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CLIMATE BENEFITS, TENURE COSTS

The Economic Case For Securing Indigenous Land Rights in the Amazon

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REPORT SUMMARY

This report presents the findings of benefit-cost analysis for securing indigenous forestland tenure in the Amazon basin of Bolivia, Brazil, and Colombia. These countries were selected primarily because they include a significant portion of the Amazon basin forest and the governments have formally recognized many indigenous lands. The research builds on WRI's recently published working paper, *The Economic Costs and Benefits of Securing Community Forest Tenure: Evidence from Brazil and Guatemala*. It provides original matching analysis on deforestation rates, incorporates carbon sequestration and an array of other ecosystem services into the benefit-cost analysis, and provides a set of policy and program recommendations for finance and land use planning ministry officials and their partners.

The matching analysis shows that for the 12-year period between 2000 and 2012, the annual deforestation rates inside tenure-secure indigenous forestlands were significantly lower than those outside in Bolivia (2.8 times lower), Brazil (2.5 times lower), and Colombia (2 times lower). The benefit-cost analysis shows that securing indigenous forestland tenure is a low-cost, high-benefit investment. The estimated economic benefits for a 20-year period are: $54–119 billion for Bolivia; $523–1,165 billion for Brazil; and $123–277 billion for Colombia. Costs amount to at most 1 percent of the total benefits. From a financial perspective, investing in securing indigenous forestland tenure is also a relatively cost-effective measure for climate change mitigation when compared with other carbon capture and storage measures—the costs of securing tenure are 5 to 29 times lower than the estimated costs for coal-fired power plants and 7 to 42 times lower than for natural gas-fired power plants.

These findings make a strong economic case for governments, climate change funding agencies, and other partners to invest in securing indigenous forestland tenure in Latin America, and, more broadly, community land rights around the world. Recommendations include: establish land laws that protect community land rights; remove administrative and other hurdles that stifle the registration and formal recognition of community land; make tenure-secure community forestlands a central climate change mitigation strategy; and utilize international climate and development funds to help document and protect community land rights. Securing indigenous and community forestlands tenure is a low-cost solution that can help governments achieve the climate goals in their Nationally Determined Contributions (NDCs).

Introduction

Community lands, including indigenous lands, can generate significant social, economic, and environmental benefits for local populations and society. They are a primary source of livelihood, nutrition, income, and employment for Indigenous Peoples and other communities in Africa, Asia, Latin America, and elsewhere. Community lands can provide local socioeconomic benefits in the form of job creation, community reinvestment in health and education programs, and reduced conflict and avoided related costs to society. For many communities, they are historically, culturally, and spiritually significant, providing security, status, social identity, and a basis for political relations.

Community lands also provide environmental benefits. Indigenous and community forestlands provide a suite of ecosystem services, including carbon sequestration, hydrological services, nutrient retention, and pollination. For example, the forests to which communities have some legal rights—about one eighth of the world's total—contain approximately 37.7 billion tonnes of carbon, which is 29 times larger than the annual carbon footprint of all passenger vehicles in the world.

A large body of literature shows that tenure-secure community forestlands are often linked to low deforestation rates, significant forest cover, and the sustainable production of timber and other forest products. While titling or other measures to secure tenure do not alone guarantee low deforestation rates, tenure security is recognized as an important precursor to other factors that promote sustainable management of indigenous forestlands.

Much is known about the local and societal benefits of many community forestlands. Questions remain, however, about the economics of securing community forestland tenure. This research report seeks to address this issue by asking: What are the costs compared to the benefits of securing and maintaining tenure for indigenous forestlands in the Amazon basin? It builds on WRI's recently published working paper, *The Economic Costs and Benefits of Securing Community Forest Tenure: Evidence from Brazil and Guatemala*. The report focuses on indigenous lands in the Amazon basin of Bolivia, Brazil, and Colombia (Figure 1), provides original matching analysis on deforestation rates, incorporates an array of ecosystem services into the benefit-cost analysis, and provides a set of policy and program recommendations.

This report aims to inform technical leads in the land, forest, and financial sectors of governments, as well as funding agencies, on the economic gains achievable from securing indigenous forestlands. Such information can encourage new investments in recognizing and protecting community land rights broadly. It may also help Indigenous Peoples, communities, and their partners to make economic arguments for securing their land rights.

Economic Benefits of Tenure-Secure Indigenous Forestlands

Three principal types of economic benefits are recognized.

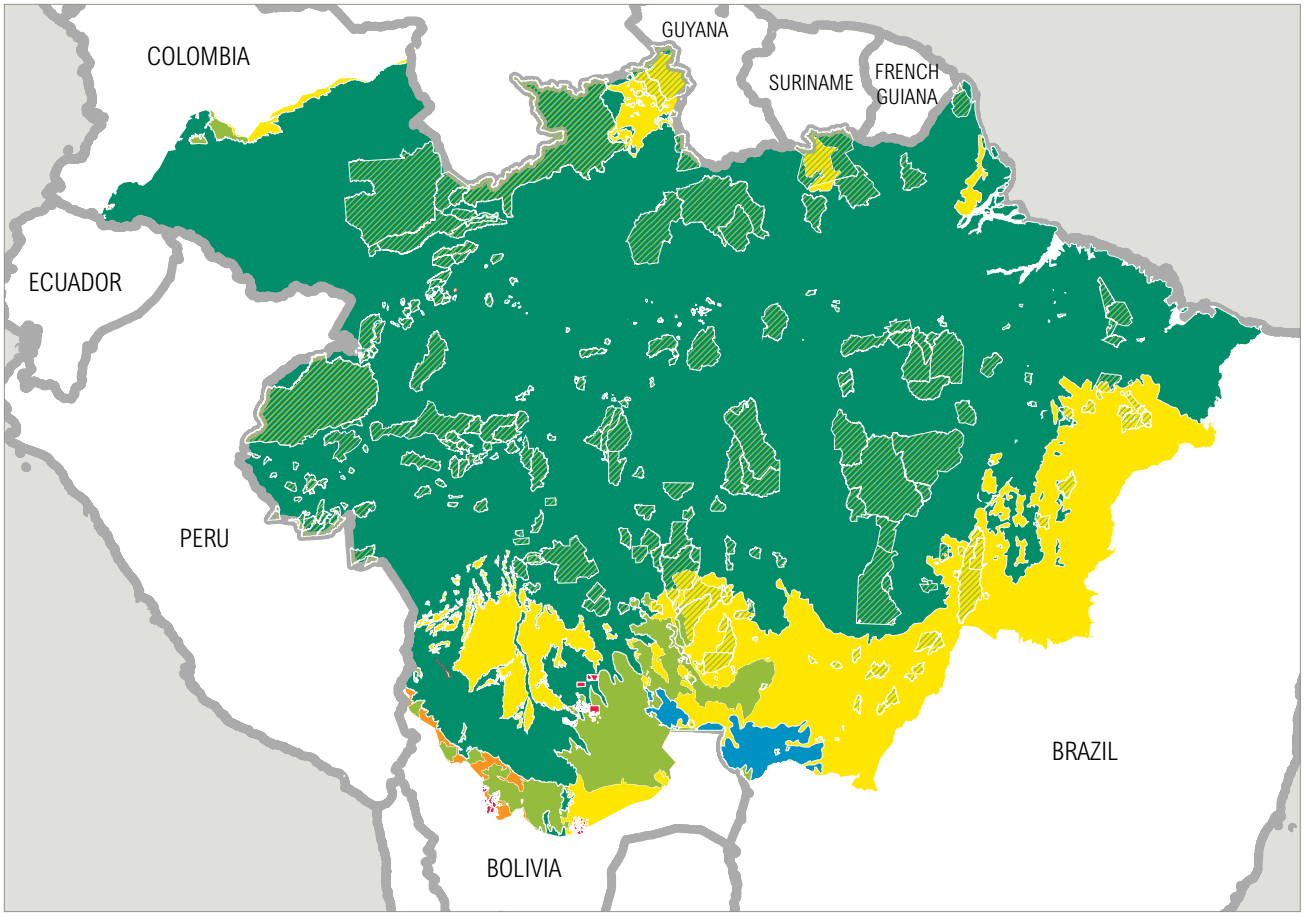
- **ECOSYSTEM-SERVICE BENEFITS.** Ecosystem services are the benefits people obtain from ecosystems. For example, forest-ecosystem services include provision of fuelwood, timber, plants and other forest products; the regulation of climate and water cycles; carbon sequestration; erosion control; pollination; and important species habitats.

- **COLLECTIVE-ACTION BENEFITS.** When Indigenous Peoples and other communities have secure land rights, they may be better able to work with each other and with external stakeholders. This can reduce both transaction costs and conflict costs.

- **OTHER SOCIAL BENEFITS.** Secure tenure can encourage job creation and actions that support Indigenous Peoples and communities. Local forestry enterprises often reinvest a portion of their profits from timber sales into education, health, or other social programs.

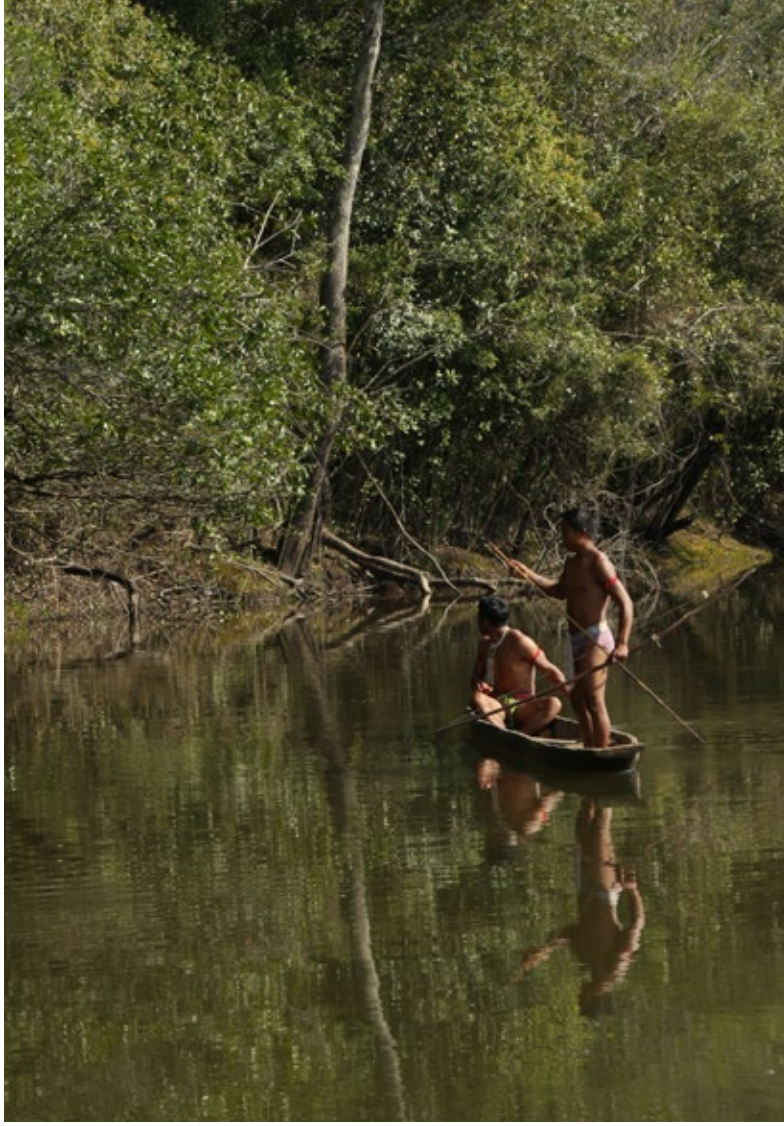
Due to data limitations, this research does not attempt to assess the total economic value of these three types of benefits. Rather, it quantifies selected ecosystem-service benefits resulting from reduced deforestation on forestlands where land rights are clearly recognized for Indigenous Peoples. The research focuses on seven critical ecosystem services that provide local, regional, and global benefits—carbon sequestration; hydrological services; nutrient retention; regulation of local climate dynamics and water cycling; pollination; existence value; and recreation and tourism.

Figure 1 | **Map of the Amazon Basin Showing the Indigenous Lands in Bolivia, Brazil, and Colombia**



The quantification and assessment of these ecosystem-service benefits consists of four steps. First, a matching analysis is conducted to estimate the total area of indigenous forestlands that is saved annually from deforestation due to the presence of tenure security. Second, the selected ecosystem services provided by the annually avoided deforestation area are quantified. Third, the unit values of the selected ecosystem services (measured in $/ha/yr) provided by indigenous forestlands are estimated based on the literature. Last, the unit value of the ecosystem services is multiplied by the quantity of these services to calculate the total economic benefits of tenure-secure indigenous forestlands.

Deforestation Rates. Matching analysis is a statistical impact-evaluation technique widely used in economic evaluations of policy impact. It pairs protected and unprotected locations that are similar in their landscape characteristics, in order to allow for the isolation of a specific policy-change impact—in this case, the establishment of tenure security. The effect of tenure security is measured by comparing the rate of deforestation inside tenure-secure indigenous forestlands with the rate on similar forestlands outside but without tenure security.

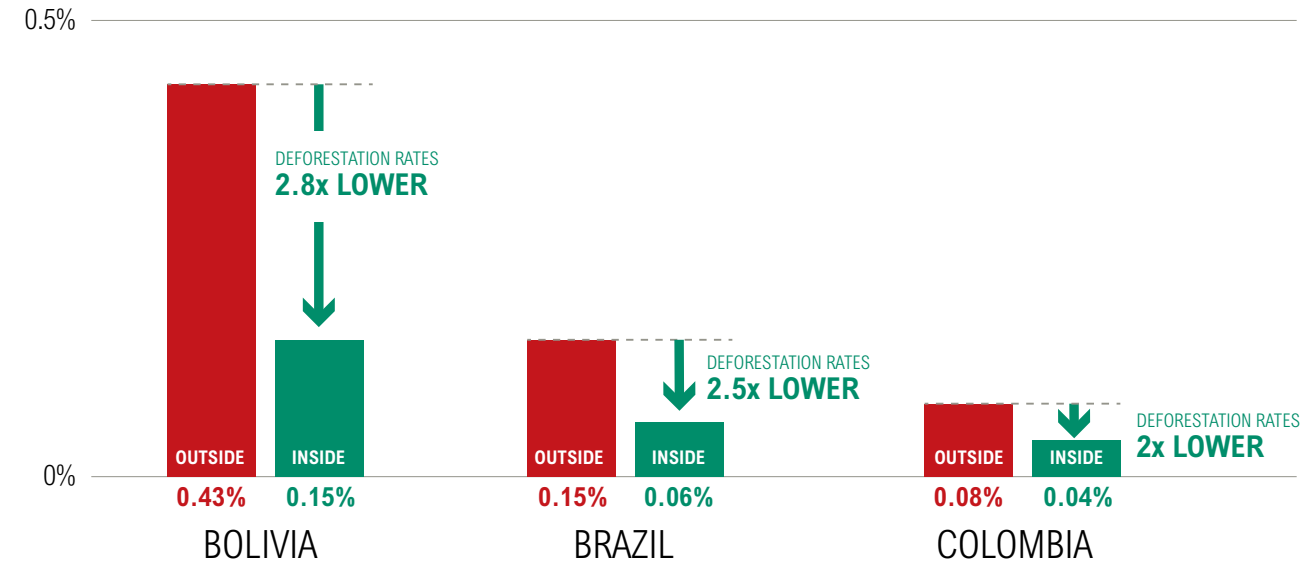


The matching analysis results are presented in Figure 2. The average annual deforestation rates are those estimated for the 12-year period between 2000 and 2012. Overall, the annual deforestation rates inside the tenure-secure indigenous forestlands are significantly lower than those outside in Bolivia, Brazil, and Colombia. This suggests that securing indigenous forestland tenure contributed to reducing deforestation in these areas between 2000 and 2012. All three countries have undertaken a regularization and titling process to recognize indigenous lands since the 1990s and, in particular, in the past decade. The effects on reducing deforestation in many areas are already observable, which suggests that deforestation rates have declined over time and that these effects will likely continue if the indigenous forestlands remain secure.

Ecosystem-Service Benefits. The estimated values of ecosystem-service benefits are presented as follows.

Carbon Sequestration. With the annual deforestation rates in tenure-secure indigenous forestlands in Bolivia, Brazil, and Colombia, the total avoided deforested areas is calculated to determine the total carbon stored in these forests. A common deforestation rate is assumed for all indigenous forestlands

Figure 2 | **Deforestation Rates Inside vs. Outside Tenure-Secure Indigenous Forestlands**



in each country, but the carbon density (i.e., total carbon stored per hectare of forestland) differs depending on the type of Amazon basin biome[1] and its current status (i.e., intact, partially deforested, or deforested). Along with the size of that biome held by Indigenous Peoples, these factors determine the total avoided carbon dioxide (CO_2) emissions that can be stored by each biome. The estimated avoided CO_2 emissions from different Amazon basin biomes are summed to calculate the total carbon sequestered by total avoided deforested forestlands that are held securely by Indigenous Peoples in Bolivia, Brazil, and Colombia.

To monetize these carbon-mitigation benefits—the avoided damages from the avoided deforestation in tenure-secure indigenous forestlands—various estimates of the social cost of carbon (SCC) are used. The SCC is an estimate of the economic damages associated with an incremental increase in CO_2 emissions in a given year. The U.S. Government's latest estimate of the global SCC of \$41/tCO_2 (estimated at a 3 percent discount rate and adjusted to 2015 US\$) is used for this research. Table 1 presents the estimated per hectare carbon storage benefits derived from every additional hectare of forest that is prevented from deforestation annually due to tenure security.

Table 1 | **Estimated Carbon Storage Benefits from Avoided Deforestation on Indigenous Forestlands (US$/ha/yr, 2015 USD, Estimated with SCC=$41/tCO$_2$)**

COUNTRIES	AVERAGE	LOWER BOUND	UPPER BOUND
Bolivia	40	32	48
Brazil	14	12	16
Colombia	6	5	7

Note:
Lower-bound estimates the carbon storage benefits obtained from protecting partially deforested area.
Upper-bound estimates the carbon storage benefits obtained from protecting completely deforested area

Other Ecosystem Services. For this research, valuation of the six other selected ecosystem-service benefits from tenure-secure indigenous forestlands relies mainly on the findings reported in various peer-reviewed and grey literature. Table 2 presents a summary of the value ranges of ecosystem-service benefits of Amazon basin forests. These values are presented in the form of per-hectare values covering the average, lower- and upper-bound estimates in the literature.

Economic Costs of Tenure-Secure Indigenous Forestlands

While processes for establishing and maintaining tenure vary within and across countries, four general categories of costs are identified:

- **TENURE-SECURITY ESTABLISHMENT COSTS:** Costs associated with establishing or changing the institutional and legislative framework to secure indigenous forestland tenure. Costs include investment and transaction costs associated with legislative or regulatory changes.

- **INDIGENOUS-FORESTLAND ESTABLISHMENT COSTS:** Upfront or initial investment and transaction costs for identifying and securing lands as indigenous forestlands, including identification, demarcation, registration, titling, and management-plan establishment costs.

Table 2 | **Value Ranges of Local Ecosystem-Service Benefits from the Amazon Basin Forests (US$/ha/yr, 2015 USD)**

ECOSYSTEM SERVICES	AVERAGE	LOWER BOUND	UPPER BOUND
Hydrological services	287	175	400
Nutrient retention	150	100	200
Regulation of local climate dynamics and water cycling	113	55	170
Pollination	45	40	50
Existence value	15	5	25
Recreation and tourism	5	3	7

Source: van Beukering (2015) Table 5.1, based on Verweij et al. (2009)

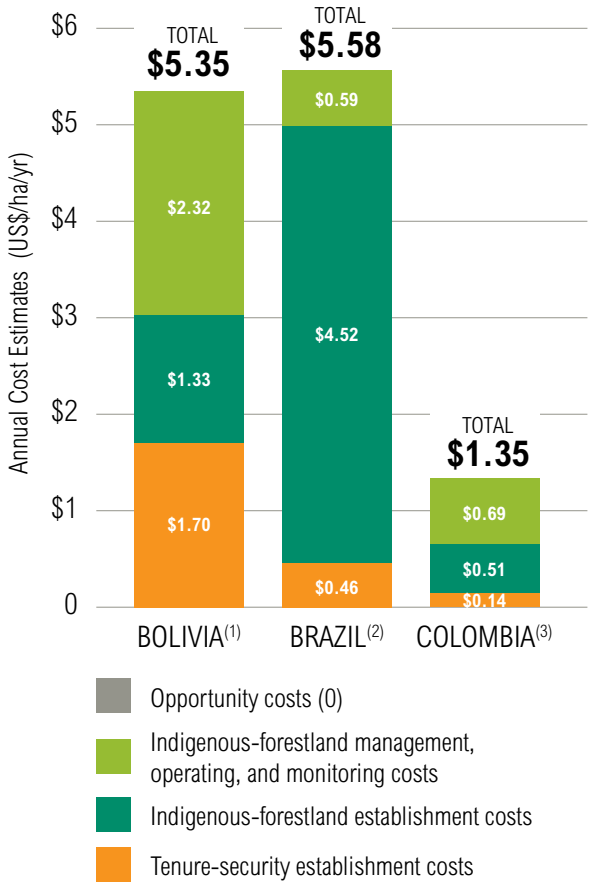
- **INDIGENOUS-FORESTLAND MANAGEMENT, OPERATING, AND MONITORING COSTS:** Annual or recurring costs associated with protecting indigenous forestland tenure; monitoring and enforcement activities on these lands to ensure that rights are protected; transaction costs associated with handling disputes over indigenous forestlands; and recurring investments in programs or activities to support and strengthen indigenous rights and livelihoods on these lands.

- **OPPORTUNITY COSTS:** Foregone income from alternative land use that Indigenous Peoples and other parties would have received if the indigenous forestlands had been converted to another highest-value alternative land use, such as agriculture or cattle pastures.

For this research, cost data were collected primarily from government and other stakeholder websites, publicly available data on land regulatory programs financed by international organizations, peer-reviewed and grey literature, and solicitation of data from relevant stakeholders and country experts.

Figure 3 provides the annual cost estimates of securing indigenous forestland tenure in the Amazon basin of Bolivia, Brazil, and Colombia. Opportunity costs are excluded from the benefit-cost analysis, principally because the laws in Bolivia, Brazil, and Colombia stipulate that while legally-recognized indigenous lands can be used for traditional or subsistence uses, they cannot be

Figure 3 | **Costs of Securing Indigenous Forestland Tenure in the Amazon Basin (2015 USD)**



Source: Authors' estimate based on (1) World Bank (2006); IDB (2003, 2012); USAID (2011); (2) CGU/Transparencia Pública (2015); FINBRA (2015); (3) INCODER (2015); World Bank (2001)

converted to another land use (e.g., logging or the commercial use of other forest products) without government approval which is rarely provided. As a consequence, if tenure laws are adhered to, the opportunity costs of conversion are equal to zero.

Comparing the Benefits and Costs of Tenure-Secure Indigenous Forestlands

In this report, benefit-cost analysis is used to assess whether the continuous effort of securing indigenous forestland tenure in the Amazon basin is worth pursuing from an economic perspective. It involves comparing the total expected costs of establishing and maintaining tenure security of indigenous forestlands against the total expected benefits, to determine whether the benefits outweigh the costs. Both benefits and costs are expressed in monetary terms, and are adjusted for the time value of money (2015 US$) so that all flows of benefits and costs over time are expressed on a common basis in terms of their "present value".

In this study, annual benefits and costs are calculated over a 20-year period and discounted to their present value in 2015 using a 6 percent real discount rate (6 percent is the average discount rate between 2 percent and 10 percent—the rates that are most commonly used in forestry studies). The discounted benefits and costs are then compared to calculate the net present value (NPV). NPV is a common metric for comparing benefits and costs because it converts benefits and costs into a single value by discounting so that they can be compared in present value terms. The results of the NPV can be used to assist policy decision-making; a positive NPV indicates a gain from investing in indigenous-forestland tenure security in the Amazon basin whereas a negative NPV indicates a loss. In this analysis, NPV results are presented at both per-hectare and aggregated-indigenous forestland scales.

Table 3 | **Benefit-Cost Analysis Results—The Net Present Value (Period = 20 years, Discount rate = 6%, 2015 USD)**

BENEFITS/COSTS/NPV	BOLIVIA	BRAZIL	COLOMBIA
Global Carbon-Mitigation Benefits		**US$/ha**	
Lower-bound estimate	373	144	57
Upper-bound estimate	555	196	87
Local and Regional Ecosystem-Service Benefits		**US$/ha**	
Lower-bound estimate		4,559	
Upper-bound estimate		10,274	
Total Benefits (= Global Carbon-Mitigation Benefits + Local and Regional Ecosystem-Service Benefits)		**US$/ha**	
Lower-bound estimate	4,933	4,704	4,616
Upper-bound estimate	10,829	10,470	10,360
Tenure-security Establishment and Maintenance Costs (US$/ha)	45	68	6
The Net Present Value (= Total Benefits – Tenure-security Establishment and Maintenance Costs)		**US$/ha**	
Lower-bound estimate	4,888	4,636	4,610
Upper-bound estimate	10,784	10,402	10,344

Note: Costs are likely underestimated due to data constraints regarding tenure-security establishment. Likewise, benefits are also likely underestimated due to data constraints.

The NPVs for Bolivia, Brazil, and Colombia are positive (Table 3), indicating that the economic benefits of the ecosystem services provided by tenure-secure indigenous forestlands significantly outweigh the annual per-hectare costs of securing indigenous forestland tenure. The analysis suggests that securing each hectare of indigenous forestland tenure can generate global carbon-mitigation benefits and local and regional ecosystem-service benefits that are higher than the costs of tenure-security establishment and maintenance costs. Comparing the total benefits (i.e., the local and global benefits combined) against the costs, securing indigenous forestland tenure can generate a net total benefit in Bolivia ranging between $4,888/ha and $10,784/ha, a net benefit in Brazil ranging between $4,636/ha and $10,402/ha, and a net benefit in Colombia ranging between $4,610/ha and $10,344/ha, respectively. This translates into estimated total economic benefits for a 20-year period of $54–119 billion for Bolivia, $523–1,165 billion for Brazil, and $123–277 billion for Colombia (Figure 4). These benefits largely outweigh the total costs of securing the community forest tenure for 20 years, which are estimated to be at most 1 percent of the total benefits derived.

Figure 4 | **Benefit-Cost Analysis Results–Net Present Values (2015 USD)**

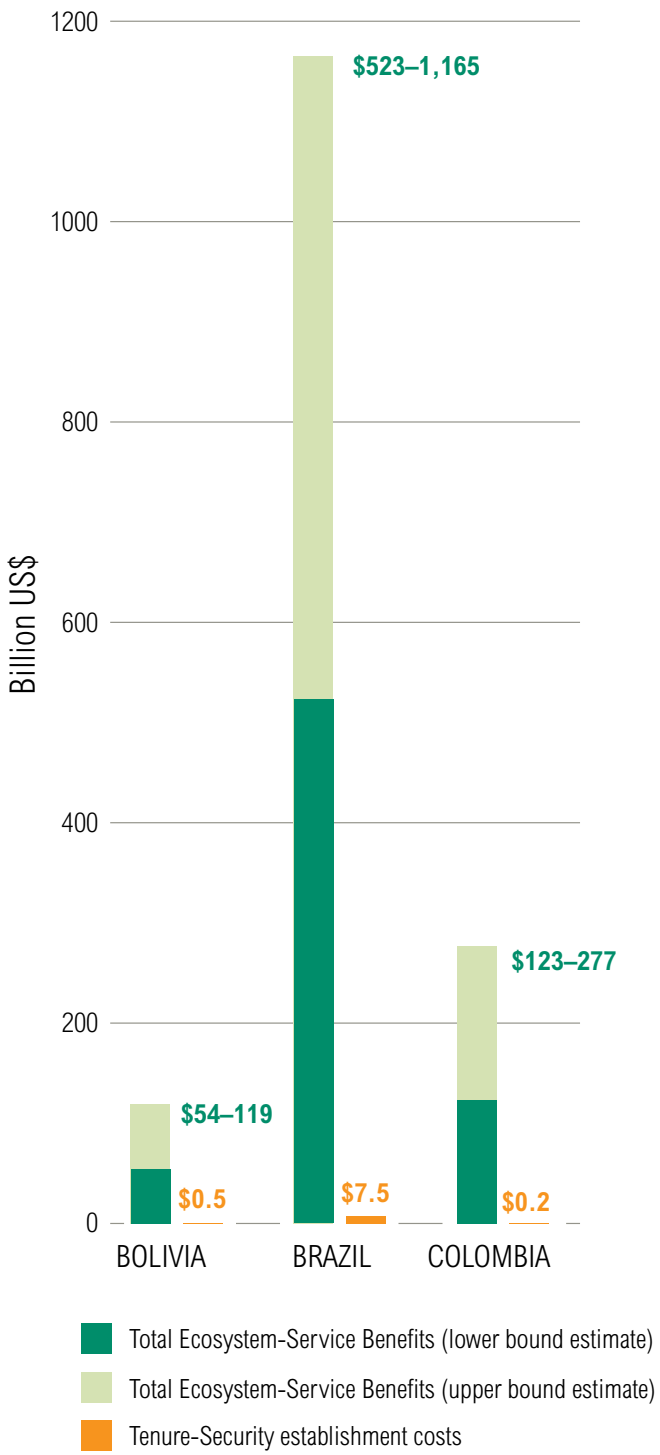
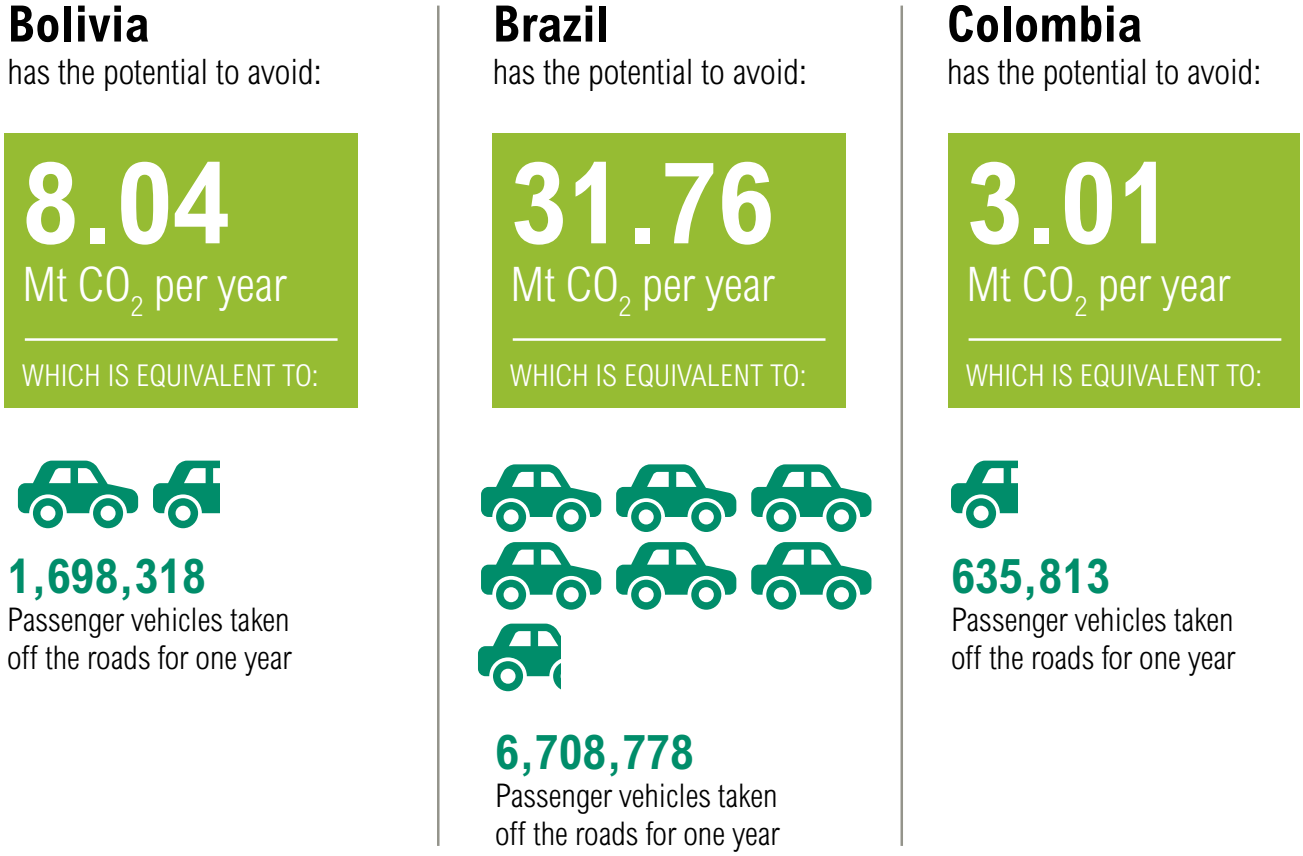


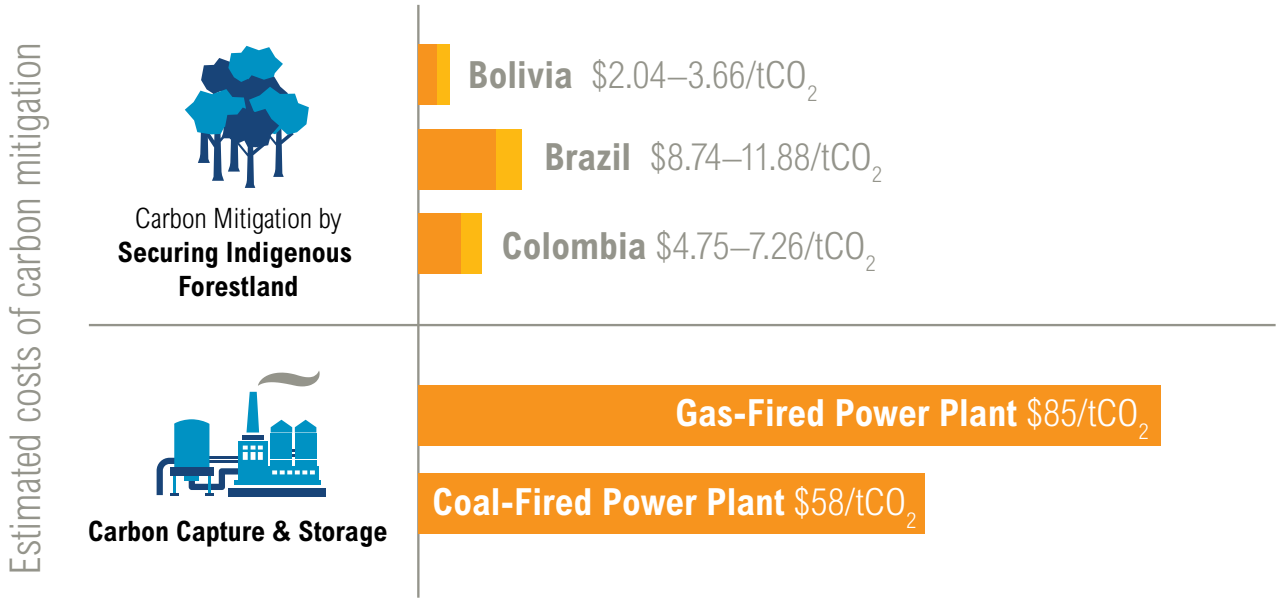
Figure 5 | **Annually Avoided CO_2 Emissions through Indigenous Forestland-tenure Security in Bolivia, Brazil and Colombia**



The benefit-cost analysis yields two principal findings:

1. **Securing indigenous forestland tenure is a low-cost, high-benefit investment.** Three aspects of this finding are noteworthy:
   - Tenure-secure indigenous forestlands provide significant global carbon-mitigation benefits in Bolivia, Brazil, and Colombia, amounting to a total of US$25–34 billion over the next 20 years in net present value through the avoided annual release of an estimated 42.8–59.7Mt CO_2 emissions. This is equivalent to taking between 9 and 12.6 million passenger vehicles off the roads for one year (Figure 5 presents the lower-bound estimates of the annually avoided CO_2 emissions).
   - Tenure-secure indigenous forestlands provide significant local and regional ecosystem-service benefits, including regulation of local climate dynamics and water cycling, hydrological services, pollination, nutrient retention, existence values, and recreation and tourism values. These benefits are estimated to range between $679 and 1,530 billion (or $4,559–10,274/ha) for the next 20 years, calculated in net present value resulting from indigenous forestland tenure-security investments.

Figure 6 | **Estimated Costs of Carbon Mitigation through Indigenous Forestland-tenure Security and Other Carbon Capture and Storage**



- Tenure-secure indigenous forestlands provide low-cost forest conservation investments for governments (and therefore the public). Investments in tenure security are estimated at $45/ha in Bolivia, $68/ha in Brazil, and $6/ha in Colombia—the calculated sum of discounted total costs for a 20-year period. This amounts to, at most, 1 percent of the total benefits derived from tenure-secure indigenous forestlands in the three countries. Comparing the total benefits with the costs, securing indigenous forestland tenure can generate a positive net per-hectare benefit for all three countries.

2. **Securing indigenous forestland tenure has significant potential for cost-effective carbon mitigation.** From a financial perspective, investing in securing indigenous forestland tenure is a relatively cost-effective measure for climate change mitigation when compared with other carbon capture and storage measures. The estimated costs of carbon mitigation through indigenous forestland tenure-security programs in Bolivia, Brazil, and Colombia range from $2.04–3.66/tCO$_2$, $8.74–11.88/tCO$_2$, and $4.75–7.26/tCO$_2$, respectively (Figure 6). These costs are significantly lower than the average costs of avoided CO$_2$ through fossil carbon capture and storage, which are estimated to be about $58/tCO$_2$ for coal-fired power plants (5 to 29 times more expensive than securing indigenous forestland tenure), and $85/tCO$_2$ for natural gas-fired power plants (7 to 42 times more expensive).

Policy Recommendations

These findings present a strong economic case for governments, climate change funding agencies, civil society organizations, and other parties to invest in securing indigenous forestlands in Latin America. While significant progress has been made in some Amazon basin countries over the last 10—30 years toward formally recognizing indigenous lands, more efforts are needed to secure the community lands that are not documented or protected by government. Given that many community lands around the world are not secured, these recommendations may also apply to other countries. These efforts include the need for the following:

1. **Establish tenure-secure community forestlands.** Governments and their partners should consider reforming their laws and taking other actions to strengthen community land rights. For instance, the laws in Bolivia, Brazil, and Colombia recognize indigenous land rights, but do not provide Indigenous Peoples with sufficient legal protections. Statutory laws that do not adequately protect community land rights should be reformed or replaced by new supportive legislation. For Indigenous Peoples and communities to realize their rights, laws that support their lands must also be implemented and enforced. Despite some progress in securing land rights in Bolivia, Brazil, and Colombia, considerable areas of indigenous lands are not mapped, demarcated, or formally registered. Governments should remove administrative hurdles and provide responsible agencies with the human and financial resources needed to document and protect all indigenous and community lands in their country.

2. **Make tenure-secure community forestlands a central climate change mitigation strategy.** The Nationally Determined Contributions (NDCs) of Bolivia, Brazil, and Colombia do not make any specific commitments to securing indigenous land rights, but the research findings show that indigenous lands have helped reduce deforestation rates. Had the Indigenous Peoples not had secure tenure over their forestlands, the CO_2 emissions of each country would have been higher—about 9 percent more per year in Bolivia, and 3 percent more per year in Brazil and Colombia. For Brazil, this emissions difference is equivalent to 25–35 percent of Belgium's total national CO_2e emissions in 2012. Given these climate benefits, investing in securing indigenous forestland tenure would be a relatively inexpensive action that governments could take to help meet the emissions reduction objectives put forward in their NDCs.

3. **Utilize international development funds to support securing community forestland tenure.** The research findings provide evidence that governments and their partners should increasingly direct their resources to securing indigenous and community forestlands. The funds could support government agencies to formally document community lands as well as the Indigenous Peoples and communities which invest in protecting their forests. In addition to traditional bilateral and multilateral support, governments should look to the global climate finance architecture, such as the Global Environment Facility, Green Climate Fund, and Africa Climate Change Fund. Some analysts have argued that progress in reducing deforestation through these and other climate funds has been limited. This research suggests that climate funds could in some cases meet their climate change and avoided deforestation objectives by supporting efforts to secure community forestlands.

Finally, further analysis is needed on the benefits and costs of securing indigenous and community forestlands. For example, additional research is critical to:

- *Address data constraints that limit more comprehensive analysis*. Improved methods for valuing ecosystem services and social benefits, coupled with disaggregated and transparent budgetary data, would help to fill some of the data gaps.

- *Conduct benefit-cost analysis of other community lands*. It is important to assess the economic benefits and costs for community lands in the research countries (e.g., *Quilimbola* communities in Brazil) as well as community forestlands in other parts of the world, especially Africa.

- *Conduct complementary economic analysis on tenure-secure community land*. The benefit-cost analysis in this report identified several questions that need further study. For example, additional research is needed on the opportunity costs of different uses of indigenous lands.

The recently launched Sustainable Development Goals (SDGs) and new Paris agreement to curb climate change present opportunities for the world to secure indigenous and other community lands and achieve positive development and environment outcomes.

ENDNOTE

1. Five Amazon basin biomes are recognized in this research: tropical and subtropical moist broadleaf forests; tropical and subtropical grasslands, savanna, and shrublands; tropical and subtropical dry broadleaf forests; montane grasslands and shrublands, and flooded grasslands and savannas.

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ABOUT WRI

World Resources Institute is a global research organization that turns big ideas into action at the nexus of environment, economic opportunity and human well-being.

Our Challenge

Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

Our Vision

We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

Our Approach

COUNT IT

We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

CHANGE IT

We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

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We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.

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