazon accounted for much of this growth, increasing from 26 million to 70 million head of cattle—an increase of 169 percent—while the rest of Brazil increased at a rate of 7 percent, passing from 121 million head to 130 million head.[57]

Broader economic development

Hydropower is another key component of Brazilian economic development that depends on the Amazon. Brazil generated 84 percent of its electricity from hydropower in 2009, which represents roughly one-third of available hydrocapacity.[58] The government plans to develop 48 new hydroelectric power plants by 2020, totaling 42,157 megawatts of installed power—more than 80 percent of that energy would come from 18 new dams in the Amazon River Basin.[59]

The environmental and social fallout of mega hydroelectric projects is profound. The Belo Monte Dam, expected to displace between 16,000 and 40,000 people—accord-

ing to government and nongovernment sources, respectively—illustrates the vulnerability of populations in the region. A Brazilian judge temporarily suspended the project, however, decreeing that construction can only continue after further consultation with the indigenous groups that would be affected.[60] Similarly, the Madeira River Complex bordering Peru and Bolivia is another mega infrastructure initiative that seeks to create a major artery for the export of commodities to the Pacific through a network of dams, navigable rivers, and trans-Amazonian roads with Peru and Bolivia, as well as an energy project that would account for 8 percent of Brazil's energy needs.

Such massive infrastructure projects are accompanied by the expansion of roads and the arrival of new settlers. This often paves the way for other large extractive industries, particularly mining and logging. Given its immense gold, iron ore, copper, and tin reserves, the Amazon is the scene of formal and informal mining, and rapidly growing global demand for these resources—particularly gold—has had a heavy effect on the region.

Informal mining of gold and diamonds is carried out by itinerant or migrant miners known as *garimpeiros*, who create "gold rush" settlements in remote areas of the Amazon almost overnight. Thousands of *garimpeiros* can establish makeshift settlements over a period of a few days and generate significant environmental and social damage. Their arrival often gives rise to deforestation, land grabbing, the invasion of local and indigenous communities, a culture of illegality, violence, a rise in infectious diseases, and severe mercury and cyanide polluting of the local environment. Mining is particularly harmful to water supplies and fisheries, as it generates sediment that affects Amazon River ecosystems and the populations that rely on them. When local mineral resources are exhausted, most of these settlers move on, leaving behind unproductive, deforested areas that are heavily polluted.

Migration

Migrant or itinerant movement within the Amazon region, as well as transnationally, shapes the economic life of the region and presents serious challenges. The movement of people in the Amazon region is primarily driven by economics and, more subtly, by social tensions and environmental conditions.

Booming extractive industries such as soy cultivation, mining, logging, and cattle ranching, along with large infrastructure projects such as highways and dams make real the promise of an open frontier in Brazil. Cheap land and economic opportunity

create a movement of diverse socioeconomic actors to the region: landless migrants (*sem terras*), colonists and small-hold farmers, land speculators, ranchers, drug traffickers, informal gold miners (*garimpeiros*), laborers or debt slaves, heavily capitalized large-scale farmers, land grabbers (*grileiros*), and loggers and sawmill operators. This movement of people can create disruptive boom-and-bust cycles where the prices of food and land can skyrocket before sometimes plummeting.

The Amazon region is one of the primary destinations of migratory flows in Brazil. Between 1991 and 2004, the population of the Amazon region increased at an annual rate of 2.8 percent, greater than the rest of Brazil, which as a whole grew at a 1.8 percent rate.[61] Internally, migration to the Legal Amazon has increased. Manaus, a city of nearly 2 million people, has grown the most in the past decade and is now Brazil's seventh-largest city, while Palmas, the capital of Tocatins, is believed to have had the highest growth among Brazil's state capitals. The far-western Amazonian state of Rondonia, meanwhile, showed 7.3 percent growth in 2011, the fastest among Brazil's 26 states.[62] Ten Amazonian cities have doubled in population over the past decade, and the region's population climbed 23 percent from 2000 to 2010, roughly twice the national pace.[63]

These migrants, many of whom are poor or vulnerable, form informal economies that exert enormous pressure on the natural environment, and the indigenous and poor populations.[64] Many of these economic actors are primarily seeking short- or mid-term economic gain, and in the face of such rapid boom-and-bust cycles it is difficult to address sustainable development. With minimal government presence, exploitation and violence is never far from the surface.

The influx of capital, industry, and migrants generates pressure on fragile social ecosystems and can be particularly destructive among indigenous populations with high rates of poverty and little economic and social integration, access to credit, or steady cash income.

This pressure on the land, natural resources, and the Amazonian frontier is expected to increase with the IIRSA[65] and Brazilian Accelerated Growth Program, or PAC, mega-infrastructure projects, which are increasing migration to remote areas of the region. Projects such as "highway corridors will stimulate the migration of hundreds of thousands, or even millions, of people into the region; new migrants who vie for resources with traditional communities, most of whose residents are ill prepared to compete with the more sophisticated immigrants."[66] This process has been underway for some time and its effects are clear, but it is just now gathering steam.[67]

Joaquim Bento De Souza Ferreira Filho of the University of São Paulo agrees, writing that increased migration to the Amazon will likely heighten the pressure on the natural environment and sharpen the competition for resources—already a matter of great concern for the Brazilian government.[68]

Secure land registries and the recognition of traditional use rights are among the necessary safeguards to protect residents and indigenous communities from encroaching market forces and illicit economies.[69] Such safeguards, already pursued by the Brazilian government, could help prevent or diminish the tension raised by new projects and migration by removing the primary grievance of local populations and the most frequent cause of violent disputes.

Climate change

While current migration to the Legal Amazon is expected to continue increasing as infrastructure facilitates the flow of goods and people, climate change will introduce countervailing trends, transforming the push-and-pull factors and perhaps turning the region into a source of emigrants rather than a destination.

The slow onset impacts of climate change are expected to severely affect ecosystems by changing rainfall patterns and introducing more drastic swings in temperature. These effects will heavily impact agricultural activities—most tellingly the soy industry, which is particularly vulnerable to changing conditions—reshaping local livelihoods and mega-industries. Likewise, increasing incidence of sudden-onset events linked to climate change—such as mudslides, floods, and forest fires—will displace people and undermine livelihoods. Extreme weather events in the region preview the dangers facing residents in the decades to come.

In Acre, a western Brazilian state bordering the Pando region of Bolivia and Madre de Dios of Peru, extreme droughts and floods have consistently hit record levels over the past decade. In 2005, during one of the Amazon's worst droughts over the past 100 years, Acre experienced a 300 percent increase in normal forest fires. Schools, businesses, and airports were closed as hospital admittances soared due to smoke inhalation.[70] The costs for the State of Acre were estimated at about $87 million—from fires alone—about 10 percent of the state´s GDP.[71] In 2010, the Amazon—and Acre—was hit by another severe drought that damaged roughly 400,000 hectares of forest in Acre state alone.

People stand at a flooded street in Trizidela do Vale, state of Maranhao, Brazil in 2009. The flooding was the worst in 20 years, and experts have warned river levels including the Amazon could hit records not seen since 1953.

ASSOCIATED PRESS/ANDRE PENNER

These two "once in a century" droughts within a five-year interval may be a harbinger of things to come, and Acre and the wider Amazon may be looking at the new normal.[72]

This is extremely worrisome for long-term climate trends, as well—the 2005 drought, not as severe as 2010, released 5 billion tons of carbon dioxide into the atmosphere through associated fires—nearly the equivalent of all U.S. CO2 emissions in 2009.[73] Of course, fires are only the most spectacular ramification of these climatic changes. The 2010 drought also diminished the level of the Rio Negro River, a major tributary of the Amazon River itself—to the lowest level ever recorded—leaving communities isolated and stranding thousands of *riberinhos*, the traditional riverside residents of the Amazon, who depend on waterways as their means of transportation and for their basic livelihoods.[74]

In January 2012, a year after the historic Rio de Janeiro floods,[75] torrential rains swept through Amazonia, leaving 83 percent of municipalities in the state of

Amazonas in a state of emergency, and the city of Manaus, with a population of nearly 2 million, with heavy flooding.[76]

The flooding was particularly devastating for the State of Acre and its capital city, Rio Branco, where an estimated 14,000 homes were destroyed, 7,000 people left homeless, and 2,000 people displaced.[77] The Brazilian federal government was forced to issue nearly $3 million in emergency aid to the state of Acre and $2 million to Rio Branco in response to the floods.[78] The devastating 2012 floods marked the second-largest flood on record for Amazonas and Acre.

The future of climate change in Brazil's Amazon and Cerrado

The extreme weather events of 2005, 2009, 2010, and 2012 should be seen as part of a broader long-term change in weather patterns wrought by climate change. Such natural disasters are set to occur with greater frequency in the decades to come—indeed the evidence supports the conclusion that this trend is already visible. The disruption and human dislocation they cause will likewise increase as the Amazon frontier is pushed back with increased migration, the exploitation of the Cerrado expanded, and the development of Brazil's Amazonian hinterland accelerated.

Large infrastructure projects, cattle ranching, mining, soy cultivation, and slash-and-burn agriculture are currently the greatest threat to the Amazon biome, and are likely to remain so for the next 30 years. Additionally, extreme weather events—particularly droughts and flooding—are already major threats to the Amazon, and these trends will only accelerate with the effects of global climate change and increasing temperatures.[79]

The replacement of dense forest cover with more open terrain and lower levels of vegetation reduces rainfall, drying the ground and undermining vegetation, raising the risks of destructive fires.[80] Loss of forest density also undermines the functioning of the biosphere and leads to soil erosion, sedimented or contaminated water, and the decrease of humidity in the biome.[81]

A self-reinforcing feedback loop could be initiated by deforestation of the Amazon—one of the world's largest carbon sinks. Deforestation decreases the planet's ability to process carbon dioxide and releases further carbon into the

atmosphere, thereby accelerating the processes of climate change. This dangerous feedback loop could diminish the humidity and water storage capacity of the Amazon, influencing precipitation patterns throughout the South American region, global atmospheric and ocean systems, and accelerating global warming.[82] These altered conditions in turn could negatively affect agriculture in Argentina, Paraguay, and Santa Cruz and Mato Grosso do Sul, Brazil—collectively the most important granaries of the continent.[83]

Referred to as the Amazon dieback, this process increases evaporation rates, decreases sustained water vapor in the air, and reduces water available for the rain cycle.[84] The World Bank states that there is "substantial probability of Amazon dieback," which would result in severe losses to agriculture, forestry, and power generation, as well as the environmental services rendered by the forest—freshwater, oxygen, biodiversity, ecosystem integrity, services to other species—and the loss of genetic information through a major collapse of the system.[85]

Walter Vergara, co-editor of *Assessment of the Risk of Amazon Dieback* and Chief of Climate Change and Sustainability at the Inter-American Development Bank sums it up, stating simply that "The Amazon dieback is the greatest climate threat that South America faces."[86]

The Amazon biome will see continuing changes to precipitation patterns in the decades to come. There is a strong likelihood that Northwestern Amazonia will receive increased rainfall during the rainy season, and that Eastern and Southern Amazonia will experience increased dry spells and decreased precipitation for longer periods, along with rising temperatures.[87]

Amazonia will also undergo more frequent extreme weather oscillations such as the 2005, 2009, and 2012 droughts. Whereas the average over the past century was for such devastating droughts to occur once every 100 years, the World Bank predicts that by 2100 the frequency will average once every 17 years.[88]

The social, agricultural, and economic consequences of these changes are considerable. The Intergovernmental Panel on Climate Change, or IPCC, predicts substantial losses in agricultural productivity and useable land for various regions and crops in Brazil. One study indicates that climate change may cause agricultural losses of $7.4 billion in grain crops in Brazil by 2020. If climate change occurs toward the severe end of the predictive spectrum the damage could reach $14 billion by 2070.[89]

The Intergovernmental Panel on Climate Change scenarios indicate losses in productivity and agricultural land availability in the Northeast and Center-West regions of Brazil, both current migrant recipient regions.[90] The soya bean, the main crop of the Legal Amazon, is extremely sensitive to extreme heat and dry weather conditions and will be the export crop most affected in Brazil, with profound consequences for the rural communities and laborers who rely on it for their livelihoods.[91]

What's more, extreme weather events, extended dry periods, and changing patterns of precipitation linked to climate change will lower river capacity and downriver flows, substantially reducing the amount of energy produced by Brazil's hydroelectric facilities, particularly during dry seasons. Estimates place the reduction in power generation between 31.5 percent and 29.3 percent by 2050.[92]

Finally, the consequences of climate change will directly affect the health of the inhabitants of the Legal Amazon. Rising temperatures can impact water quality and facilitate the expansion of organisms that act as vectors for diseases, such as mosquitoes transmitting dengue fever, malaria, and Chagas disease.[93]

More frequent droughts also will limit access to freshwater, particularly dangerous to remote populations that already lack many basic water and sanitation services. Despite being one of the most water-rich regions in the world, one-third of the Amazon's population lacks reliable access to clean drinking water.[94] This will likely increase the incidence rates of water-transmitted diseases as people are forced to turn to stagnant water sources such as ponds or lakes, which can harbor diseases.[95]

Social disruption from climate change

Beyond industry losses and environmental degradation, the social fallout of climate change has the potential to be severe. Widespread poverty, weak government institutions, and reliance on subsistence living based on natural resources define many livelihoods in the region and present key vulnerabilities to climate change.

The Legal Amazon—along with Northeast Brazil—holds the highest Climate Change Index vulnerability and the lowest Human Development Index, or HDI, in Brazil.[96] The region's vulnerability to climate change is exacerbated by poverty, which limits the adaptive capacity of affected populations. An already complex socioeconomic transition is further complicated by climate change and the feedback processes initiated by unregulated development.

The slow- and sudden-onset effects of climate change are expected to cause migration, with particular stress felt in the Northeast and parts of the Legal Amazon. The absolute number of climate migrants is not projected to be very high, but more vulnerable, less-skilled workers will represent the bulk of the migrants.

Brazil's Northeast and the Center-West regions are likely to be most severely hit by the effects of climate change in agriculture. Joaquim Bento De Souza Ferreira Filho points out that Intergovernmental Panel on Climate Change projections indicate a loss in productivity and agricultural land availability in the regions that are currently net recipients of migration, meaning it is fair to expect a reversal of the current internal migratory flows in the decades to come. Climate change has the potential to increase the size of movements out of the Amazon.[97]

Currently, migratory movements bring many laborers to the center of Brazil's agribusiness—the states, Mato Grosso, Mato Grosso do Sul, and Nordeste—but these flows may be redirected toward the Southeast as current agricultural regions become less productive. The principal projected migratory flows will bring people from the increasingly drought-struck Northeast—Maranhao and Piaui—and from the less-productive Center-West—Mato Grosso do Sul—region to the Southeast and South. Separately, migrants from the Northeast have increasingly gonee to Amazonian regions such as Amapa and Roraima—already experiencing increasing internal migration—putting pressure on natural resources in those regions. This trend is likely to increase with the more severe effects of climate change, transforming the Northern region of the Amazon.[98]

Demographically, the 24 million people living in the Amazon region represent approximately 12 percent of Brazil's population.[99] This subset is highly urbanized in Amazonian cities and towns and suffers from significantly high levels of poverty—42 percent of the Amazon population, compared to 28.8 percent for the rest of Brazil.[100] This poverty limits the options available to residents when climatic or environmental conditions deteriorate; most do not have the resources to weather short-term disruptions, and fewer have capital to relocate or effectively prepare for or adapt to longer-term developments. Also, poverty is linked to environmental degradation in the Legal Amazon, as many poor rural residents are driven to use unsustainable methods to make ends meet.

High poverty levels also create openings for illicit economies. In 2004 informal employment may have reached 8 million people, representing 68 percent of the economically active population in the region. While the informal economy is prevalent

Members of the Brazilian non-governmental organization Rio de Paz sprinkles beans on a cloth during a protest against the number of homicides in Brazil.

ASSOCIATED PRESS/FELIPE DANA

throughout much of Brazil, Amazonia's percentages were well above the national average, estimated at 40 percent of the gross national income.[101]

Inequality will likely complicate the social and political reactions to development and climate change in Brazil. Brazil has long been plagued by deep inequality and ranks as one of the most unequal nations in Latin America and the world. The wealthiest 10 percent of the population controls approximately 45 percent of the country's wealth, while the poorest 10 percent control just 1.1 percent of the wealth.[102]

Brazil has a very high concentration of land ownership; properties larger than 1,000 hectares compose 46 percent of Brazil's farmland, while farms smaller than 10 hectares occupy only 2.7 percent of total farmland.[103]

Brazil's history of land conflicts gave rise to the Movimento dos Trabalhadores Rurais Sem Terra—the Landless Workers Movement. Officially established in 1984,

it is considered the largest social movement in Latin America with an estimated 1.5 million landless members. Supporters of the Landless Workers Movement claim that there are 4.6 million landless families living in extreme poverty and approximately 150,000 landless families living in 900 encampments across Brazil.[104]

To address this problem, the federal government launched the Legal Land Program in 2009 to expedite land regularization of 300,000 informal occupations on public land in the Legal Amazon. This represented official recognition that land property rights are a major source of conflict in the region and a severe barrier to the development and implementation of sustainable development policies. Despite these efforts, in 2010, 50 percent of the lands in the region were without formal allocation and thus subject to illegal occupation or dispute, making any efforts at adaptation or mitigation untenable and contributing to the perception that the government is unable or unwilling to act as a fair arbiter of disputes over resources.[105]

This stark inequality, combined with climate change and the disruptive forces of globalization, raises the risk of instability, crime or violence in the coming decades. As new settlers and natural population growth increase the demographic pressures, productive land will become scarcer. Climate change, environmental degradation, large infrastructure projects, and the continuing expansion of large-scale agro-business will increase this pressure, further squeezing the availability of land and resources.

In this context, given the extreme inequality, organized crime, and existing lawlessness in these peripheral areas it is likely that Amazonia will see increased incidence of violent protests and conflicts over land or other resources.

Case in point: A study on land conflict correlated climate and land invasions and revealed that decrease in income generated by drought or floods led to increased land invasions in rural Brazil, particularly in regions with very high levels of land concentration such as the Para (Amazon), one of the most unequal states in Brazil.[106]

As rural workers, increasingly central to the large-scale agro-business and soy production along the Amazon-Cerrado belt of development are squeezed out as small landholders, they are particularly likely to turn to such remedies. The World Wildlife Fund estimates that, in Brazil, for every worker who finds employment in the soybean sector, an average of 11 agricultural workers—who would have been supported by more traditional agricultural activities—are displaced.[107] Left with few alternatives when faced with economic hardship, this population is more

likely to mobilize and stake illegal claims to land.[108] With increasingly frequent droughts and floods and global forces pushing greater consolidation of land-holdings, these stressors are set to increase in the coming years.

The construction of paved highways attracts immigrants to frontier settlements, leading to rapid growth rates and more violence in small frontier cities and towns of these municipalities. This pattern was visible in the early 2000s in the municipalities of Humaitá, Presidente Figueiredo, Caracaraí, and Cantá, where homicide rates spiked to more than 100 murders per 100,000 inhabitants. The rapid increase in violence in these municipalities began during the road-building phase, peaking with the completion of paved highways.[109]

This will compound a volatile situation; the Legal Amazon is already an area of high social conflicts. In 2006, the Amazon region accounted for 43 percent of the 761 land conflicts registered in Brazil.[110] Rural conflicts and murders linked to land disputes are regular occurences in the region and correlate closely with deforestation and the expansion of agriculture, cattle ranching, mining, and predatory logging.[111] The rapid expansion of soy cultivation in Maranhão caused land conflicts to increase by 424 percent in just a few years, culminating in 89 land conflicts in 2005.[112] Meanwhile, the Brazilian Pastoral Land Commission has attributed 367 deaths to land conflicts in the last 10 years.[113] This violence is a symptom of the rapid transition of peripheral areas into large-scale extractive activities and accompanying rural dislocation.

Academic research of these dynamics continues, but it seems clear that the parallel and overlapping influences of large-scale infrastructure, unregulated development, and migration have frequently contributed to heightened violence and social conflict in these frontier regions. More attention needs to be given to how increasing internal migration in the Amazon will impact social cohesion.

Historically, the migration of unskilled workers toward the big cities in Southeast Brazil has caused the *favelas* to surge in size. Some projections indicate that this process may repeat itself as southeastern cities receive migrants.[114] These migrants would be primarily less-skilled workers with few resources and little education, which "suggests that a new surge in the population of already large slums in the Southeast cities could start to appear again in the near future. These low wage workers, which belong to the most socially vulnerable groups, would be left with no option but migration, if adaptation measures are not put into action."[115] Such an influx of economically marginal migrants could have disruptive social repercus-

sions, potentially increasing poverty, crime, and drug trafficking. Social cohesion along Brazil's periphery and in the large urban centers is influenced by the future development of the Cerrado and the Legal Amazon.

While the Amazon has historically had to grapple with many of the pressures outlined above, the number and scale of external interests and stakes are increasing. Furthermore, climate change adds a new and unprecedented layer of complexity. Particularly regarding basic livelihoods, human security, and macroeconomic stability, the best available climate scenarios pose new, overlapping risks which could cause major disruptions.

Indeed, the current administration seems to be backing off some protection of the Amazon. The recently passed Forest Code is seen by some environmental groups as favoring the farm lobby, while the decentralization of governance over much of the Amazon passes oversight from the competent hands of the Brazilian Institute of Environment and Renewable Natural Resources, Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis, or IBAMA, the well-regarded environmental protection agency, to local governments which may be ill-equipped to manage such complexity.[116]

Andean-Amazonian Peru

Overview

Widely identified as an Andean country, roughly 60 percent of Peru's territory is actually comprised of Amazonian forests, followed by 29 percent of national area occupied by the Andean highlands and a narrow coastal desert that occupies 11 percent of Peruvian territory. Geographically, Peru is an overwhelmingly Andean-Amazonian country while demographically it is clustered along the Pacific slope, where over 65 percent of its population is concentrated.[117]

While marked geographic, economic, developmental, social, demographic, and environmental characteristics differentiate these regions, they all face challenges related to poverty, inequity, rural and urban divides, and weak governance—and increasing pressures from climate change and the growth of extractive industries. This paper addresses the rural areas of these three regions, focusing primarily on the most peripheral and isolated interior regions of the Andes and the Amazon.

The remote peripheral regions of Peru are similar to the Brazilian frontier in that they have urban agglomerations set among immense, sparsely populated rural hinterlands. Peru's periphery is also significantly disadvantaged in comparison to the rest of the country. The Andes and the Amazon have the highest levels of poverty and inequality in the country, major deficiencies in basic services, and face, to varying degrees, an accumulation of threats related to environmental degradation, climate change, organized crime, violent groups, and narcotrafficking.

Rural poverty is widespread and deeply entrenched in Peru—60 percent of the rural population lives in poverty and 21 percent lives in extreme poverty, compared to 23.5 percent and 3.4 percent respectively in urban areas.[118] National categorizations often mask the realities of rural areas; for example, a national overall score on the Human Development Index[119] of 0.77 places Peru as an upper-middle-income country, far removed from the situation in rural areas, which have an extremely low HDI score of just 0.49—roughly equivalent to Angola.[120]

- Extreme pressure on water sources in coastal and Andean areas, including major urban centers of Lima and Cusco.
- Melting glaciers are shrinking dry season water supplies, disrupting highland rural society and sparking migration.
- Widespread social tension and violence centered on the environmental impacts of extractive industry and large infrastructure projects.
- Peru is now the largest cocaine producer in the world, supplying distant urban markets and provoking violence in peripheral areas.
- Incredible geographic and climatic diversity—between the Amazonian, Andean, and coastal regions—complicate responses and adaptive efforts.

Employment statistics reaffirm regional inequalities: In urban areas 80 percent of the economically active population is employed, whereas in rural areas only 20 percent population has formal work.[121]

Basic services overwhelmingly fail the needs of the periphery regions: Only 35 percent of the population of the Amazon and Andean regions has access to electricity.[122] The 2010 United Nations Development Program ranked Peru as having the highest inequality in access to potable water in Latin America.[123]

Paradoxically, as one of the region's most water-rich nations,[124] Peru is one of the region's most water-stressed nations. While it has one of the highest ratios of renewable freshwater availability per capita at 74,546 cubic meters per person per year, this supply is nearly exclusive to the Amazonian interior, far from the coastal and Andean population centers.[125] The coastal plain is home to more than 65 percent of Peru's 29 million inhabitants—including 8 million inhabitants in the capital, Lima—and 80 percent of national gross domestic product, but it has less than 2 percent of the nation's water resources.[126]

Water stress—already a very serious threat to the Andes and the Pacific slope—often leads to social conflicts over water. This problem is set to worsen in the arid regions of the Andes and the coastal plain, where water resources are dwindling while population growth continues. Lima, the world's second-largest desert city, continues to grow at a 1 percent annual rate,[127] while the glaciers the city relies on for water continue to disappear and extractive mining and agriculture industries continue to tap this dwindling resource.

For the peripheral populations of Peru, the usual stresses of rural subsistence living are made worse by the lack of basic government services and infrastructure, market-driven forces and competition for resources from extractive industries, shifting long-term climatic patterns, the intensification of the El Niño/La Niña effect, and sudden-onset natural hazards linked to climate change, such as floods, landslides, and storms.

Peru's ambitions for the coming decades cannot be realized without addressing the needs of the most vulnerable segments of society and mobilizing greater resources to defend their basic livelihoods in the face of such disruption.

Residents march during a demonstration against the Conga gold and silver mining project in Mamacocha Lagoon, Peru in 2012. Demonstrators say they fear the mine will taint their water and affect a major aquifer.

ASSOCIATED PRESS/MARTIN MEJIA

Extractive industry and the future of Peru's periphery

Extractive industries and global market forces are reshaping Peru's vulnerable periphery—particularly the Andes and the Amazon. The country's abundance of gold, silver, tin, copper, zinc, and lead have allowed Peru to develop an export-oriented economy that capitalizes on current and future demand of commodities, paving the way for the county's promising development.

Peru has become the largest global source of silver, second-largest source of copper, and Latin America's largest producer of gold (sixth in the world), lead (fourth in the world), and zinc (second in the world).[128] As a result, Peru has experienced unprecedented economic growth, with 8.8 percent growth coming out of the recession of 2009.[129] The mining sector accounted for $21.7 billion of $35.6 billion in total exports in 2010, or approximately 61 percent of total Peruvian exports.[130]

The wealth generated by huge mining operations—often highly mechanized and requiring little manpower—has in many cases undermined, or threatened to undermine, local living conditions, rather than significantly improving the economic standing of rural Peruvians. Rural and indigenous communities face industrial contamination and pollution, land degradation and erosion, and the loss of local resources—often to the perceived benefit of coastal cities or foreign investors.

This perception of inequity and unfairness—that the benefits of development are not being shared or returned to those bearing the costs—has led to conflicts between rural populations and mining companies. These clashes often escalate with the government forced to strike a balance between developing mining projects and responding to the objections of local communities.

Environmental degradation and pollution of water, air, and land is pervasive in the Andean highlands which, in addition to being the backbone of the country's development, have become the spine of social tension. Many mining concessions are located in headwater areas in the high Andes and pass through river networks that undermine water quality far from the site of the mine. Indeed, some experts calculate that over half of Peru's rural communities have been affected by mining activities.[131] It has been estimated that mining and metallurgy activities release over 13 billion cubic meters of effluents into Peru's water courses every year.[132] According to a U.S. Agency for International Development report on climate change in Peru, the Defensoría del Pueblo—Peru's social and environmental ombudsman—reported 154 active social disputes on file of which 103 related to environmental concerns and 80 related to mining activities specifically.[133]

In fact, communities are already facing challenges and fighting back. Projects for the $4.8 billion Conga mine—which would become Peru's largest copper and gold mine—have been delayed by ongoing and deadly protests by local rural communities who feel that the mine will contaminate their water and natural resources.[134]

The Peruvian government faces a difficult balancing act. Serious, more frequent delays for the Conga mine are posing greater difficulties and risks for mining companies, risking the diversion of capital elsewhere and threatening Peru's macroeconomic health. But failure to address local concerns about mining projects risks violence and greater instability.

As Peru plays host to more and larger mining projects in a quest to continue its impressive macroeconomic growth and respond to growing world demand, rural

Peru's mining boom

Balancing economic growth and the environment

Source: Center for American Progress (2012).

areas will face growing challenges related to climate change, environmental degradation, and water stress.

In parallel to the formal extractive industries, worldwide demand and record prices for gold have also triggered a boom in clandestine mining, a phenomenon that has spun dramatically out of state control. It is estimated that 22 percent of the gold exported from Peru is of illicit origin.[135]

Illegal mining drains the state's tax revenues, severely degrades the environment, and contributes to a wider expansion of illegal activity that is increasingly destabilizing peripheral areas of Peru. Currently some 100,000 people are directly employed as illegal gold miners and 400,000 people are connected to this activity.[136] Clandestine mining and logging have also been identified as sources of financing for the Shining Path—Sendoro Luminoso[137]—Peru's longstanding hybrid Maoist insurgency with strong ties to a wide range of illicit activities, particularly drug trafficking.[138]

In the Amazon region of Madre de Dios—Peru's southeastern region, bordering Brazil's Acre State and Bolivia's Pando Department—approximately 30,000 people participate in informal gold mining. The scale of this illegal mining in the predominantly poor region is one of the primary economic activities, and simultaneously an attraction for migrants and a major cause of social conflict in the area.[139]

Widespread informal mining has spread highly toxic materials, particularly mercury and cyanide, throughout the local environment, wildlife, and food chain. In the absence of any government oversight, mining activities have poisoned nearby water sources and fisheries, giving rise to public health concerns.

Similarly, increasing rates of deforestation and erosion are linked to informal mining. In Huepetuhe, one of four districts of the province, Manu, nearly 10,000 hectares were cleared for informal mining, leaving the area largely useless in the long term.[140] Trying to combat this degradation is made difficult by the high price of gold—the value of illegally mined gold exports is estimated to have exceeded the value of the narcotics trade in 2012.[141]

The growth of such a large informal sector has overwhelmed precarious state control of the region's economy, generating environmental and social concerns while also fueling a wide range of illicit activities. The story is repeated across the region, with

the absence of a strong state presence in peripheral areas of significant poverty and abundant natural resources combining to create a setting in which illicit activities and criminal groups can flourish and establish sophisticated networks and supply chains. These circumstances should incentivize mining companies to cooperate with state officials to help secure the formal economy and combat illicit activity.

The flood of internal migrants and gold miners, along with the social problems that have appeared, has overwhelmed regional and local governments in the Madre de Dios region. This frontier migration is closely tied to dynamics outside of the region. International market prices or pressures such as poverty, conflict, or climate change elsewhere in the country can have significant social and environmental concerns in the frontier region.

The Peruvian Amazon receives migration from the rural Andean highlands, and the ensuing slash-and-burn agriculture practice is one of the principal causes of deforestation in the Amazon. These migrants, who have traditionally relied on seasonal migration to urban areas for temporary employment to compensate for bad harvests, are increasingly turning to the Amazon frontier to settle permanently. Andean migrants have brought problems linked to increased competition for resources, contributing to deforestation and invasions of public lands.

As newcomers from very different ecosystems, they are inexperienced in tropical agriculture and are unaware of local land management practices, consequently contributing to the rapid deforestation and soil degradation. The increase in population has contributed significantly to the broader pushback of the Amazon.[142]

While some research outlines the importance of infrastructure projects, like the Inter-Oceanic Highway, in opening up the region to increased mining and logging,[143] more research is needed to understand the push-and-pull factors driving this migration of highland migrants to the Amazon.

Agricultural growth

Similar to the mining sector, the global demand for agricultural commodities is also generating water stress and tensions with local populations. The agro-export boom is also an important segment of the national economy, contributing 7.5 percent to GDP, and represents an important source of employment.[144]

The most intensive agro-production occurs on the southern coast in the arid Ica region, which diverts water from one of Peru's poorest regions, Huancavelica. Paradoxically, Ica, a very dry region, hosts the most water-intensive industry in the country, producing monoculture export crops, primarily asparagus, artichokes, and other legumes—none central to Peruvians' staple diet.[145]

In the Ica and Villacuri Valleys a combination of large investments, advanced irrigation systems, underground water, and manmade catchment to divert water from the mountainous Huancavelica region have transformed the region into the heart of Peru's "agro-export miracle," with the country now a world leader of asparagus—expanding cultivation from 592 hectares in 1990 to 12,782 hectares in 2011, with production rising from 3,750 tons to 144,419 tons in 2011.[146]

Yet this "miracle" has begun to confront the limitations of finite natural resources and face questions regarding its economic, environmental, and social sustainability. Large-scale agriculture now accounts for more than 80 percent of the nation's water consumption.[147] The sophisticated irrigation systems that divert water from higher elevations are generating water shortages for Andean peasants and traditional farmers by removing water from aquifers faster than they can be replenished.

The local communities are seeing community wells dry up, bought out, or contaminated by agro-industry. A main well that provides water to 185,000 people is expected to dry in the next 25 to 30 years.[148] In the meantime, some of the most disadvantaged are surviving on as little as 10 liters of water per person per day, compared to the 50 liters basic level indicated by the World Health Organization.[149]

Finally, smaller farmers who cannot compete with large exporting producers and industry face the escalating costs of the "resource race." They are often forced into debt trying to compete before eventually selling land to agribusiness.[150]

Adding to the political volatility of the water constraints created by large-scale agro-business, it is estimated that only $0.30 of every $1.00 generated by these asparagus farms remains in Peru.[151]

Water availability—particularly along Peru's southern coast—will decrease as climate change takes its toll, with projections showing high probabilities for severe and increasing droughts in southern Peru due to changes in rainfall patterns.[152] Combined with the overexploitation of water resources by large-scale agro-business, these shortages will seriously threaten local livelihoods, exacerbating

tensions between traditional subsistence agriculture and large-scale agro-business and undermining the viability of the industry. Striking the proper balance between these tensions and the need for macroeconomic growth will be a fundamental challenge for Peru.

Balancing economic growth and the public interest

Finding an equilibrium between the benefits of rapid growth and foreign direct investment and the pressures exerted on natural resources and rural communities will remain a challenge for Peru, particularly as climate change squeezes supplies of freshwater, reduces the amount of water available for agriculture, and potentially pushes more migrants into the fragile Amazon region in search of economic opportunity.

Economic development, unaccompanied by a comprehensive regulatory framework, environmental governance, local sustainable development, and local concerns, is threatening the livelihoods of the rural poor, who are feeling the mounting pressures of flourishing extractive industries and climate change.

As communities find themselves competing with large export industries for access to water, land, and other natural resources, they are increasingly challenging state structures—primarily local and national governments—for failing to guarantee their well-being over national or foreign economic interests. Official data show that there have been 15 deaths during President Ollanta Humala's term, which began in July 2011, in protests over natural resources. During former President Alan García's term from 2006 to 2011, 174 people died in clashes over water, oil, and other natural resources.[153] Hundreds of incidents of social conflict over the degradation of natural resources and continuing attacks by the Shining Path have hurt President Humala's popularity; his approval rating dropped below 50 percent for the first time in June 2012.[154]

Water, food, and basic resources are coming to play a central role in Peruvian politics. Former President García, for example, ran his second presidential campaign, in 2006, on the promise of "water for all," promising to invest in 185 potable water and sanitation projects to increase quality and access.[155] President Humala was elected into office with the overwhelming support of Peru's rural population. During his campaign, Humala promised Peru that he would respect the roots of democracy and spread the national wealth to the overlooked rural populations. Humala won the presidential election with the support of more than 60 percent

Climate change and social tensions

Competition for scarce resources

Source: Center for American Progress (2012).

of the rural population,[156] a victory that came as a shock to many who had anticipated that Lima would once again decide the presidency.

The upset was in some ways emblematic of the popular backlash against the dislocations caused by rapid economic growth. The $4 billion Inambari hydroelectric dam in Madre de Dios was cancelled last year after years of protests from indigenous political activists, including some 4,000 individuals set to be displaced by the project.[157] Likewise, in 2009 Peru's indigenous activists managed to earn the repeal of two of former President García's decrees that would have opened much of the Amazon to development, but 24 police officers and 10 civilians were killed in clashes, bringing back memories of Peru's bloody political past.[158]

The government has made attempts to address these concerns. Peru, for example, is the only Latin American signatory to the Extractive Industries Transparency Initiative, designed to introduce new reporting requirements on companies engaged in extractive industry in order to monitor payments to governments. Despite such monitoring through the financial system, on-the-ground implementation and enforcement of measures to rein in the sprawling illicit economy is very difficult in the face of the gold rush.

Protests have become frequent, violent, and extended, undermining confidence in government and industry. The constant confrontation between government and communities discredits government authorities, leaves rural poor disenfranchised, and deepens divides in the country. Indeed, in some cases, the government's attempts to regulate and formalize illicit activities have led to major backlash from local communities who do not welcome the extension of state intervention—or taxes—to established informal economies.

In parallel, extended protests impede industry investment. According to the Peruvian National Water Authority, approximately 70 ongoing conflicts over water use in the coastal region threatened to undermine investments of up to $2 billion.[159] Potential investors are frightened of the political risk inherent in Peruvian politics, some of which is undoubtedly due to unresolved disputes over the proper allocation of the nation's natural wealth—particularly water and minerals.

In the midst of rapid growth, state institutions are overwhelmed, leading to serious failures of oversight and an expansion of illegal activity. This absence of state control has hurt social and environmental stability—resulting in increased numbers of social conflicts and lost tax revenues from illicit industry. This further

undermines the legitimacy of state presence in rural areas, the economic development of Peru's periphery, livelihoods, and basic human security, making it more difficult to address illicit activities.

Climate change

Inequality, poverty, and severe environmental degradation translate into heightened vulnerability to climate change for Peru, which is considered to be among the countries at greatest risk from the effects of climate change in the Western Hemisphere.

Nearly one-third of the population is categorized as vulnerable or extremely vulnerable to climate change and 10 of Peru's 25 administrative regions—states—have a "critical" or "very critical" vulnerability to climate change, with the greatest vulnerability being in the Andean region.[160]

Peru's environmental and geographic diversity is both a boon for current development and a burden under climate change. The climate change and climate variation scenarios faced are diverse: glacial retreat, changing temperatures, extreme weather events, the intensification of El Niño and La Niña, intensification of drought and floods, altered precipitation patterns, rising sea levels and modified sea temperature, desertification, and land erosion.

The intensification of the El Niño/La Niña Southern Oscillation, or ENSO, which influences global climate and causes extreme weather in many regions of the world, will particularly affect Peru.[161]

Past El Niño phenomena have been devastating. One of the most severe periods occurred in 1996-1998 when increased droughts and levels of precipitation in the Andean region caused a reduction in crop yields and an increase in the occurrence of crop diseases. A study of the Cañete Valley showed a rise in temperatures that led to a 45 percent increase in the occurrence of crop plagues for 1996–1997 and a 34 percent increase for 1996–1998, which resulted in 57 percent decreased crop yields for 1996–1998. Crop losses for staple foods were severe: 56 percent for potatoes, 50 percent for cotton, and 46 percent for corn. The total damage due to the El Niño effect was concentrated in the agricultural sector and worth $613 million.[162]

Some studies estimate that by 2050, Peru will have 60 percent of the water it possesses today, due principally to the improper management of water and the melting

Andean farmers work during the potato harvest in Huancavelica, southern Peru, 3,950 meters above sea level. In Peru there are around three hundred varieties of potatoes; most of them only grow at in the Andes at high altitudes.

ASSOCIATED PRESS/MARTIN MEJIA

of the Andean glaciers.[163] By 2030 the Peruvian Sierra will experience diminished water availability as it is estimated that all glaciers below 5,000 meters will have disappeared, diminishing water availability on the already arid Pacific slope by 6 percent, with the exception the northern coastal region, which will receive more precipitation.[164] Changing rainfall patterns will cause annual water shortages in the central and southern Andes, with 10 to 20 percent decreases projected.[165]

Nearly 60 percent of the rural poor and 80 percent of the extreme poor rely on agriculture and livestock and are thus extremely vulnerable to water shortages, meaning that climate change and environmental degradation directly harm their basic livelihoods.[166] Without glacial water runoff to sustain them during the dry seasons, crop yields and animal herds will be hurt. And with over half of rural households reliant on rivers, springs, and other runoff sources, decreased precipitation resulting in diminished access to and quality of water is a major threat to rural livelihoods.[167]

Water loss further poses a major risk to national food supply and economic growth. Agriculture accounts for 7 percent of GDP in Peru. More importantly, it employs 23.3 percent of the economically active population and accounts for 62.8 percent of the national food supply.[168] Two-thirds of Peru's arable land is rain-fed, meaning that projected changes in rainfall patterns due to climate change would profoundly affect the agricultural sector and population of Peru.[169]

Projections show high probabilities for severe and increasing droughts in southern Peru due to changes in rainfall patterns, while rains in the north could increase by between 10 percent and 20 percent.[170] The increase of extreme temperatures, both minimum and maximum, is also expected in a large part of the country.

In Peru and Bolivia, one of the reasons for current internal migration and emigration from rural highlands is the lack of water and the disappearance of grasses consumed by livestock above 3,500 meters.[171] In a 2012 study carried out in Huaraz and Espinar, the main reason for involuntary migration was lack of water. Diminished crop yields due to lack of water was also shown to provoke conflict among rural farmers.[172] Finally, climate change is intensifying seasonal migration, which occurs when farmers, faced with financial losses from bad yields and severe weather, leave for the city to find work and compensate for economic losses.

Teófilo Altamirano, an expert on migration in Peru, has worked in the valley of Callejon de Huaylas—situated between the Cordillera Blanca and Cordillera Negra, which hold the majority of Peru's glaciers. He argues that climate migration is inevitable: "In 10 years it will be very clear that people [Andean populations] will have to leave because they do not have water. … There are already indications today people are leaving due to climate-related issues."[173]

Altamirano asserts that Andean populations have already noticed the effects of climate change. "It is already on their mind," he says, referring to Andean populations, arguing that *campesinos* and indigenous populations who hold ancestral knowledge of mountain weather systems have seen changes in weather patterns, seasonal variation, crop yields, and the arrival of pests and insects not characteristic of the landscape.

Given these circumstances, Altamirano believes many Andean farmers will be prompted to migrate either to cities on the coastal plain, which already face water stresses, or to the Amazon, contributing to further degradation of an already fragile ecosystem.[174]

The Peruvian Amazon is already feeling the effects of climate change, most notably changing of seasons of plants, significant reduction in crop yields (corn and coffee), increase in average temperature, larger or more frequent fires in dry periods, loss of habitats and biodiversity, flooding of crop areas and fields in areas near rivers, and landslides.[175] Deforestation will play an important role in precipitation patterns in the wider Amazon region, resulting in drier conditions in areas fed by Amazonian rains—and less rainfall and runoff water for agriculture.

In addition to the slow-onset problems posed by climate change, extreme weather events are expected to increase and also threaten rural livelihoods. Currently, more than 15,000 hectares in Peru are lost annually due to climatic events. From 1995–2007 roughly 445,000 hectares were lost to climatic factors, representing a loss of $866 billion. The regions that recorded the greatest losses—Puno, Apurímac, Junín Huánuco, Cajamarca, and San Martín—nearly all have poverty rates of more than 50 percent.[176] In addition to the destruction of cropland, extreme weather events can damage or destroy houses and crucial infrastructure, particularly roads, leaving rural communities further isolated.

Most of Peru's natural emergencies—72 percent—are of "hydro meteorological" origin, such as droughts, heavy rains, floods, freezes, and hail storms.[177] These emergencies have grown more frequent in recent years, increasing more than sixfold from 1997 to 2006.[178] Extreme temperatures and floods have already hit Peru economically, with losses averaging 0.11 percent of GDP per year from 1997–2006. According to a study by the Andean Community, Comunidad Andina de Naciones, or CAN, Peru will lose an average of 4.4 percent of its GDP to climate change by 2025.[179] Most recently, between 2003 and 2007, extreme temperatures affected nearly 20 percent of the country's population, with 2 percent of the population affected by floods.[180]

Security challenges

Peru is facing security challenges complicated by rural dislocation caused by environmental degradation, climate change, and the rapid development of large-scale extractive industries. As in the remote parts of Brazil's Amazon, minimal government presence on Peru's periphery too often gives way to lawlessness and illicit activities where criminal or separatist organizations enjoy free rein and the poor communities' economic outlets are overwhelmingly related to illicit markets.

Peruvians pull out coca plants in Santa Lucia's jungle, in Junin, Peru.

ASSOCIATED PRESS/MARTIN MEJIA

Chief among these security challenges is the threat posed by coca cultivation and organized drug trafficking. Peru today is the number one coca producer in the world. The United States' and Colombia's massive eradication efforts contributed to Peru's ascension as the world leader. The annual U.S. government estimates measuring cocaine production showed Peru producing 325 metric tons in 2010, compared to Colombia's 195 metric tons in 2011 and Bolivia's 265 metric tons in 2011.[181]

This development follows suit with historical seesaw dynamics of coca production: In the 1990s, declining coca production in Bolivia and Peru paralleled rising coca production in Colombia, while in the 2000s, declining coca production in Colombia mirrored increases in Bolivia and Peru.[182]

Peru's coca cultivation and production rose while deepening its presence in key regions, as well as expanding its reach to new areas of the country. The Apurimac and Ene River Valley, or VRAE, continues to be the primary coca-producing region, with high rates of poverty, violence, and remoteness. The economic

significance of coca in VRAE livelihoods is unequivocal: Between 2007 and 2008 roughly 90 percent of the value of agricultural production in the VRAE[183] was generated by coca cultivation.[184] The area's poverty and peripheral status—it is not well-integrated into the wider formal economy—increases rural residents' dependence on coca cultivation. Meanwhile, the absence of state control makes it a breeding ground for drug trafficking organizations and the Shining Path, whose bloody struggle in the 1980s killed an estimated 69,000 people.[185]

Traditionally an Andean crop, coca is now growing in the Amazon, with the region accounting for nearly 8 percent of Peru's coca acreage, a number that is likely to rise.[186] International and national drug intelligence reports identify a growing trend of coca cultivation in the Amazon,[187] often in border regions where government presence is minimal. In the Amazonian Loreto region of northeast Peru, bordering Brazil and Colombia, the quantity of illegal coca being grown has risen by some 300 percent every year over the last seven years. In the remote province of Mariscal Ramon Castilla in the Loreto region, authorities have identified 7,000 acres currently under coca cultivation.[188]

As coca cultivation expands into new areas of rural Peru, it grows in sophistication; more efficient "Colombian-style" processing techniques have arrived in Peru, signaling the presence of Colombian drug trafficking organizations and demonstrating the efficient, international nature of the cocaine supply chain. The incorporation of subversive groups such as the Shining Path to provide security for production and transportation of cocaine points to the complexity of the illicit economies that have taken root in peripheral, rural regions of Peru and Brazil.

These illicit groups have the potential to undermine the economic development and security of vulnerable populations, crucial industries, and local governments. For instance, there is evidence of deepening connections between the illicit lumber trade and the narcotics trade. Andean drug traffickers who move coca paste and opium are increasingly interested in timber, as they can use the same networks to transport both products.[189] There are also instances of drug trafficking organizations seizing the land of indigenous residents for cultivation or forcing them to participate in the narcotics industry. While coercion is a concern, many indigenous residents also voluntarily join the trade, a rare path out of a difficult subsistence lifestyle into a cash economy.[190]

Peru's natural gas reserves and pipelines—central to the country's energy security and economic outlook—are also located in the volatile VRAE, leading to seri-

ous insecurity.[191] In April 2012, within the matter of a few weeks, Shining Path militants kidnapped 36 natural gas workers, shot down a helicopter, and killed six security agents.

Peru's main natural gas pipeline originates in the nearby Camisea fields, and the workers were purportedly targeted because of plans to build a second, $3 billion pipeline to feed a new petrochemical complex on the Pacific coast—a project that represented $13 billion in foreign investment.[192]

Peru is further exploring gas fields in other volatile areas such as Madre de Dios, where gas fields could rival those of Camisea and Ucayali. The incentives for such exploration and development are tremendous: January 2012 estimates project that Peru's dry natural gas production will double by 2016.[193]

The expansion of extractive industry along Peru's rural periphery—illicit and legal—bring new pressures to bear on rural livelihoods and also expose industries to the dangers present in isolated and ungoverned spaces. Without proper management, popular resentment from those left behind by this growth or disputing the claims of new arrivals and foreign investors could overwhelm state influence. In Madre de Dios, the government tried to implement a plan to formalize illegal mining—and criminalize illicit mining activity—and informal miners organized protests that resulted in three deaths and 55 injuries.[194]

The Andean region is no stranger to extreme violence, terrorism, and subversive groups financed from drug trafficking. And today's global economic conditions offer ample sources of income to illegal groups operating in resource-rich, minimally governed areas of the Andes and Amazon.

These peripheral areas of Peru—whether regarding social or environmental conditions, or drug trafficking and security concerns—are not having their demands for governance met and, as in Madre de Dios, often resent and resist state influence when it arrives. Peru's central government is struggling to manage a complex balance between economic growth and social stability and respond to the pressures facing the periphery. As climate change intensifies and becomes an additional and very serious source of stress on basic livelihoods in the region, rural areas risk slipping further from state control, feeding a loop of environmental degradation and social dysfunction, if an effective response is not prepared.

Given these asymmetrical challenges, military force will be an insufficient and inappropriate tool to manage the Amazon and Andes. Peru must establish control of the illicit economies of these peripheries. The military is ill-equipped to regulate supply chains exploited by illegal actors or mediate disputes over natural resources like land, mining, or logging privileges—and is indeed more likely to exacerbate tensions than resolve disputes.

The environmental degradation, social conflicts, and widespread culture of illegality implanting itself in the region needs a multifaceted approach that includes encouraging sustainable development and resource management, securing rural livelihoods, providing basic services, and responding to demands for governance from the periphery.

Bolivia

Overview

Bolivia shares many characteristics with Peru as well as with other countries straddling the Amazonian and Andean regions: deep-seated poverty, inequality, underdevelopment, varied geographies, fragile ecosystems, drug production and trafficking, and weak, decentralized government that particularly disadvantages periphery regions.

These are all serious challenges that climate change will further aggravate, but poverty plays a particularly important role in Bolivia—considered to be among the poorest countries in South America—in its current and future stability under climate change.

Poverty is the norm for the majority of both rural and urban populations. According to recent World Bank statistics, 60 percent of Bolivians live in poverty.[195] In rural areas, where approximately one-third of Bolivians live, the poverty rate averaged 77 percent in 2007. Contrastingly, urban areas, which encompass 66 percent of the Bolivian population, had a poverty rate of 50 percent in 2007.

While the urban poor approximate one-third of Bolivia's population, and constitute a potentially volatile political force,[196] the rural poor face different challenges and are more vulnerable to climate change because of their reliance on agriculture. Nonetheless, the urban poor face severe water shortage, high prices and contamination issues, all exacerbated by melting glaciers—the primary source of water for highland cities such as El Alto and La Paz.

The country's high vulnerability to climate change is rooted in its extreme geographies and the large share of the population reliant on subsistence agriculture. While the sector contributes just 10 percent to overall GDP, roughly one-third of Bolivians live in rural areas[197], meaning that rural dislocation has an outsize impact on livelihoods, social cohesion, and political stability.

- Extreme and widespread poverty and poor infrastructure leaves Bolivia's peripheral rural populations extremely vulnerable to the effects of climate change.
- Responses to the effects of climate change are complicated by geographic and climatic diversity, particularly by divides between the Amazonian and Andean regions.
- Large urban centers of La Paz and El Alto face dire water shortages linked to melting glaciers and diminished runoff.
- Deep, violent social tensions remain—despite government's efforts to expand and formalize land tenure—centered on rights to and distribution of natural resources.
- Coca cultivation expanded by an estimated 35 percent from 2006 to 2010, with little political appetite or technical capability to counter narcotrafficking into growing South American and European markets.

The 6,010-meter Huayna Potosi is seen above La Paz, Bolivia. El Alto and its sister city of La Paz, the world's highest capital, depend on glaciers for at least a third of their water, more than any other urban sprawl.

ASSOCIATED PRESS/DADO GALDIERI

Grasping Bolivia's amount of poverty is just as important as understanding the country's regional differences, which harbor ethnic, economic, and often divisive political differences. From East to West, Bolivia's three regions are lowlands (tropical forest, savannah and Chaco), the subtropical Yungas slopes of the Andes—13 percent of national territory—and the Andes highlands. These starkly varied geographies mark demographic, political, and economic differences particularly between the eastern lowland departments—such as Santa Cruz, Beni, and Pando—and the arid Andean departments.

The western Andean highlands—28 percent of national territory—are characterized by high rates of poverty, indigenous populations with deep ancestral traditions, fragile ecosystems, and harsh mountain terrain. Droughts, flash floods and landslides, severe frost, water shortages, and climate variability are also characteristic of highland Bolivia. These taxing conditions—set to become even more severe and erratic with climate change—undermine agriculture and basic liveli-

hoods, arresting agricultural development to small land plots of mostly subsistence agriculture, and stymieing development in the mountainous areas.

To deal with these hardships, temporary migration to cities is a common practice among families needing to adapt to climate volatility.[198] The western highlands also contain the large cities of El Alto, La Paz, Cochabamba, and Sucre. All of these cities face water shortages due to climate change—primarily linked to the melting of the glaciers that have provided them with water.

The contrasting eastern tropical lowland savannah (llanos), forests and Chaco cover 59 percent of territory. The region is the seat of economic power spearheaded by the Santa Cruz department and the capital city of the same name. The department covers 34 percent of Bolivia's national territory and incorporates 25 percent of its population. Rich in gas reserves and host to large-scale soy cultivation and industry, the department's share of national exports exceeds 50 percent and accounts for a large share of tax revenues.[199]

Economic growth and ensuing environmental and social disruption

While small-scale subsistence agriculture characterizes western Bolivia, market-driven agricultural production is widespread in the lowland eastern department of Santa Cruz in the Amazonian Basin, which is considered to have some of the highest-quality upland soils of all of the Amazon[200] and the highest potential for sustainable development in the Amazon basin.[201]

From 1990 to 2009 agricultural cultivation increased dramatically in the Santa Cruz department, paralleling the rise of soybean production, which increased by 600 percent.[202] In 1990, Santa Cruz had 413,320 hectares of agriculturally cultivated land, which grew to 1,821,631 by 2007; of this area, 1 million hectares were dedicated to growing soybeans.[203] Exports of soybean from Bolivia in 2011 were worth $309 million—the single-most important agricultural export and the third largest of all Bolivian export products.[204]

But such agricultural production diminishes the diversity of crops and therefore makes them more vulnerable to shocks. There has been a decline in the number of crop varieties raised by farmers in the Andean region, as well as a shift away from cultivation of traditional food crops toward cash crops grown for market. This shift

has undermined food security by reducing the availability of protein sources and increasing vulnerability to crop loss from droughts, frosts, diseases, and pests.[205] In 1986, 85 percent of Bolivia's cultivated land was used for domestic consumption (cereals, fruits, vegetables, fodder, and tubers), but by 2005 the percentage of land cultivated for domestic purposes had dropped to 52 percent. This sharp decline coincided and was linked to an intensification of industrial cultivation, which increased from 13 percent of cultivatable lands in 1986 to 47 percent in 2005.[206]

Much like the Brazilian Cerrado, the lowlands of Santa Cruz have the most concentrated land tenure in all of Bolivia, a phenomenon linked to the recent expansion of industrial-scale agro-business and particularly soya bean cultivation. In 2010, approximately 100 families owned 12.5 million acres of Bolivian farmland, while 2 million Bolivians were crowded onto just 2.5 million acres.[207]

This results in many of the same social tensions visible along the belt of development in Brazil's Legal Amazon—land invasions by migrants and protests from indigenous communities of large land holdings. Similarly, the expansion of large agro-business has increased the pressure on the land and raised tensions in lowland areas, where deforestation is leading to confrontations between loggers and indigenous communities.[208] As highland migrants increasingly under strain from difficult conditions leave the Andes and move toward the Amazon and lowland savannah, tensions are likely to be exacerbated.

The mining and gas industries are also driving land pressure and environmental degradation. As an important global producer of zinc, tin, silver, lead, and gas—Bolivia holds 35 percent of the world's lithium[209] and has the third-largest gas reserves in South America.[210] The Bolivian economy relies heavily on these environmentally intensive sectors. Natural gas and other carbon energy sources account for 6 percent of Bolivia's gross domestic product, nearly one-third of government revenues and almost all of total exports.[211]

Bolivia's mining boom, however, was not accompanied by the introduction of advanced water treatment technology or best practices for handling discharge and residuals. In some cases, mines rely on very primitive wastewater systems with little to no regulation, meaning that contaminated wastewater is improperly disposed of, generating environmental and financial losses. Mining is one of the major sources of water pollution in Bolivia, and wastewater discharge can have high concentrations of dangerous heavy metals such as arsenic, zinc, cadmium, chrome, copper, mercury, and lead.

One of the clearest examples in Bolivia is the Pilcomayo River, where the contamination of the river—the main river of the Plata river system—mainly by mining, has led to levels of zinc in nearby crops of more than nine times the permissible limit under U.N. guidelines.[212]

Similarly, Lake Titicaca, South America's largest freshwater lake, found in the arid Altiplano region, also faces severe pollution from mines and urban contamination. Wastewater and sewage from La Paz, which lacks adequate drainage and sewer systems, and pollutants from nearby mining industries reach the lake through its tributaries. These pressures combine with dramatic climate change effects occurring in the Lake's eco-region: shorter rainy seasons, high evaporation rates,[213] diminished replenishments from reduced flows of tributary rivers due to shrinking glaciers, increasing salinity levels, and decreasing water level. Continued demand of water for irrigation, consumption, and industry undermine the lake's long-term sustainability.[214]

Titicaca was named the Threatened Lake of the Year for 2012 by the Global Nature Fund, which recognized the threat to the lake's survival, and the crucial watershed it supplies—on which a population of 2.3 million people depends.[215]

Migration

Wealth, economic growth, bountiful resources, and the promise of economic opportunities and employment drive largely indigenous highland migrants eastward, despite the hostilities they face. As rural residents continue to migrate to cities in the face of increasingly difficult climatic conditions and extreme weather events due to climate change, Santa Cruz and the East will continue to receive large numbers of new arrivals from the marginalized Andean region. While this movement of people may eventually shift the demographics of the East sufficiently to necessitate a broad political settlement, in the meantime tensions are likely to continue to rise.

Historically, regional tensions in Bolivia were rooted in ethnic differences between mestizo whites from the east and more indigenous migrants from the Andean regions.[216] Currently, however, highland migrants are often discriminated against because they are seen as encroaching and competing for jobs and resources and engaging in informal work that overpopulates and degrades the urban landscape of Santa Cruz.

Workers become targets of antimigrant sentiment and slander, often referred to as "second-class members of society" and excluded from social expression and political participation.[217] The racist or xenophobic treatment of migrants from the western highlands—generally indigenous—has prompted international attention, with Amnesty International and the United Nations Special Rapporteur on Racism condemning the discrimination.[218]

Locally, the migrant cause is part of the political and separatist debate. The Comite Civico Pro Santa Cruz, a political movement calling for more autonomy or even the separation of the eastern departments of Beni, Pando, and Santa Cruz argues that these regions should not be obligated to receive highland immigrants if their regions have failed to provide employment to their citizens.

Climate change

Environmental degradation is one piece of the complex puzzle facing Bolivia with the onset of climate change. As in Peru, the country's most vulnerable populations find themselves confronting overlapping challenges: varied effects of climate change across the diverse regions, high poverty rates, widespread reliance on subsistence living, inadequate infrastructure, and limited government resources—all affecting isolated regions where illicit economies and international drug traffickers are entrenched.

As climate change gets worse, Bolivia's overriding challenge—particularly for rural populations—will be providing access to freshwater. The nation holds 20 percent of the world's tropical glaciers—these play a central role in human consumption, irrigation, agriculture, industry, and hydropower—and 40 percent of Bolivia's electricity is generated through hydropower.[219]

Bolivia's productive agricultural and urban areas are often located in extremely dry areas and depend on water systems reliant on rivers and wells.[220] The rural and urban poor who rely on this infrastructure, fed by glacier runoff in lean times and dry periods, will be most affected by climate change. The threats posed by melting glaciers are multiple: They increase the risk of flooding and landslides during the wet season, contribute to the sedimentation of riverbeds, and significantly reduce dry season water supplies.

An indigenous Aymaran woman prepares to dock her boat off in the Island of Suriki on Lake Titicaca. Sewage and trash polluted the water causing Lemna and Azolla aquatic plants to grow creating photosynthesis on the surface, depleting the oxygen from the water, causing fish to die.

ASSOCIATED PRESS/DADO GALDIERI

Bolivia, like most of Latin America, relies on rain-fed crops for most of its agriculture—90 percent depends on a regular supply from precipitation, underground aquifers, and glaciers while only 10 percent of Bolivia's cultivated land uses irrigation systems.[221] Without irrigation systems, varying precipitation patterns can lead to crop losses and undermine basic livelihoods, further increasing the vulnerability to climate change.

As glaciers retreat up mountain slopes, the lower-lying villagers receive less water in runoff, increasing competition for water or forcing people to relocate to new pastures. These trends are already in progress, with some highland peasants moving to lower-lying areas where there is more water, and others migrating to cities—particularly La Paz and Santa Cruz—which have experienced significant growth.

Bolivia's rural indigenous populations are already migrating due to pressures associated with climate change. Similar to the vanishing water resources, the Uru Chipaya

community has seen their numbers dwindle as water resources have become scarce and competition over water sources upstream with the Ayamara, another indigenous population, are forcing migration and depopulation of these communities.[222]

Rural Bolivians are diversifying crops based on ancestral practices to decrease the risks of small-scale agriculture and insulate themselves from climate change. But such methods entail the planting of drought or water-resistant crops depending on coming seasons, which in turn requires accurate weather measurements and predictions—technology most Bolivian farmers and local governments are lacking.

Several studies document a general understanding among farmers on the Altiplano—the Andean plateau—that the climate is changing, and likewise detail their feeling that these changes are combining with other stressors to significantly undermine agricultural production and food security.[223] More data is needed to illustrate on a larger scale how peasant communities are being affected. But as it stands, Bolivia's most vulnerable farmers are left to grapple with shifting patterns of rain and seasonal variation alone.

Among the most pressing urban water sites are the twin cities of La Paz and El Alto. The pair are home to a combined 2.3 million people and are growing rapidly—El Alto is one of the fastest-growing cities in the hemisphere.[224]

These cities have traditionally received 30 to 40 percent of their potable water from the Cordillera Real range to the east. With the melting of major glaciers in the mountain range, 35 percent of La Paz's water supply may disappear over the next 20 to 30 years,[225] threatening the water security and economic livelihood of the city.[226]

Both La Paz and El Alto are already experiencing the realities of water shortages and lack of access; up to 80 families share one communal faucet, people are forced to use contaminated water from streams for washing, and fights break out over the use of water.[227] La Paz Prefect Pablo Ramos responded to water shortages by discussing solutions such as building dams, tapping underwater reserves, and even trying to relocate people away from the city.

Ramos told BBC News, "We are thinking about a planned programme of migration, mainly to the north of the region."[228] While such a scenario remains highly unlikely, the statement reveals the extent to which water scarcity is a serious threat to the city's long-term future.

Water scarcity and access have already contributed to violence in 2000, during the "Water War" of Cochabamba, another city on the Altiplano facing serious water shortages. Rate hikes in the wake of a World Bank-backed privatization of the municipal water company—in an effort to combat corruption and high rates of water leakage—led to massive protests and a general strike. The protests and subsequent government institution of martial law left five people dead and some 40 injured.[229] Less dramatic but equally telling struggles over water and rationing of supply are fixtures of life in many of Bolivia's highland cities.[230]

The current panorama demonstrates that the country is ill-equipped to respond to future water demands. Water demand for irrigation and industry will increase by 150 percent and 250 percent, respectively, by 2050, and is likely to outpace supply.[231] A systematic response will be needed to insulate and prepare the most vulnerable in the agricultural sector.

In addition to water shortages, extreme weather events are increasing in Bolivia. The U.S. Agency for International Development's international disaster database indicates that from 1900 to 2010 the worst climate-related disasters in Bolivia have occurred in the last decade with the increased frequency of droughts, floods, extreme temperatures, and landslides of catastrophic proportions.[232]

These extreme weather events place Bolivia among the most at-risk countries in the world. In 2007, the Germanwatch Climate Risk Index listed Bolivia in the top 10 countries most affected by extreme weather events. That year, severe flooding affected 400,000 Bolivian families and left a critical humanitarian situation in the department of Beni in the Amazon region.[233]

Natural disasters are not a foreign concept to Bolivia. Floods, landslides, and droughts are becoming recurring products of Bolivia's shifting climate. In 2010 a series of droughts left numerous farmers both homeless and unemployed. The El Chaco region of Southern Bolivia, an already arid terrain, was one of the worst hit by the droughts. It is heavily populated by indigenous farmers, and suffered severe crop failures that devastated the local agribusiness. In addition, numerous wild fires destroyed what little crops farmers had managed to salvage. Given the inability to produce an abundance of crops, many families were forced to sell their lands and relocate. An estimated 55,000 people were affected by the drought.[234]

If climate change continues to follow its current pattern, El Chaco will not be the only region in Bolivia suffering from severe droughts. Scientists believe that if

average temperatures in Bolivia increase another 1.5 to 2.0 degrees Celsius, other regions of the country will transform into desert-like environments.[235]

Responding to the needs of Bolivia's rural population is made particularly difficult by differing geographic settings and lack of development. The majority of Bolivians live in the Andes, 31 percent live on the Altiplano—where the environmental realities are most intense and poverty is highest—and 47 percent live in the high Andean valleys, while just 22 percent live in the lowlands and forests of eastern Bolivia and the Chaco.[236]

Bolivia's minimal infrastructure further undermines the resiliency of the rural communities most vulnerable to climate change. Less than 5 percent of the 26,604 miles—42,815 kilometers—of roads in Bolivia are paved[237], with the remainder poorly maintained dirt or gravel-topped roads. The North Yungas road, which runs from La Paz northeast toward Coroico and Caranavi and is dubbed "The World's Most Dangerous Road," exemplifies the difficulty in reaching remote rural areas of Bolivia. The country's mountain roads become extremely hazardous during the rainy season when rock slides and road and bridge washouts occur regularly, as do deaths due to collapses and washouts.

The government and civil society acknowledge that climate change is a threat. And farmers confirm changes in seasons and precipitation patterns, poor harvests in quality and size, changing temperatures—sometimes permitting "atypical" crops to be planted in new areas—and the presence of different plant diseases and pests.[238]

Bolivia has made some progress in establishing institutional frameworks such as the Mecanismo Nacional de Adaptación al Cambio Climático—introduced into the constitution. But moving toward implementation remains a major challenge.[239] Bolivia's weak state structure, recent decentralized governance, serious deficit of technical and scientific resources, and lack of instruments to monitor and address climate change further complicate Bolivia's ability to respond on a national scale.

Political and social instability from drug trafficking

Bolivia's history, political volatility, and frequent social protests underpin the fundamental need for the national government to address the demands and frustrations of citizens—particularly the rural and urban poor—who will face increasing threats to their basic livelihoods as the effects of climate change come to bear.

A soldier of Bolivia's Special Force to Fight Drug Trafficking throws diesel oil at a coca factory found during a patrol in the region of Chapare, Bolivia.

ASSOCIATED PRESS/DADO GALDIERI

Rural dislocation rooted in changing conditions, conflict over land and scarce water resources, migration, and volatile urban populations will sharpen already tense political divisions between east and west, Andean and lowland, and industry and indigenous rural populations.

But the challenge of providing for the poor and vulnerable with regard to climate change is merely one of the difficulties that face the Bolivian government. Drug trafficking organizations are increasingly establishing operations in Bolivia, and without a coordinated response the country might find itself spiraling back into circumstances similar to the drug trafficking epidemic of the 1980s and early 1990s.

Bolivia is the world's second-largest producer of cocaine—behind Peru—as well as a significant transit zone for Peruvian cocaine to Brazil, the Southern Cone, Africa, and Europe. But while a comprehensive regional response is required, Bolivia's ability to successfully identify, investigate, and dismantle drug trafficking organizations has been significantly diminished following the expulsion of the

U.S. Drug Enforcement Agency, or DEA. President Evo Morales, a former leader of the coca workers' union, has long resented America's role in eradication efforts and, despite the recent—2011—normalization of relations, has declared the DEA unwelcome in Bolivia.[240]

Partly as a result of the withdrawal of U.S. assistance, Bolivia has failed to reduce net coca cultivation and cocaine production, and has not curtailed the growing drug trafficking threat.[241] Bolivia has stated its opposition to the production and trade of narcotics, but also asserts that, as a traditional crop, coca cultivation is justified up to a certain limit in the *cocalero* region, centered on the Chapare region, north of Cochabamba. Nevertheless, the country fails to comply with these self-imposed limits.

In fact, Bolivian coca cultivation increased by an estimated 35 percent from 2006 to 2010, from approximately 26,000 hectares to 35,000 hectares. The potential for pure cocaine production increased 70 percent during the same period, from 115 metric tons to 195 metric tons—the highest area under cultivation and purity figures in over a decade.[242]

Drug trafficking organizations boosting the cocaine production capacity in Bolivia are using the technical experience of Colombian and Brazilian traffickers, and Bolivian officials have voiced concern about the growing presence of Colombian, Brazilian, and other foreign narcotrafficking groups in the country.[243] But with remote, porous, and poorly monitored borders, and lax immigration controls, Bolivia offers cocaine traffickers a lower-risk environment and lower odds of government interdiction than Colombia or Brazil.

The increasing presence and strength of drug trafficking groups is visible even at the highest levels of Bolivia's government. General René Sanabría, the former "czar" of the Bolivian antinarcotics police force, was arrested and extradited to the United States for cocaine smuggling in 2011.[244] Awash in capital, sophisticated drug trafficking networks have cash resources with which to corrupt officials of an already weak and under-resourced government.

At the community level, increases in violent crime in Santa Cruz are linked to the growth of drug trafficking organizations. Police in Santa Cruz registered 7,275 crimes in 2011, up from 6,460 in 2010.[245] Authorities have also reported an increase in the presence of foreigners in the Santa Cruz region which they associate with the burgeoning illicit economy and the drug trade in particular.[246]

Given the clear indications that Bolivia is losing ground to international drug trafficking organizations, the United States and the region must find a new way to intervene in Bolivian territory and increase Bolivian capacity to counter narcotrafficking and organized crime. Despite the animosity in President Morales's remarks toward the United States,[247] there is hope that through trilateral, regional, or multilateral frameworks the United States will once again be able to provide assistance in combating international drug trafficking organizations and cocaine production in Bolivia.

While Morales expelled the DEA in 2009, for example, and has refused to receive direct support from United States, Bolivia has recently signed the Integrated Monitoring System for Surplus Coca Cultivation Reduction Pilot Project,[248] which will promote technical and scientific cooperation among signatory nations—Bolivia, Brazil, and the United States—to improve monitoring and measurement of surplus coca production for eradication. Unfortunately, the future of this tri-party agreement—signed in 2012 for one year only—is still unclear.

Despite Morales's sympathies for the struggles of the *cocaleros*, or coca farmers, Bolivia must distinguish between the plight of small-hold farmers and the industrial-scale, violent business of international drug trafficking organizations or risk becoming a narco-state.

Cooperating to prepare for the impacts of climate change and insulating the most vulnerable from its worst effects could provide the United States and the international community with an opportunity to reopen effective cooperation with Bolivia on the whole range of complex issues facing the country, including the trade in narcotics.

Conclusion and recommendations

Realities on the ground

The Amazon

The Amazon Basin is vastly complex and plays a central role in global food production, regional energy supply, and regional and global climate systems. The Amazon—and Brazil's periphery more broadly—also plays host to several threats to national and international interests. Lack of effective governance, poverty, rugged terrain, and porous borders have allowed illicit economies to prosper.

These peripheral areas absorb increasing numbers of migrant and itinerant actors who contribute to undermining the stability of fragile social, environmental, and economic orders. The multiple illegal actors—drug trafficking organizations, criminal gangs, rebel factions, human traffickers, *garimperos*, illegal loggers, poachers, and land speculators—have established themselves among the 24 million urban and rural residents of the Amazon, operating in the shadows of large-scale extractive industries reshaping the region to supply international demand for commodities.

And despite the spread of large-scale extractive industry, the benefits of development have been slow to reach the most vulnerable residents of these peripheral regions. Poverty is disproportionately high and formal employment is scarce. This often makes illicit economies attractive and the de facto economic alternative, offering viable economic opportunities and livelihoods to many poor rural residents.

Poverty and the illicit economies endemic to the region contribute to much of the environmental destruction occurring in the Amazon. The reliance on illicit activities reinforces a more general lawlessness throughout the region and contributes to increasing violence in frontier communities. With minimal state control, the opening up of the territory through new roads and other infrastructure projects has brought clashes with poor communities and indigenous groups, as illicit or

informal actors penetrate deeper into the forests, expanding and strengthening networks while contributing to environmental and social degradation.

As infrastructure allows for further penetration of the region, more actors will migrate to the region, increasing pressures on resources and stability. Further environmental degradation will undermine a region that will be severely affected by climate change, exacerbating Amazon dieback, extreme weather events, forest fires, and increased incidence of flooding and droughts. While the exact impact on migration is very difficult to model, the effects of climate change are expected to lead to reverse migration in parts of the Amazon which are currently a destination for migrants. Given this anticipated reverse migration under climate change scenarios, it is all the more important to ensure sustainable development, understand and control migration to the region, and mitigate the worst excesses in Amazonia.

Ensuring the social cohesion and sustainable development of the Amazon should be a central security concern for Brazil, Peru, and Bolivia. This highly strategic region is at risk of instability as drug trafficking groups and organized crime strengthen their hold and threaten to transform it into another lawless safe haven for the global cocaine trade and other illegal activities. The growth of these trades threatens Brazil's urban centers, contributing to already high rates of cocaine consumption and undermining governance through corruption initiated by cash-rich cartels. As a crucial hub in the trade of drugs to Latin America, Africa, and Europe, the vulnerability of the Amazon is an increasing national, regional, and global security concern.

Peru

Peru faces severe future climate change scenarios, complicated by the country's diverse terrains and multiple geographic realities. Peru is considered one of the most vulnerable countries in the region. Water—or the absence of water—is already a central concern to a wide spectrum of Peruvian society, particularly poor, rural Andean *campesinos*.

The pressures on these vulnerable groups will intensify as the effects of climate change—receding glaciers, changes in temperature and precipitation patterns, and intensification of El Niño—come to bear. Important regions of the country will face water scarcity, provoking migration to urban centers or to the water-rich Amazon, a fragile ecosystem already suffering environmental degradation from Andean highland migration, deforestation, informal mining and infrastructure projects.

Miners work at a legal mining concession in Huaypetue, Madre de Dios, Peru. Government efforts to halt illegal mining have mostly been futile. The state of Madre de Dios prides itself on its biodiversity and attracts eco-tourists for its monkeys, macaws and anacondas. But an estimated 35 metric tons of mercury is released annually by miners in this state alone, slowly poisoning people, plants, animals and fish, scientific studies show.

ASSOCIATED PRESS/ESTEBAN FELIX

Similarly, climate change will threaten the sustainability of the mining and agricultural industries—already competing for scarce water resources with local communities in some cases—that have underpinned Peru's macroeconomic growth. Environmental degradation caused by extractive industries, both legal and illicit, gives a hint of what is to come as fragile environments and vulnerable populations face dwindling supplies of clean water.

Environmental degradation is also closely linked with migration. Increasingly, poor migrants from the Andean highlands have sought more favorable conditions in the Amazonian lowlands. These migrants have degraded local environments as they carve out a livelihood through informal mining or unsustainable agricultural practices that exhaust resources and undermine long-term sustainability. Migration is expected to increase as climate change further destabilizes the livelihoods of rural populations in the Andes; this will exert further pressure onto already environmentally stressed environments such as the water-stressed coastal cities or the fragile Amazonia.

Peru faces difficult political questions as to how to balance macroeconomic growth and the demands of industry with the plight of the traditional agricultural sector and the nation's most vulnerable populations. These questions surrounding the distribution of Peru's natural wealth—particularly water and mineral wealth—are complicated by political tensions in an incredibly diverse state. Such tensions must not be allowed to boil over as continued development and climate change further increase competition for resources.

On top of this, Peru finds itself increasingly threatened by drug trafficking organizations, organized crime, and illicit economies, which disproportionately impact the most vulnerable populations. Peru is now the largest global producer of cocaine, the heart of a trade that corrodes societies far from Peru and finances a wide range of criminal activities. The trade has also been a boon for the full range of illicit economies in the Peruvian Amazon. But the drug trade—along with other extractive industries that have boosted Peru's formal economy—is not just Peru's responsibility. The rise of cocaine production in Peru is driven by global demand and the crackdown in Colombia.

For Peru, its neighbors, and the international community, there is a vested interest in providing basic human security and preventing the further growth of illicit activities in Peru's peripheral areas. For the United States in particular, it is important to help build Peru's capacity to maintain stable and prosperous development. If illicit actors are allowed to continue building sophisticated networks of smuggling and illicit markets, the state will face the increasingly difficult challenge of controlling these actors. As world demand for drugs and commodities continues to increase there is the risk that these groups will further expand their activities and overwhelm state responses.

Bolivia

Bolivia is highly vulnerable to climate change due to its geography and high levels of poverty—some of the worst in the region. Bolivia's most vulnerable *campesino* and indigenous highland communities are increasingly suffering the effects of climate change. Melting glaciers, the intensification of El Niño and changing seasonal patterns, temperatures, and rainfall patterns are fraying the vulnerable social fabric of these subsistence populations.

Water shortages are already forcing migration away from the Andes; many *campesinos* and indigenous communities are moving to urban centers, transform-

ing what was once a remedial temporary migration to the cities to compensate for poor harvest to permanent migration. As they migrate to Andean urban centers, they increase demands on urban water sources and land availability—already under tremendous stress. El Alto and La Paz, both major destinations for migrants, have already overwhelmed their capacity to provide water to their citizens. Some Andean migrants have chosen to move east instead to the lowlands and Amazon region, where their arrival has deepened underlying racial tension and fueled the separatist discourse prevalent in Santa Cruz. As environmental conditions in the Andes continue to deteriorate, migration from this poor, peripheral zone will increase the pressure and instability in already stressed regions.

Bolivia also faces fundamental internal divisions on how to allocate and regulate natural resources, particularly land, water, and mineral wealth. Its trajectory has been different from Peru's, with greater weight given in recent years to the interests of indigenous populations and environmental concerns. But tensions between interests from the East and West of the country remain, as do resentments of extractive industry. In a country with a long history of social tension and violence, and an incipient decentralized government, Bolivia must guard against the further erosion of state authority.

Concurrently, Bolivia increasingly faces the threat of organized narcotrafficking. The country's permissive coca cultivation policy and the expulsion of the U.S. DEA has contributed to the rising presence of Mexican and Colombian cartels, particularly along the eastern border with Brazil. A weak central government with limited resources and capabilities is increasingly challenged by the power and sophistication of cartels. Moreover, the political will and influence of the *cocaleros*, an important base of political support for President Evo Morales, further complicates the country's response to the growing presence of international drug trafficking organizations.

Regional challenges and the need for a new U.S. agenda for the Americas

The relationship between countries in the Western Hemisphere has seen profound changes in the past two decades. While Latin American countries have gone through drastic political and economic transformations that have deepened democratic processes throughout the region, North-South American cooperation has not kept pace with the growing opportunities and challenges these developments present.

At the same time, the level of economic interdependence—in the form of energy, trade, and investment—has reached unprecedented levels. Three of the United States' top trading partners—Mexico, Venezuela, and Brazil—are in Latin America. Five of the top 15 exporters of crude oil to the United States are in Latin America, with Mexico ranked 3rd, Venezuela 4th, Colombia 7th, Brazil 9th, and Ecuador 11th.[249] Remittances from the United States to Latin America peaked at $42 billion in 2008.[250]

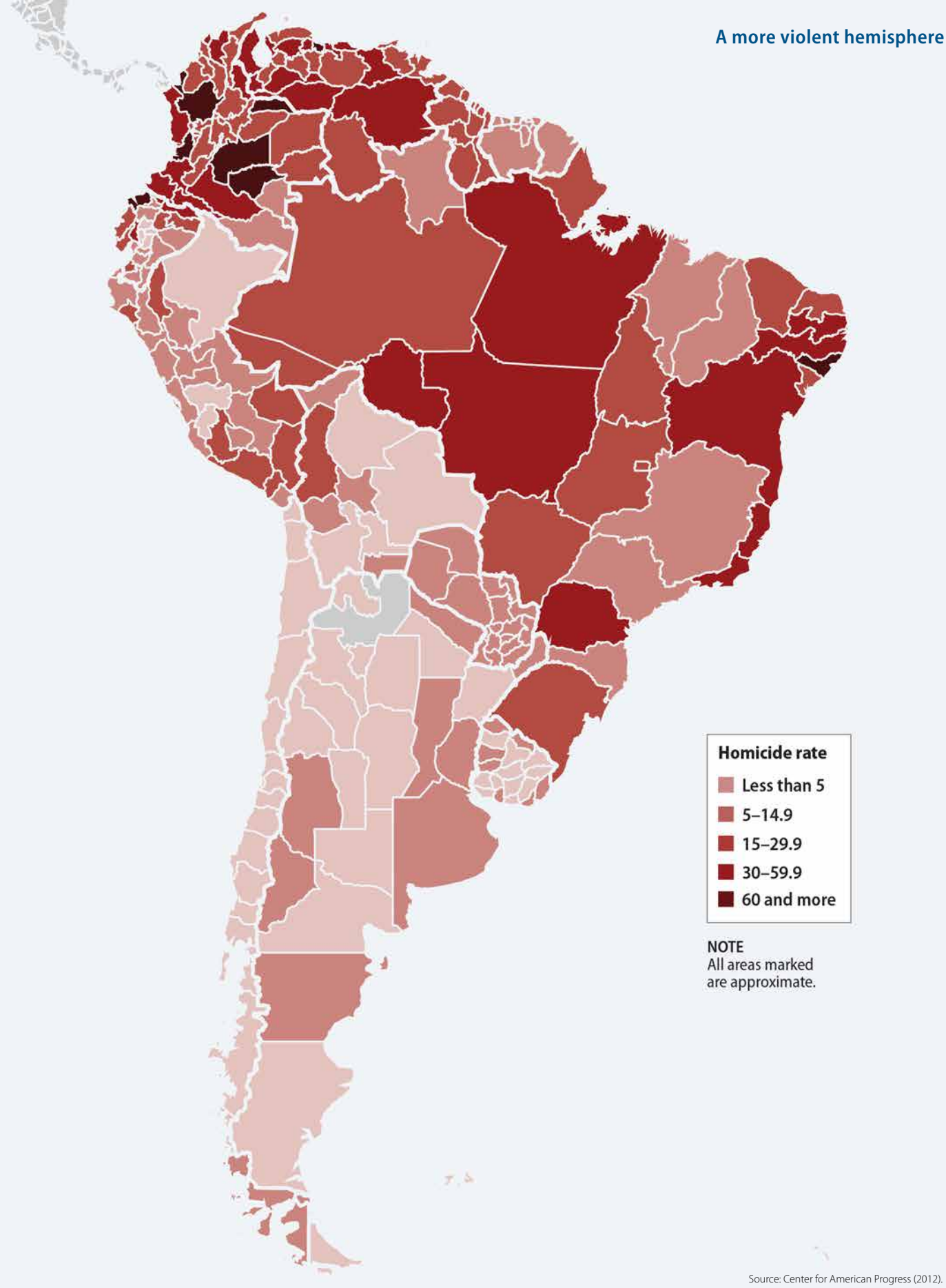
While increased economic integration exposed Latin America to the effects of the economic slowdown in the United States, the region proved resilient through the recent crisis.[251] The global price of commodities and raw materials has allowed Latin American export economies to thrive, creating an economic boom that "represents an opportunity for the region to lay the foundations for sustained medium-term growth by making investments in infrastructure, innovation and human capital ... to help create more stable conditions for growth and progress towards greater equity."[252]

Apart from the economic links that connect the United States to the countries in Latin America and the Caribbean, important demographic connections bring residents of the United States in closer contact with the region, bringing with it the cultural impact these demographic links carry. More than 40 million Hispanics live in the United States, comprising over 16 percent of the U.S. population.[253] The presence of Latin culture in mainstream U.S. media speaks to the dynamically changed cultural landscape of the United States.

Opportunities abound for the United States to forge a more progressive and cooperative approach to hemispheric issues, taking steps to rebuild a foreign policy that enhances its global standing. The United States will fail to capitalize on these opportunities, however, if policymakers do not overcome inattention toward the region; inattention that results in a deficient understanding of the complex economic and political developments that have occurred in South America in the last 20 years. Understanding the nexus of climate change, migration, and conflict or insecurity is an important first step toward addressing the shortcoming and deepening U.S. engagement with this region.

Rising public and human insecurity in Latin America is one of these principal challenges. The presence of transnational criminal organizations is having a profound effect on the governments and institutions of the region, resulting in widespread corruption and impunity, undermining the rule of law, and weakening the state's ability to promote human rights throughout the region.[254] Militarization

A more violent hemisphere



Source: Center for American Progress (2012).

in the face of this challenge has failed to address the root causes of insecurity; by broadening our understanding to encompass basic human security and the provisions of alternative livelihoods, policymakers can address the insecurity of transnational crime and prepare for the impacts of climate change.

Rising crime, and especially violent crime, should concern the United States as well as the societies of South America. The United States is still the largest consumer of cocaine in the world, with almost all of the cocaine produced for the U.S. market coming from Colombia, Peru, and Bolivia. With such demand in the United States, and growing demand in Brazil and other nations, the global drug trade reached a total global value of $400 billion in 2007.[255] Increasingly, traffickers are also using routes across the Atlantic to West Africa—profiting from stronger ties between Brazil and the African continent—where minimal state regulation and migratory routes allow them to move cocaine across the Sahara to Western Europe. There is compelling evidence that funds from this trade are increasingly financing extremist activities, and the expansion of the trade in West Africa has prompted a fierce U.S. security response.[256]

Because U.S. and European domestic demand are major drivers of this trade, these countries bear a moral responsibility to help South American countries tackle the rampant criminality and corruption caused by the presence of drug trafficking organizations and work to reduce domestic demand. In designing a more progressive policy for Latin America and the Caribbean, the United States and Europe must first be ready to listen to what the region has to say—every government stands to benefit from a cooperative approach to these problems.

New sustainable security strategies are needed to address these sources of instability, accounting for the dislocation caused by climate change and human mobility. Along with combating organized crime and the international narcotics trade, providing sustainable development and preparing for the effects of climate change is the central stability challenge for the region in the decades to come.

These challenges intersect in the peripheral areas described in this paper, and military or police approaches employed at the country level to combat the presence of these transnational criminal networks will not succeed without a more fundamental strategy for porous border regions.

Finally, a re-evaluation of hemispheric policy on these issues may provide an opportunity to address problems that are important to the United States and

South America, as well as work to diminish anti-American sentiments by providing human development and security assistance.

Policy recommendations

Objectives

The intersection of climate change, migration, and insecurity provides an opportunity for the United States to recast its hemispheric relations in a positive, progressive way. Both the United States and its partners have a variety of interests that would be well served by devising and investing in programs to address these issues in cooperation with the affected countries.

There are global environmental and health reasons to act now. The Amazon is a crucial global carbon sink and source of vast natural wealth and biodiversity, which is only partially explored and understood. In addition to altering regional weather patterns, substantial dieback of the Amazon biome could accelerate global climate change.

Ensuring the sustainable development of the Amazonian periphery, the Cerrado and the wider tropical savannah, and the Andean highlands is also a key economic goal. These areas are central to the global commodity supply chain and food security, in addition to playing host to substantial U.S. economic interests, such as large investments from agribusiness, mining and infrastructure firms.

While the risk of instability from climate change, migration, and security is not as immediate in Latin America as in Northwest Africa,[257] or India and Bangladesh,[258] this should be seen as an opportunity for smart planning and preparation, not an excuse for inaction. Furthermore, geographic proximity means these outcomes have a more immediate effect on core U.S. interests

Preparing the region for climate change and incentivizing sustainable development will help reduce a number of economic, environmental, humanitarian, and security risks. Economic growth will be served if regional agriculture is prepared for the projected impact of climate change, helping both large-scale agribusiness and small-hold farmers. Improving the resilience of small-holders and insulating rural society will, in turn, decrease the strain on overstressed cities—particularly important in the Andean highlands and the Pacific slope, where large urban

A man crosses a portion of a polluted river in Lima, Peru.

ASSOCIATED PRESS/ESTEBAN FELIX

centers face nearly intractable water shortages. Helping urban centers establish efficient, badly-needed water infrastructure will be important.

Adaptation can also help prepare communities for the loss of electricity due to diminished river flows, which are projected to affect hydropower generation in the coming decades. While this is a central economic interest, proactive preparation can also preempt potential regional flashpoints over hydro-generation and distribution as supply is constricted. Investment in other renewable sources of energy could diminish these impacts as well as reduce emissions.

Finally, climate change, particularly the melting of Andean glaciers, and the continuing expansion of extractive industry and agriculture into new parts of the Amazon and the Cerrado, are combining with economic interests to drive people into new areas, particularly the Amazon periphery. Many sustainable development projects, particularly adaptation efforts, can help accommodate new migrants, provide livelihoods, and expand and improve governance in marginal areas.

Governance and protecting basic livelihoods are increasingly urgent in the peripheral Amazon and Andean highlands, where illicit economies—particularly the international drug trade—are entrenching themselves. This decade is crucial in the development of the Peruvian and Brazilian Amazon, in particular, and investments made now to provide alternatives to illicit activities and protect vulnerable populations from exploitation will save security expenses down the road.

These illegal networks, particularly the cocaine trade, undermine governance and social cohesion in the peripheral regions that host them and in far-off urban centers, from São Paulo to Europe. Additionally, narcotraffickers have increasingly strong ties to wider criminal networks, including extremist groups active in Northwest Africa, through drug routes—passing along the waterways and rapidly growing cities of the Amazon—linking the cocaine-producing regions of South America with West Africa and Europe.

These policy objectives are not a Northern Hemisphere wish list, and should be embraced as serving the core interests of governments in the region. Improving governance and the provision of basic services and sustainable livelihoods to underserved populations will increase security and stability while contributing to economic growth. Brazil's troubled *favelas* cannot be improved, nor the rise of cocaine consumption arrested, without a serious reckoning with the wider narcotics trade. Building resiliency and providing responsible oversight of the region's natural wealth will create social and economic stability now and in the future.

The following are our recommendations for achieving these goals.

Collect better data

Better data is central to protecting the interests outlined above. Better monitoring and early warning systems for climate data are needed at the national and international levels, requiring equipment, financial aid, and human capital.

Brazil is largely self-sufficient in this area, while Peru's monitoring has made significant improvements in the past decade. Bolivia needs more assistance. National statistical agencies are of uneven quality, with Brazil far ahead of its neighbors in monitoring important agricultural, climatic, land-use and migratory trends. As such, Brazilian and American authorities should help bolster the data-gathering and analytic capacities of the other countries studied.

More detailed simulations and transparent models are needed to assess and predict the shocks from climate change to agriculture, hydropower generation, and other crucial sectors. Presently, only strategic level, long-term projections exist, and more granular data is needed to undertake detailed planning and preparation by sector and region. In addition, better understanding of the drivers of human migration, more detailed numbers for temporary or seasonal migration, information about who is migrating and an understanding of governments' ability to shape migration with information and subsidies, would help improve security and sustainable development.[259]

Find political willpower

Each of the countries studied faces its own obstacles in mustering the political will to grapple with the issues in this report. While this political process is not the focus of the study, it certainly deserves attention.

Brazil

Brazil's powerful agricultural and ranching interests are central to the country's economic boom and must be brought on board through this process, not fought. The need for secure land tenure cuts two ways; legal title must be secured to prevent violence and provide social and economic stability, but this must be done without creating incentives for deforestation and unsustainable practices through land-use provisions.[260]

Brazil has had some success in arranging incentives and controlling credit to prevent deforestation. For instance, researchers at the Climate Policy Initiative determined that policies making access to credit contingent upon satisfying environmental requirements helped contribute to a significant reduction in deforestation.[261]

Responses to climate change could be aided by strengthening the relevant Brazilian government institutions. For instance, the Department of Climate Change is understaffed[262] and should be expanded to oversee mitigation and adaptation efforts on a larger scale.

Brazil is currently focusing on renewable energy and on simple changes that can help reduce emissions, for example through changes in land use. While these steps are important, the country must decide how much of the Amazon will be opened for exploitation. Numerous economic incentives—such as the expiration of

protections for American corn-based ethanol[263]—will likely drive further development, but Brazil would be wise to take a long-term approach to the Amazon.

Such a reckoning will largely center on how the implementation and enforcement of the updated forestry code unfolds. Brazil's forestry code, first passed in 1965, had required farmers—particularly in the Amazon—to preserve a large percentage of rainforest to offset land cleared for agriculture. While enforcement was a serious challenge, the forestry code helped reduce Amazon deforestation in 2011 to the lowest level in several decades[264]—except for in fast-growing Rondonia and Matto Grosso along the Bolivian border.

But the new forestry law—approved by the Chamber of Deputies in April 2012—erodes many of the old restrictions, allowing the clearing of land on hilltops and closer to river banks, which was previously protected, and granting amnesty for land deforested prior to 2008.[265] These changes raise concerns that increasing demands for agricultural products will spark a renewed surge of deforestation.

Finally, environmental groups such as Greenpeace have pointed out that the mandatory mapping requirements for rural properties, the Rural Environmental Registration, will now be mapped using only one coordinate of geo-referencing rather than the boundaries of the property, making it more difficult to enforce. On top of that, control of the registry will be decentralized to the municipal level, raising more concerns around transparency and enforcement.[266]

Again, Brazil is trying to strike a delicate balance between economic growth, food security, and sustainability, but the new forestry code presents serious risks to the long-term health of the Amazon and the populations it sustains.

Bolivia

In Bolivia, a complex and ongoing process of decentralization will help defuse the latent socioeconomic tensions causing unrest and instability. Fortunately, this process—due to massive nationalization of energy and natural resources—allows the central government to continue to pursue progressive environmental standards. Bolivia's long-term development would be well served through renewed partnership with the United States and vigorous centralized oversight of water and forestry resources.

Bolivia faces similar challenges to Brazil in controlling deforestation and land degradation. Bolivia's 2007 Adaptation Mechanism and Mitigation Strategy focused

on managing the country's forestry resources and developing hydroelectricity, but these efforts have been hampered by a lack of resources; the National Climate Change Programme, responsible for overseeing these adaptation and mitigation efforts, has only 20–25 staff.[267] With this paucity of technical and manpower resources, the country's forestry law is ineffective and unenforced.

But it is far from a simple calculus in Bolivia, where the Agrarian Reform Law, passed by President Morales, dictates the use of state forests and land concessions. The pressure on Morales to distribute productive land to landless and indigenous populations is tremendous. With the progress made over the last decade in allaying some of the social tensions rooted in the unequal distribution of land, Bolivia would do well now to prioritize its long-term environmental sustainability by strengthening enforcement of the forestry law and preserving public lands from development.

Bolivia would benefit from greater cooperation at the regional level and technical assistance from outside sources, but a problematic—though improving—relationship with the United States has squeezed one source of such aid. The Andean Community of Nations—Bolivia, Colombia, Ecuador, and Peru— is working on an Andean Strategy on Climate Change, which will set regional priorities and improve cooperation within the U.N. Framework Convention on Climate Change, or UNFCCC, and Kyoto Protocol frameworks.[268] But continuing the rapprochement with the United States would expand the technical and financial resources available to Bolivia to improve enforcement and monitoring.

Peru

In many ways, Peru is becoming a model for cooperation between USAID and host governments. The Country Development Cooperation Strategy for 2012–2016, developed by USAID in conjunction with President Humala's administration, is an excellent blueprint, outlining the priorities and plans for U.S.-Peruvian development efforts over the coming years. Peru's central political challenge will be to recognize and accept that it is heading for tremendous water problems in its urban centers, and to resolve social tensions centered on the division of natural resources and large infrastructure projects.

In the Amazonian regions of Peru, there is still tremendous work to be done. Peru should take lessons from Brazil's successes slowing deforestation through monitoring and controlling access to credit.

Improve processes

Governments and providers of assistance should remove or realign project evaluation standards that penalize sustainable options because of higher upfront costs. Parallel to this, focusing on smaller scale projects, in consultation with local communities, can be more effective than large-scale, centrally controlled infrastructure projects, which often provoke political controversy or local backlash.

Particularly in the peripheral areas in this report, relatively small investments in transportation and communications infrastructure can have transformative effects, drastically improving resiliency and security. On top of this, these areas often have very limited energy demands, allowing relatively small renewable projects to provide high relative emissions savings while limiting contamination—and associated economic and social damages—in the long term.[269]

Access to credit is essential for adaptive instruments, and for the sort of community-driven solutions needed to address the nexus of climate change, migration, and security. The international assistance community should continue to improve access to credit in peripheral areas and protect vulnerable populations from predatory lending rates. At the same time, lending must not be at rates so low it provokes loan deviation, as in the past.[270] Finally, as mentioned above, linking access to credit to requirements for sustainable practices can secure long-term prospects by reducing environmental degradation.

Similarly, updating the agricultural insurance network in Brazil—and implementing such schemes in Peru and Bolivia—should be supported. These insurance schemes, critical to protecting farmers from the effects of climate change, must reflect the most up-to-date scenarios for climate change. Presently, rates are based on past averages, but recent events such as the crippling drought in Brazil demonstrate that predictive models are necessary to accurately reflect risks in the decades to come.[271]

Of course, more robust climate modeling and early-warning systems must accompany such insurance schemes. The private sector, particularly companies such as Cargill, Coca Cola, and Mars, lead the way in such technologies and have considerable technical expertise. These companies should be enlisted and provided with incentives to help build technical capabilities in at-risk regions.

Despite these opportunities for private sector engagement, the urgent need for human resources and technical expertise to address these problems must ultimately be met by governments. In capacity building and training, the United States, Brazil, and the European Union can and should lead the way. And with the United States and Brazil seeking a new, equitable framework for bilateral relations, and Brazil seeking a more assertive international role, cooperation in addressing these regional challenges represents an obvious area for joint leadership.

One idea is a joint institute for sustainable development to bring together USAID project managers and Brazil's excellent forestry and agricultural officials. Such an institute could train practitioners from throughout the region and directly oversee projects. In the wake of the U.N. Climate Change Conference in Cancún in 2010, new organizations such as the International Renewable Energy Agency could do the capacity-building that work governments are unable or unwilling to do. The agility with which such nongovernmental organizations can operate—compared to the United Nations, World Bank, or national governments—means that they should operate at the cutting edge of sustainable development, trying new renewable energy projects in peripheral areas and conveying best practices to larger scale, more institutionalized bodies.

Likewise, state-to-state or province-to-province cooperation is increasing. The Chile-California "Partnership for the 21st Century" is one such program, designed to build technical expertise in agricultural technology and seed design, solar energy, environmental protection, and emergency management and disaster response.[272]

More such cooperative agreements at the subnational level will help address the gaps in human resources and technical expertise, while avoiding the many bureaucratic or political hurdles at the national and multilateral levels.

At the community level, regional leaders have increasingly demanded that polluters or developers cover the social and economic costs of environmental degradation linked to extractive industry or large infrastructure projects. Unfortunately, many of these social protests have turned or been driven to violence, either in the face of unresponsive state or business interests or because of poor leadership. These groups should be engaged and their protests channeled to peaceful recourses. Likewise, developers and state officials must recognize that these populations will bear the brunt of climate change and degradation, and they are well within their rights to demand safeguards and, when appropriate, compensation.

Aerial view shows a neighborhood destroyed by landslides in Nova Friburgo, Brazil in 2011. From Chile to Colombia to Mexico, Latin America has been battered recently by wildfires, floods and droughts. While leading climate scientists are unable to pin any single flood or heat wave solely on climate change, experts say the number of extreme weather events is increasing worldwide and the evidence suggests global warming is having an impact.

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Launch infrastructure projects and protect rural populations

Water projects are top priority for addressing the problems outlined in this paper. Such projects need not be large, and micro-watershed management to improve resiliency and decrease waste is a particularly promising area for investment. Building new reservoir capacity in the Andean highlands is of particular importance, given the water crisis already occurring in those areas. And dams to protect glacial lakes can help protect local populations from flooding while simultaneously providing dry season runoff for agriculture. Small dams and canals can also help provide small-hold farmers, who lack the resources to undertake irrigation projects, with water for their families and their crops.

Agricultural research can also help insulate the most vulnerable peripheral populations from climate change and environmental degradation. Preventive research to prepare crops for anticipated conditions, particularly drought, should receive serious government support. Improving market access for small farmers in

peripheral areas can also insulate them from localized environmental shocks and improve their basic livelihood stability. Helping farmers set up cooperatives to effectively transport and market goods can be very effective. Such cooperation and economies of scale can allow communities to become more efficient mobilizing the resources needed to build or improve roads, refrigeration, and organization, without the socially disruptive effects of large-scale agribusiness.[273] Such cooperatives are more economically viable, and only when there is the prospect of future income can terracing, irrigation, and other improvements be financed.

In concert with the establishment of such cooperatives, ongoing efforts to determine land tenure and provide secure, formal title to lands should continue to receive international support. Sustainable forest management, Reducing Emissions from Deforestation and Forest Degradation, or REDD, financing, and efficiency investments all depend upon securing reliable tenure.[274]

But despite all of these efforts, climate change and global economic trends will make it difficult or impossible to preserve cohesive rural societies in parts of the Andean highlands, the Amazon periphery, and the coastal plain. Given this reality, livelihood diversification and training in nonagricultural skills is important to supplement rural incomes and ease the transition away from agricultural production. Even if such training increases the odds that residents will migrate to urban areas or different peripheral areas, migration is a proactive adaptive strategy that should not necessarily be seen as a negative outcome. In addition to adding value and facilitating apprenticeships, efforts to provide job and skills training can also help monitor and protect against labor abuse and informal or exploitative labor arrangements.[275]

Boost climate funding and make it smarter

While climate finance is not a primary focus of this paper, effectively responding to the challenges outlined in this report will require large investments—funding that is simply not available today at the scale required. The Kyoto Protocol's Clean Development Mechanism, or CDM, is still a major source of funding for Latin American sustainable development and needs reform, renewal, expansion, and ratification by the United States.

But given the problems encountered in establishing the Clean Development Mechanism as an effective market-based solution, the Green Climate Fund con-

ceived at the 2010 U.N. Climate Change Conference in Cancún and set up at the 2011 Durban Conference must be expanded and fast-tracked. Indeed, the actual transfer of the $30 billion in fast-start funding promised by 2012, and the overall target of $100 billion by 2020, must be viewed as a crucial down payment on what will be a long process of adaptation and mitigation.[276] Parts of Latin America, particularly the Andean highlands and the coastal plain of Peru, are in imminent danger from climate change and water shortages and must be given large-scale assistance in the short term.

The incentives and penalties in current climate finance are biased toward mitigation, leaving considerable opportunities to focus more on adaptation, which is a more pressing need in the region. Considering the implications of water shortages in cities such as Lima, Cusco, La Paz, and El Alto, this balance should be reconsidered.

Finally, financial fragmentation is a major factor inhibiting progress on adaptation and mitigation in the region. More than 20 major funds for climate-related activities, mostly mitigation, are active in the region, each with its own set of rules. Overlapping or redundant efforts and competition for funds reduces the effectiveness of all efforts, and a concerted attempt to rationalize and prioritize these funds would vastly improve results.[277]

Get the United States involved

The United States' policy toward the region is currently uneven. Each of the countries studied has different resources and priorities, and U.S. policy is therefore calibrated to suit the early stages of a joint regional leadership arrangement with Brazil, an excellent cooperative relationship with Peru to tackle that country's domestic problems, and a problematic but improving relationship with Bolivia.

These relationships are appropriate. As argued repeatedly in this paper, both the United States and Brazil have much to gain by accelerating their cooperation and taking joint responsibility for addressing climate and security concerns in the region. Trilateral cooperation between the United States, Brazil, and other countries in the region is a central tenet of any effective response to the problems outlined in this paper. The United States' policy toward Peru—particularly USAID's Country Development Cooperation Strategy, or CDCS, for 2012–2016[278]—is an excellent example of consultative diplomacy and strategic development planning.

Children cover themselves from heavy rain in the outskirts of Trinidad, Bolivia in 2007. The U.S. delivered $1.1 million worth of medicine and supplies to Bolivia's flood-ravaged eastern lowlands.

ASSOCIATED PRESS/DADO GALDIERI

The Country Development Cooperation Strategy focuses USAID and the Peruvian government on the key challenges outlined in this paper: providing alternatives to illicit coca cultivation in targeted peripheral regions, improving the management and quality of public services in the Amazon basin areas undergoing rapid development, and sustainable managing of the natural resources of the Amazon and the Andean glacial highlands. Each of these directly contributes to the security and stability of the Peruvian state by combating illicit economies and allaying social tensions from the poor provision of services or unfair allocation of natural resources.

Simply put, the Country Development Cooperation Strategy for Peru is an excellent model for U.S. and international engagement in the region. The strategy could add water security in the Ica region, which hosts 60 percent of Peruvian agricultural production, Lima, and Cusco to its list of priorities.

Since this is such a crucial period in the development of Peru's Amazonian regions, USAID could also fast-track aid to combat deforestation and provide alternative livelihood training to migrants to the Amazon periphery.

Such preventive efforts could help establish positive feedback loops now, building a legal, sustainable economic foundation. But these are relatively minor points in what is an excellent approach devised by USAID in conjunction with President Humala's government. Both the content and the consultative process through which it was devised should inform similar strategies for Bolivia and the wider region.

In Bolivia, USAID focuses on helping the government provide secure land tenure.[279] These projects should continue because they help ease social conflict, slow rural-to-urban migration, and ease pressure on already-stressed cities. But Morales's efforts to promote land tenure should extend to cover rights to water, forests, and other natural resources.

Bolivia's political system may be uniquely suited to promoting a sustainable development model, but is hampered by a shortage of training and technical resources. The United States and Brazil could provide the expertise to improve oversight and protection of Bolivia's natural resources. In addition to promoting sustainable development, such efforts would strengthen the American and Brazilian hand when dealing with thorny political issues surrounding coca cultivation in Bolivia and its ties to the wider narcotics trade.

Bolivia's 2009 constitution decentralized much political power but left the management of land and other natural resources under central control. Currently, the conditions for land access or acquisition are that the land must be productive, fulfill a socioeconomic function—to counteract the accumulation of large plantations—and must not be exploited through debt bondage or slavery. Environmental stewardship and watershed care aren't required, but the central government is able to enact such reforms. The United States should support such an effort, alongside a continuation or expansion of land tenure registries, which are still tenuous and expensive in peripheral rural areas.

Such efforts, in conjunction with continuing projects to build water treatment and waste disposal plants, would aid Bolivia's sustainable development, allay future instability, and strengthen U.S. influence in a key region in the struggle against the international narcotics trade.

About the authors

Ana I. Grigera is a consultant in the international development field. She has worked in Latin America, Europe, and the United States with the Latin American and Caribbean region on issues pertaining to migration, public health, higher education, and women's issues. She received her undergraduate degree in anthropology and sociology from New York University and her master's degree in anthropology from Université Paris 1 Panthéon-Sorbonne, where her research focused on cultural mediation among immigrant populations.

Max Hoffman is a researcher on the National Security and International Policy team at the Center for American Progress. Max graduated with an M.A. in history from the University of Edinburgh in Scotland, winning the Compton Prize in American History for his dissertation on the U.S. role in the Cuban Revolution of 1933. A native of the Virgin Islands, Max has studied military history and Spanish in Oxford and Salamanca. Prior to joining CAP, Max interned on the Hill for the House Armed Services Committee, worked at the United Nations on disarmament and security issues and the effects of climate change on small island states, and worked in public affairs in Boston.

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