CONNECTING THE SPOTS

THE SOCIOECONOMIC IMPACT OF JAGUAR HABITATS IN LATIN AMERICA

WWF is an independent conservation organization, with more than 35 million followers and global network active through local leadership in over 100 countries. WWF's mission is to stop the degradation of the planet's natural environment and build a future in which humans live in harmony with nature by conserving the world's biological diversity, ensuring the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

The designation of geographical entities and the presentation of the following information do not imply the expression of any opinion whatsoever on the part of WWF concerning the legal status of any country, territory or area, its authorities, or the delimitation of frontiers or boundaries.

Report prepared by WWF-LAC.

November 2024.

Suggested citation
López, C., Castillo, L., Izquierdo, S. 2024.
Connecting the Spots: The socioeconomic impact of jaguar habitats in Latin America. México, WWF LAC.

Cover photo: © WWF-Sweden / Ola Jennersten

CREDITS

Authors:

Dr. Carlos Andrés López Morales
M. SC. Liliana Castillo Rivero
Dr. Santiago Izquierdo Tort

Editorial and analytic coordination:

Roberto Troya
Jorge Rickards
María José Villanueva
Jatziri Pérez
Sandra Petrone
Andrea Lara

We would like to thank those who collaborated in this study:

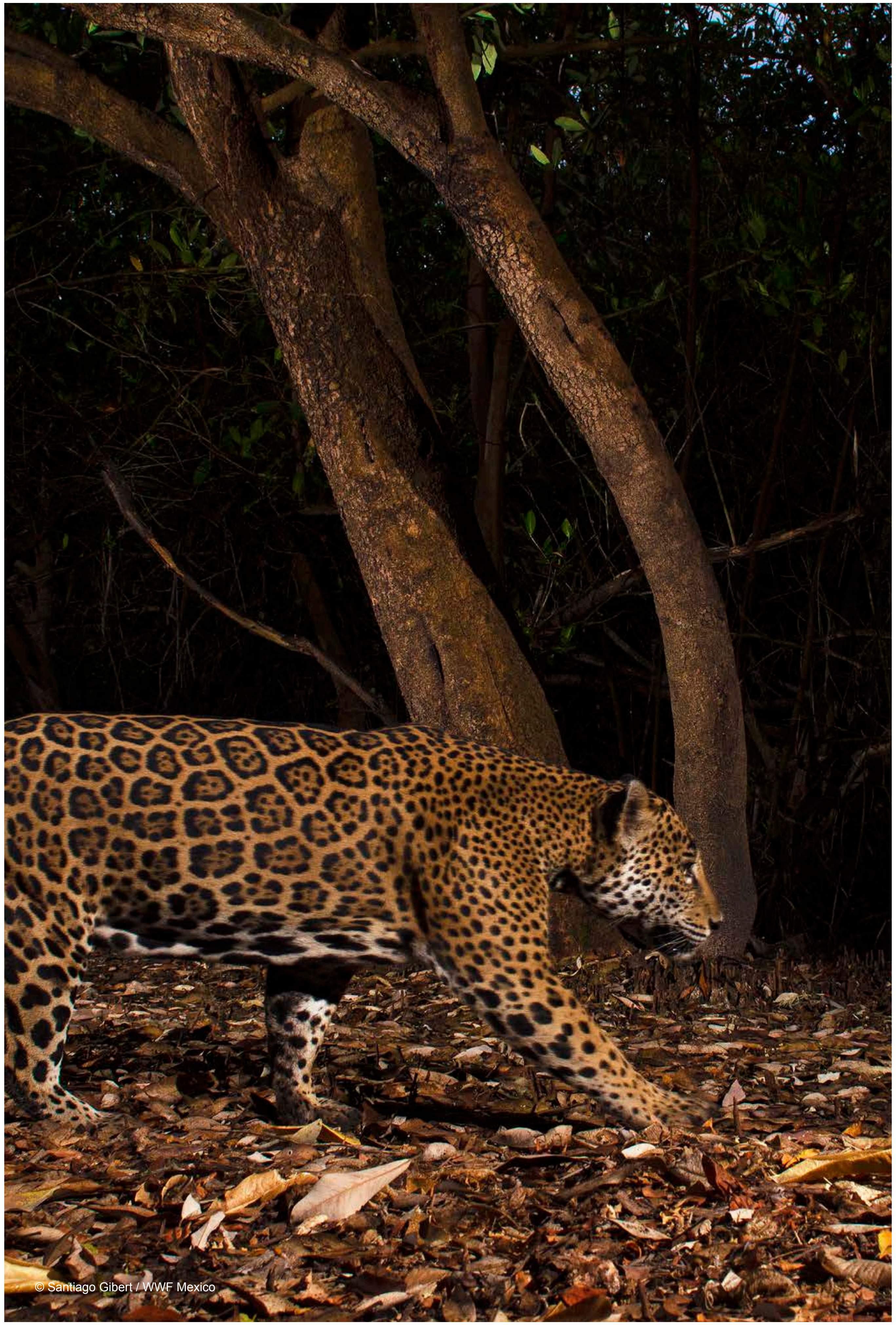
Adriana Rivera
Agustín Paviolo
Alonso Martínez
Andrea Cruz
Becky Chaplin-Kramer
Carlos Coutiño
Carlos Molinas
Carlos Orrego
Claire Blanchard
Damian Fleming
Daniela Rode
Elizabeth Aceituno
Esteban Falconi
Fernando Contreras
Francisco Robino
Gavin Edwards
Hermine Kleymann
Ignacio March
Jenny Roberts
Jessica Pacheco
Jordi Surkin
José Angel Koyok Kú
José Javier Gómez
Juan Pablo Sanabría
Julia Naime
Karen Wood
Katia Jaluff
Leigh Henry
Lila Sainz
Liliana Estrada
Lorena Zárate
Lucía Lazzari
Lucía Benavides
Lucía Ruiz
Luke Brander
Maggie Kinnaird
María Paz Dávila
Marina Ferreira
Marion Osieyo
Melissa Arias
Nabil Moura
Paul Aulestia
Robin Naidoo
Rodrigo León
Ronaldo Morato
Sebastien Proust
Valeria Boron
Valeria Toledo
Víctor García
Virginia Barreiro
Wendy Elliot
WWF jaguar range and supporting offices

Designed by:

Fibios Comunicación Ambiental

© Nick Gordon / naturepl.com / WWF

CONTENTS



© Santiago Gibert / WWF Mexico

FOREWORD

Roberto Troya

Senior Vice President & General Director for WWF-LAC

María José Villanueva

Jaguar Initiative Leader for WWF

The jaguar, an emblem of Latin America's rich natural heritage, stands at a crossroads, symbolizing both the beauty and the vulnerability of the continent's ecosystems. As an apex predator, the jaguar plays a pivotal role in maintaining ecological balance across vast and diverse habitats, yet it faces increasing threats from habitat loss, degradation, and human-jaguar conflict. Now is the time to act—to conserve not only the jaguar but also the invaluable ecosystems it inhabits, which support human wellbeing and drive economic resilience for millions across Latin America.

This report provides a comprehensive analysis of WWF's Jaguar Priority Landscapes, which span 244.3 million hectares across 14 countries in the region. The economic valuation of ecosystem services in these landscapes — including provisioning, regulating, and cultural services — ranges from USD $1.5 to $4 trillion annually. In this context, and by comparison, these landscapes are dynamic hubs of economic activity, generating USD $708.3 billion annually through service sectors such as commerce, transport, education, and finance, a figure that is significantly exceeded by the valuation of ecosystem services, by 2.1 to 6 times. The extraordinary economic value of ecosystem services highlights the importance of investing in their conservation. However, current public funding for the protection of these landscapes remains insufficient, underscoring the urgent need to increase commitment and investment to safeguard both these ecosystems and the essential services they provide.

Through an exploration of diverse stakeholders' perspectives across five of these landscapes, this report reveals a shared recognition of the critical role of natural ecosystems. Community leaders, agricultural producers, and other local stakeholders underscore the importance of ecosystem services such as water regulation, food provision, and climate control. However, they also highlight a pressing gap between the immediate economic activities that dominate these regions—such as monoculture and livestock grazing—and the sustainable, life-sustaining services that natural ecosystems provide.

WWF is implementing an ambitious strategy to ensure that jaguar populations, their habitats, and connectivity are stabilized or increasing across these priority landscapes. This effort involves a participatory, community-based approach that fosters sustainable economic activities aligned with jaguar conservation. WWF promotes a holistic coexistence model to mitigate human-jaguar conflict, and draws on its extensive experience in planning and managing large-scale protected areas, shaping markets, and influencing financial flows toward conservation-friendly development in sectors like infrastructure.

The findings in this report offer a powerful narrative: by safeguarding jaguar habitats, we are also investing in Latin America's ecological and economic resilience. This effort requires coordinated action among governments, civil society, the private sector, and local communities. As we look to the future, let this report serve as both a call to action and a roadmap for how we can collectively ensure that jaguars, their habitats, and all the vital services they provide endure for generations to come.

EXECUTIVE SUMMARY

The jaguar –the largest feline native to the Americas and an apex predator– plays a crucial role in maintaining healthy ecosystems. Revered across various cultures for their spiritual and symbolic value, these top predators contribute to the stability of ecosystem structures and help regulate the abundance of other species. Their widespread presence across multiple habitats in 18 Latin American countries helps sustain vast and diverse ecosystems.

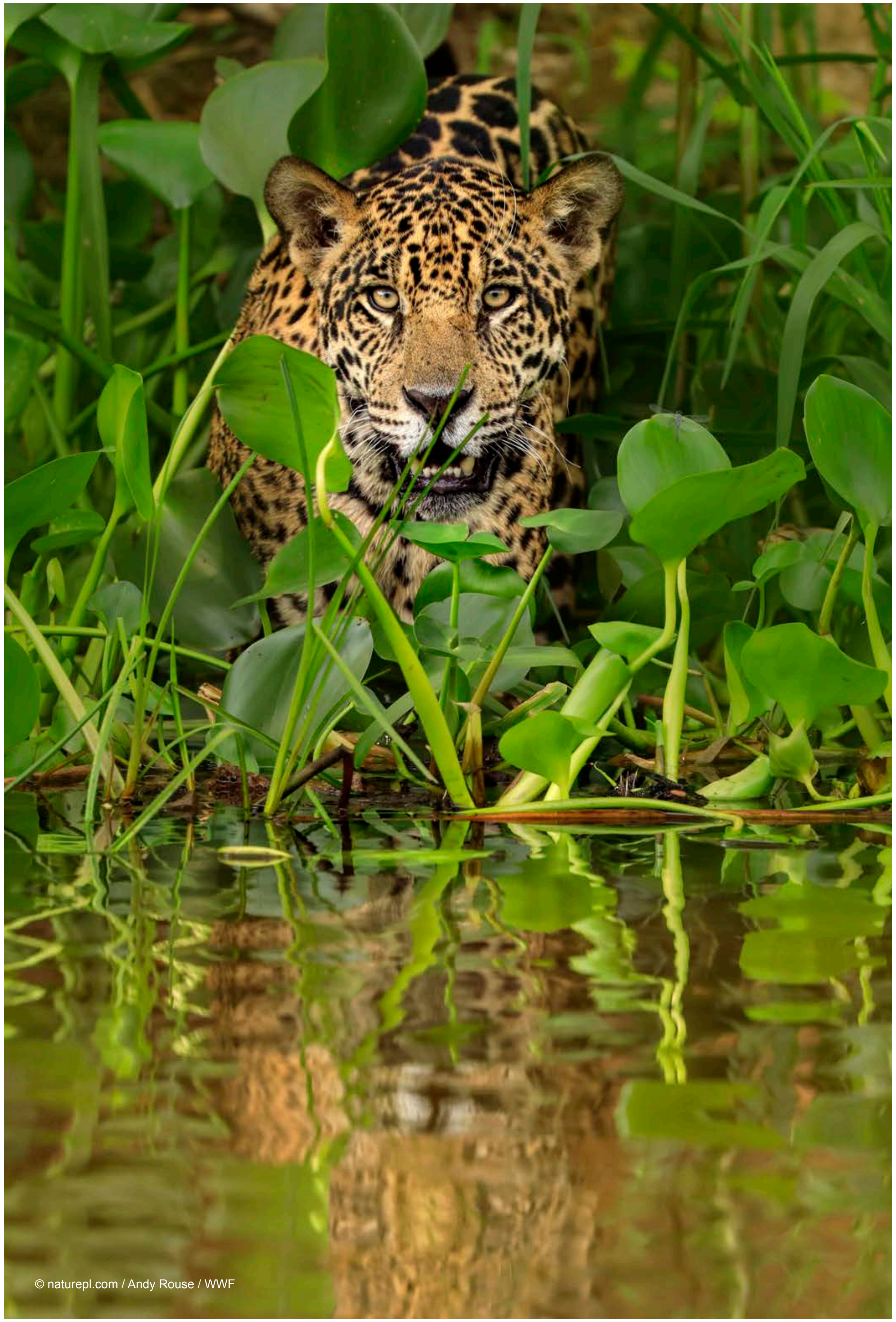
Despite their ecological and cultural importance, jaguars face significant challenges. Their current populations and long-term viability are threatened by habitat loss and fragmentation, driven by agricultural expansion, urban development, and infrastructure projects. Additional pressures on populations include direct killing out of fear or retaliation for livestock predation, wildlife trafficking, trophy hunting, and decline of their prey. Classified globally as Near Threatened on the International Union for Conservation of Nature's (IUCN) Red List, and as Vulnerable, Endangered or Critically Endangered on national listings, jaguars have lost half of their historic range, which points to an urgent need for conservation measures to mitigate these threats and preserve their habitats.

Because jaguars need large areas to survive, conserving them and their habitats holds significant potential for generating ecological and socioeconomic benefits. By conserving extensive biodiverse areas essential for ecosystem stability, protecting jaguars not only benefits numerous other species within these ecosystems but also bolsters key environmental initiatives like forest conservation and climate mitigation. Furthermore, jaguar conservation can protect and improve vital ecosystem services –such as water and erosion regulation, climate control, and food provision– benefiting the livelihoods of communities on local and global scales.

WWF's Jaguar Strategy has identified 15 priority landscapes for jaguar conservation (Figure 1). These "Jaguar Priority Landscapes" are crucial areas for jaguars across Latin America, as defined by jaguar scientists over the last 20 years, and offer promising opportunities to secure jaguar populations that are viable over the long term. WWF's Jaguar Strategy aims to protect key habitats that not only support jaguar populations, but also provide essential ecosystem services that benefit human societies. By focusing on these landscapes, jaguar conservation activities can promote broader sustainability goals within the region, while also benefiting human populations, thus helping to achieve global sustainability frameworks like the United Nations' Sustainable Development Goals (SDGs) and the targets of the Kunming-Montreal Global Biodiversity Framework (CBD, 2022).

Figure 1. WWF's 15 Jaguar Priority Landscapes.

Source: Own elaboration based on WWF (2020).



© naturepl.com / Andy Rouse / WWF

This report focuses on WWF's 15 Jaguar Priority Landscapes, providing an up-to-date assessment of key economic and environmental protection trends, an estimate of the economic value of ecosystem services, and insights from case studies conducted in five Jaguar Priority Landscapes, focused on local stakeholders' perceptions of ecosystem services.

Results

The Jaguar Priority Landscapes span 14 Latin American countries and contain roughly 10% of Latin America's human population (62 million people). Our results reveal an annual per hectare economic value of ecosystem services between USD $15,800 to $22,200 (international 2020 dollars[1]). Regulating services like erosion prevention and climate regulation generate the most value, followed by provisioning services like water, genetic resources, raw materials, and food.

Forest ecosystem services from Jaguar Priority Landscapes yield a staggering economic value of USD $1.5 to $4 trillion annually.

Applying these per-hectare valuations of forest ecosystem services to the total forest area in the landscapes yields a staggering economic value of USD $1.5 to $4 trillion annually, with regulating services contributing between USD $1.1 and $2.8 trillion, and provisioning and cultural services between USD $0.3 and $1.1 trillion. This monetary value is likely an underestimate of the full value of ecosystem services, due to the difficulty in translating many cultural values to monetary metrics.

1 International dollar is the currency used in the Ecosystem Service Valuation Database (ESVD), which we used to estimate the economic value of ecosystem services in the Jaguar Priority Landscapes. As noted by Brander et al. (2023: 10), "international dollar is a hypothetical currency that has the same purchasing power parity as the US dollar in the United States of America at a specified point in time. Conversion of other currencies to international dollars involves adjusting for differences in prices levels (purchasing power) across countries."

© Gianfranco Mancusi / WWF-Brazil

To put these values in context, the study also calculated the current economic output of human activities in these Jaguar Priority Landscapes to be USD $708.3 billion, mainly through the financial and other services sector, including commerce, transportation, education, and banking. The Brazilian Coastal Atlantic Forest landscape, which includes the cities of São Paulo and Rio de Janeiro, represents 54.4% of the total population and 66.1% of the total economic output in the Landscapes. Though the majority of the population across the Jaguar Priority Landscapes is urban, areas like the Southern Guianas remain predominantly rural, which reflects the diversity of the socio-economic characteristics observed.

Put together, the monetary value of all of the ecosystem services (i.e. provisioning, cultural, and regulating) exceeds the region's total economic output 2.1 to 6 times over. The value of regulating services alone ranges between 1.6 and 4 times that of the total economic output, while provisioning and cultural services represents between 0.5 to 1.6 times that value (Figure 2). The ecosystem services' immense relative economic value is especially notable in some landscapes, such as the Southern Guianas, where their value is more than a hundred times the total economic output in the area. Such findings highlight the critical importance of these natural assets and the need to prioritize their conservation.

The level of environmental protection varies widely across the countries containing Jaguar Priority Landscapes. In the case of Guyana, Suriname, and Paraguay, over 80% of the national protected area land coverage is located within the Jaguar Priority Landscapes; whereas this figure in Colombia, Belize, Bolivia, Peru, Guatemala, and French Guiana is mid-range, between 27% and 75%; and Argentina, Mexico, Honduras, and Brazil have the least amount of their protected areas within the Priority Landscapes, between 3 and 12.5%. Overall, less than half of the current Jaguar Priority Landscapes fall within current protected areas. Bolivia, Colombia, French Guiana, Brazil, Belize, and Guatemala all have more than 50% of their Jaguar Priority Landscapes protected, while Peru, Ecuador, Honduras, Paraguay, Suriname, and Mexico have between 26% and 47% of these landscapes protected, and Guyana and Argentina only have a small fraction protected (17% and 7.7%, respectively). This disparity indicates a need for targeted conservation efforts in jaguar habitats, particularly in sites with lower levels of protected and conserved areas. Public spending on the environment has remained stagnant since 2013 at about USD $9 billion (2020 prices) of annual investment by central governments, which further complicates these efforts, and highlights the necessity for increased financial commitment to safeguard these vital ecosystems.

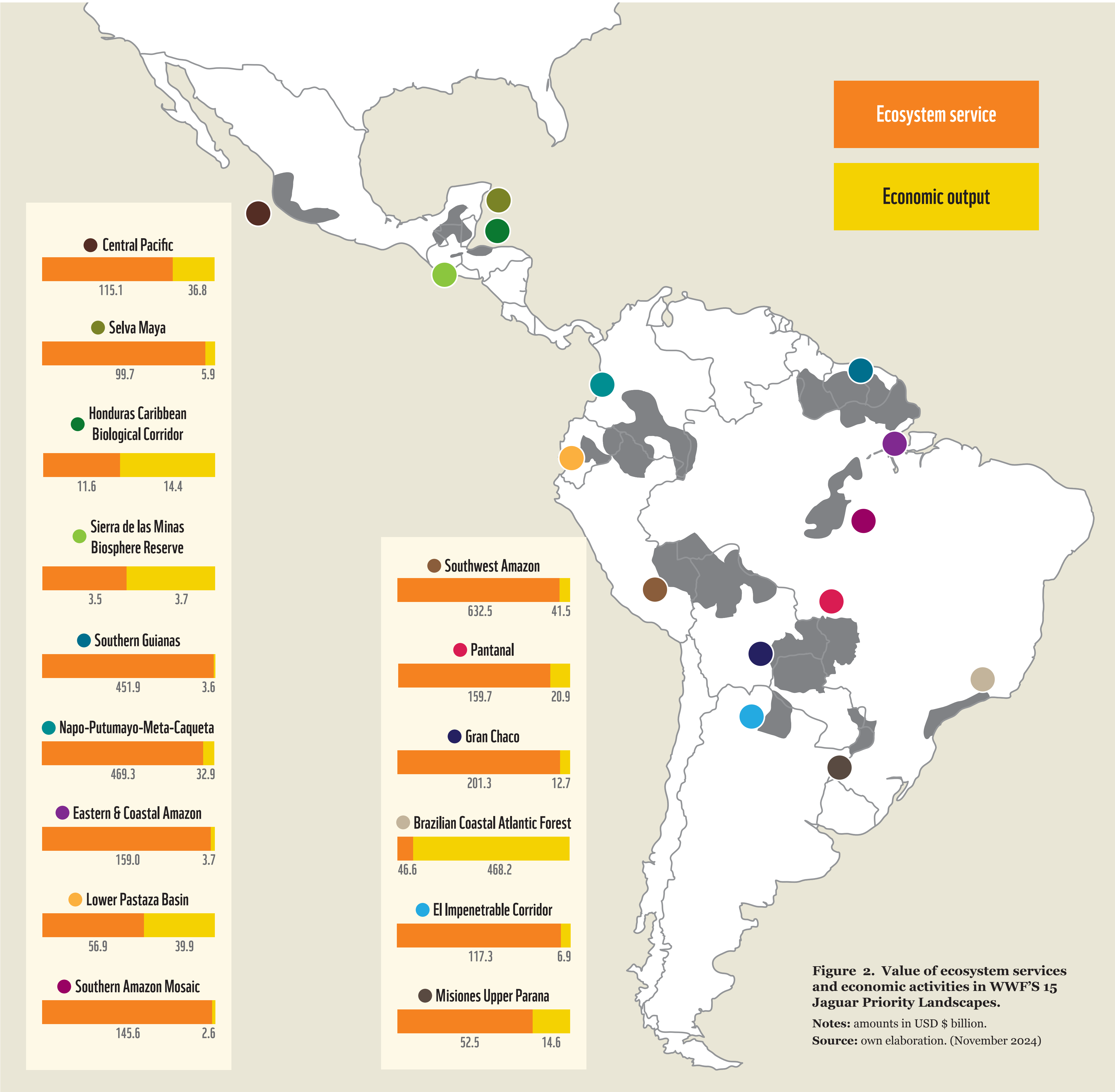


Figure 2. Value of ecosystem services and economic activities in WWF'S 15 Jaguar Priority Landscapes.

Notes: amounts in USD $ billion.

Source: own elaboration. (November 2024)

We conducted in-depth case studies in five specific Jaguar Priority Landscapes to complement the economic valuation and analysis of key trends across the region. The selected landscapes include Selva Maya (Mexico), Lower Pastaza Basin (Ecuador), Southwest Amazon (Bolivia), Pantanal (Paraguay), and Misiones Upper Parana (Argentina). In these case studies, we conducted 105 interviews with diverse local stakeholders to capture a wide range of perceptions regarding ecosystem services, including local authorities, community leaders, and agricultural producers. The objective of incorporating these case studies was to enrich our understanding and ensure that the analysis reflects the nuanced views and experiences of those directly interacting with the landscapes.

Surveys indicated that locally a high level of importance is attributed to various ecosystem services, though with notable differences in perceptions throughout the region. Regulation services generally scored high across landscapes, except in Mexico where disease regulation and waste treatment were viewed as less critical. Provisioning services like food and firewood were universally valued, though commercial uses of wild foods and timber varied by region.

Survey results also highlighted a preference for natural ecosystems over human-made landscapes, as these contribute directly to local wellbeing. There was a notable disconnect in some landscapes between the current land use, dominated by productive activities such as livestock pastures and monocultures, and the types of land use that local people perceived as providing the highest direct benefits, including natural ecosystems like native forests and water bodies. This mismatch suggests that prevalent economic activities may not always align with the perceived needs or benefits of local communities. We note that this result may have been influenced by the types of stakeholders involved in the interviews, which mostly included local authorities, community leaders, and agricultural producers.

Our results reveal an annual per hectare economic value of ecosystem services in the Jaguar Priority Landscapes between USD $15,800 to $22,200.


© Nay Jinknss / WWF-Brazil

Conserving jaguar habitats yields substantial economic benefits across the Jaguar Priority Landscapes.

Survey results also revealed a widespread concern about ecosystem degradation. Most participants noted a decline in ecosystem services due to deforestation, unsustainable agricultural practices, and rapid urbanization driven by demographic shifts and policies unsuited for local communities. Potential solutions identified by respondents include enhancing regulatory frameworks, promoting local, sustainable consumption, and implementing specific local environmental policies that support ecosystem conservation. These insights underscore the complex challenges and necessary actions for sustaining ecosystem services in these diverse landscapes.

Conclusions and next steps

Our findings confirm that conserving jaguar habitats yields substantial economic benefits across the Jaguar Priority Landscapes, primarily through provisioning and regulatory services. In fact, as we have shown, economic valuation of ecosystem services surpasses the current aggregate value of economic activities in the Landscapes. These findings provide evidence to support jaguar habitat conservation from an economic standpoint.

Yet, economic, demographic and environmental protection trends in the Jaguar Priority Landscapes suggest a series of emerging challenges. Rising urbanization, agricultural expansion and population growth pose additional pressure on Jaguar Priority Landscapes, risking further loss and fragmentation of jaguar habitat and human-jaguar conflicts. Also, stagnant public funding allocation limits government capacity to safeguard jaguar habitats. This situation raises the need for collaboration and innovation among governments and the private sectors and civil society, to achieve the conservation of jaguar habitats and ensure the enormous benefits they provide to people are maintained.

We provide specific recommendations for next steps in further analysis and decision-making among policymakers, civil society, the financial and private sectors, local communities, and academia.


@ Adriano Gambarini / WWF-Brazil

1. INTRODUCTION

© WWF-Sweden / Ola Jennersten

1.1. THE CASE FOR JAGUAR CONSERVATION

The jaguar *(Panthera onca)* is the largest felid species native to the Americas and an apex predator. The jaguar is the only living representative of the genus *Panthera* on the American continents. Weighing between 50 and 160 kilograms, the jaguar is the largest cat in the Neotropics and the third largest globally after the tiger (*Panthera tigris*) and lion (*Panthera leo*) (Seymour, 1989).

As top predators, jaguars play a crucial role in maintaining a healthy habitat structure and function. Through predation, jaguars contribute to maintaining a healthy balance in food chains with seed dispersers, folivores and mesopredators, which in turn has an effect on the recruitment of woody plants and the soil carbon/nitrogen ratio (Ripple et al., 2014; Terborgh, et al., 2001).

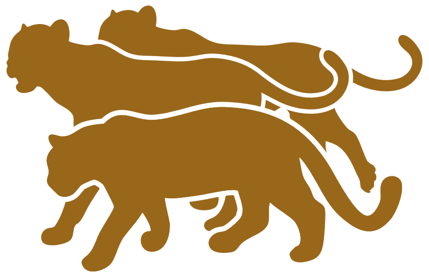
Additionally, jaguars are of vital cultural importance in both ancient and modern Latin American societies. Jaguars are revered in folklore and religious practices across indigenous communities, where they symbolize spiritual strength, power, beauty, and fertility (Figel et al., 2022). The jaguars is an icon that continues to influence modern cultural expressions, from art and literature to symbols of national identity and environmental protection policy (Saunders, 2013).

However, jaguar populations face severe and pressing challenges. Jaguar populations have already lost 50% of their historic range and continue to face significant pressure from habitat loss and fragmentation - driven by expanding agricultural and livestock frontiers, increased urbanization, and infrastructure projects - as well as direct killing out of fear, retaliation for livestock depredation, trafficking, and trophy hunting (Arias, 2021; Hoogesteijn and Hoogesteijn, 2005; Jędrzejewski et al., 2017; Knox et al., 2019;). As a result, jaguars are classified as 'Near Threatened' on the IUCN Red List of Threatened Species (Quigley et al., 2017). We note, however, that this global category does not reflect the reality of subpopulations which are nationally classified as Vulnerable, Endangered or Critically Endangered. Furthermore, with the exception of a large population that spans the Amazon, Pantanal and south to the Yungas, all other jaguar subpopulations are threatened because of their small size, isolation, insufficient protection and high human population density (de la Torre et al., 2018)

Jaguar range spans from the southern United States (Arizona and New Mexico), through Mexico, Central America, and South America to southern Argentina (Río Negro) (de la Torre et al., 2018; Jędrzejewski et al., 2018; Quigley et al., 2017). As jaguar habitats shrink, their movements to satisfy their basic metabolic and reproductive needs further expose jaguars to human threats (de la Torre et al., 2018; Jędrzejewski et al., 2018; Thompson et al., 2021). The total jaguar population has been estimated at 173,000 individuals (95% confidence interval: 138,148-208,137) (Jędrzejewski et al., 2018), of which, around 75% are found in the Amazon biome (derived from Jędrzejewski et al., 2018). Currently, less than 50% of the jaguar range is located within Protected Areas (Jędrzejewski et al., 2018).

Promoting a jaguar-focused conservation strategy can yield significant ecological and socioeconomic benefits. As previously outlined, jaguars are a keystone species essential for maintaining ecosystem health and balance (Ripple et al., 2014; Terborgh et al., 2001). Jaguars are also an effective umbrella species for protecting vast areas of biodiverse

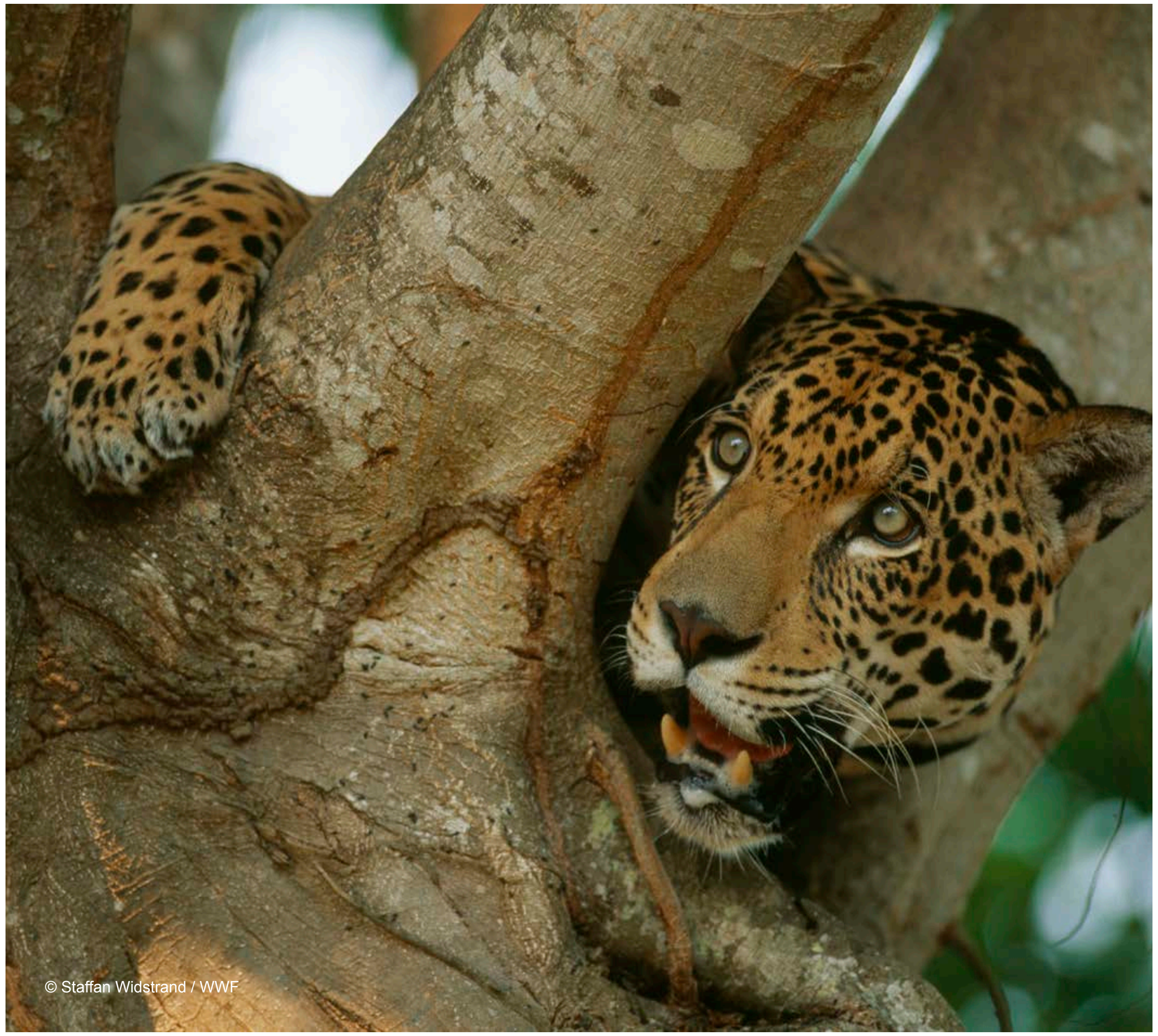
Jaguar populations already lost 50% of their historic range.



The total jaguar population has been estimated at 173,000 individuals, of which around 75% are found in the Amazon.

habitats, crucial for maintaining ecosystem function. By concentrating on protecting jaguar habitats, conservation efforts safeguard numerous additional species that share the same ecosystems, while also contributing to conserving valuable habitats for forest integrity, climate mitigation, and biodiversity conservation initiatives (Figel et al., 2019; Thornton et al., 2016; WWF et al., 2020). Additionally, jaguar conservation efforts geared towards ecosystem protection provide substantial benefits to human societies by securing or enhancing vital ecosystem services, including provisioning services (e.g. food, timber, and firewood), regulating services (e.g. air quality regulation, climate regulation, erosion prevention, and pollination), and cultural services (e.g. cultural heritage sites, recreation, ecotourism, and spiritual and religious values) (MA, 2005). These ecosystem services are crucial to environmental sustainability and human wellbeing, benefiting not only local communities but also humanity as a whole, for example, through the planetary climate regulation services the Amazon provides.

Therefore, promoting jaguar conservation can help deliver not only on wildlife conservation, but also on human wellbeing goals within international sustainability frameworks, such as the United Nations' Sustainable Development Goals (SDGs) and the Kunming-Montreal Global Biodiversity Framework (CBD, 2022; Roberge and Angelstam, 2004; Thornton et al., 2016; UN, 2018).



1.2. WWF'S 15 JAGUAR PRIORITY LANDSCAPES

The WWF Jaguar Strategy highlights 15 critical areas for jaguar conservation (Figure 1). These Jaguar Priority Landscapes span an extensive territory of 244.3 million hectares across 14 Latin American countries —Mexico, Guatemala, Belize, Honduras, Colombia, French Guiana, Suriname, Guyana, Peru, Ecuador, Bolivia, Brazil, Paraguay, and Argentina— to promote ecosystem connectivity across the jaguar's distribution.

This WWF initiative focuses on safeguarding vital habitats that support jaguar populations and offer crucial ecosystem services beneficial to communities. By prioritizing these landscapes, where WWF collaborates with a wide range of stakeholders, the efforts aim to support on-the-ground implementation of overarching environmental sustainability objectives in the region, contributing to human wellbeing and helping to deliver on international frameworks such as the UN Sustainable Development Goals and the Kunming-Montreal Global Biodiversity Framework.

WWF's initiative focuses on safeguarding vital habitats that support jaguar populations and provide essential ecosystem services.

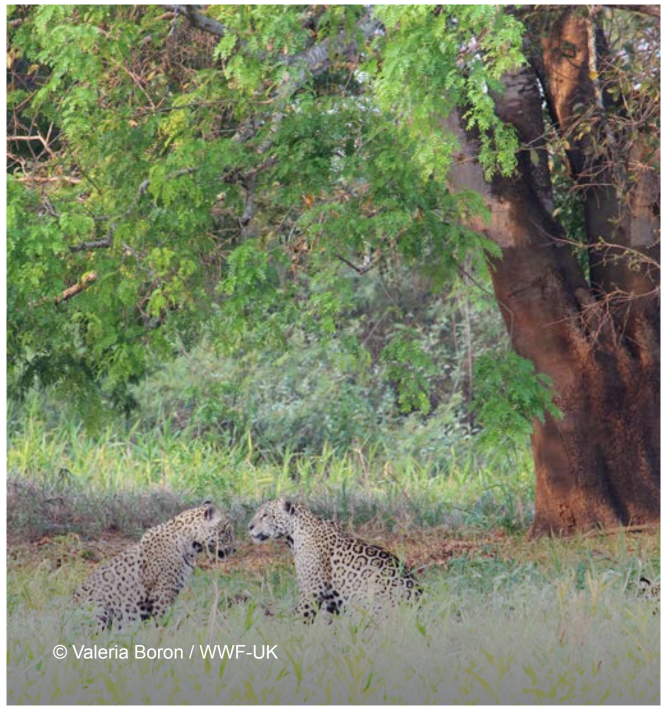
© Santiago Gibert / WWF / México

© Valeria Boron / WWF-UK

1.3. ABOUT THIS REPORT

This report focuses on WWF's 15 Jaguar Priority Landscapes. The following section presents an up-to-date assessment of key economic and environmental protection trends in the Jaguar Priority Landscapes, as well as estimates of the economic value of ecosystem services in the region. The report also presents results of case study analysis conducted in five landscapes, focused on local stakeholders' perceptions of ecosystem services, which include: Selva Maya (Mexico), Lower Pastaza Basin (Ecuador), Southwest Amazon (Bolivia), Pantanal (Paraguay), and Misiones Upper Parana (Argentina). The report then concludes by summarizing the main findings and highlighting potential next steps for key stakeholders: policymakers, civil society, the financial and private sector, local communities, and academia.

© Luis Barreto / WWF-UK



© Valeria Boron / WWF-UK

© Envato Elements

© Santiago Gibert / WWF México

2. KEY TRENDS AND SOCIOECONOMIC VALUES IN THE JAGUAR PRIORITY LANDSCAPES

2.1. DEMOGRAPHIC CONDITIONS, ECONOMIC ACTIVITIES AND ENVIRONMENTAL PROTECTION TRENDS

The Jaguar Priority Landscapes are distributed in 14 Latin American countries and include 800 municipalities, which are home to about 62 million people (around 10% of Latin America's population) (Table 1). Over half of the population in this region (54.4%) is located in the Brazilian Coastal Atlantic Forest, which contains the metropolitan areas of São Paulo and Rio de Janeiro. Over 85% of the region's population is classified as urban –consistent with a broader pattern across Latin America–, though rural populations are larger in some individual Landscapes with smaller overall populations (Southern Guianas, Sierra de las Minas Biosphere Reserve or Gran Chaco). Our analysis shows that most municipalities in the region are transitioning towards urbanization, though these transitioning municipalities are smaller than those that are already urbanized (See Appendix A).

The Jaguar Priority Landscapes are distributed in 14 Latin American countries and include 800 municipalities, which are home to about 62 million people (around 10% of Latin America's population).

© Jacqueline Lisboa / WWF-Brazil

Table 1. Population and municipalities in the Jaguar Priority Landscapes

	Landscape	Total population	Rural population	Urban population	Total municipalities	Mainly rural municipalities
1	Selva Maya	2,485,096	1,237,989	1,247,107	35	22
2	Central Pacific	4,901,098	1,550,543	3,350,555	144	69
3	Sierra de las Minas Biosphere Reserve	609,489	400,589	208,900	16	13
4	Honduras Caribbean Biological Corridor	2,484,490	629,726	1,854,764	27	10
5	Southern Guianas	326,323	210,059	116,264	24	21
6	Southwest Amazon	2,477,636	1,050,110	1,427,526	85	53
7	Eastern and Coastal Amazon	851,200	148,920	702,280	18	2
8	Southern Amazon Mosaic	743,520	295,518	448,002	16	9
9	Napo Putumayo Meta Caqueta	2,000,792	596,484	1,404,308	63	31
10	Lower Pastaza Basin**	4,305,552	1,930,715	2,374,837	51	45
11	Gran Chaco	172,550	106,898	65,652	9	6
12	Impenetrable Corridor	865,006	114,471	620,535	10	1
13	Pantanal	2,487,842	333,855	2,153,988	48	21
14	Misiones Upper Parana	3,353,462	1,018,186	2,335,276	108	46
15	Coastal Atlantic Forest*	33,491,035	823,451	32,667,584	138	19
	Total	**61,555,091**	**10,447,513**	**51,107,578**	**796**	**368**

Note: *Mainly rural* counts municipalities for which the rural population is at least 50% of the total. *Includes data for São Paulo and Rio de Janeiro; population figures for years between 2015 and 2020 depending on national statistics; ** Includes data for Quito.

Source: own elaboration with data from ECLAC (2022).

Overall economic activities in the Jaguar Priority Landscapes produce an annual output of USD $708.3 billion (2017 prices), though the economic contribution varies significantly between landscapes (Table 2). The financial and other services sector –including commerce, transport, education, banking, and other financial activities– are by far the most important economic sector (71.4%), followed by industry (19.1%). The Brazilian Coastal Atlantic Forest generates USD $470 billion of economic output, which represents 66.1% of the total economic output in the Jaguar Priority Landscapes. Four landscapes (i.e. Southwest Amazon, Lower Pastaza Basin, Central Pacific, and Napo Putumayo Meta Caqueta) contribute about 5% each, whilst the remaining 10 contribute with less than 3.0% each. Importantly, these figures do not account for the role of ecosystem services in producing or maintaining these outputs.

Overall economic activities in the Jaguar Priority Landscapes produce an annual output of USD $708.3 billion.


© Nay Jinknss / WWF-Brazil

Table 2. Economic output in the 15 Jaguar Priority Landscapes. Figures in 2017 USD billion

Jaguar Priority Landscape	Sector					Total per landscape (% of total for all landscapes)
	Agriculture	Mining	Industry	Construction, Energy, Urban water	Financial and Other Services	
Brazilian Coastal Atlantic Forest	2.1		90.7		375.4	468.2 (66.1%)
Southwest Amazon	5.7	4.5	4.8	4	22.6	41.5 (5.9%)
Lower Pastaza Basin	2.5	0.5	5.7	5.4	25.8	39.9 (5.6%)
Central Pacific	5.7	1	10.2		20	36.8 (5.2%)
Napo Putumayo Meta Caqueta	4.1	10.2	1.6	3	14.1	32.9 (4.6%)
Pantanal	2.8		5.1		12.9	20.9 (3.0%)
Misiones Upper Parana	1.7		5.3		7.6	14.6 (2.1%)
Honduras Caribbean Biological Corridor	2.9	0	2.8		8.7	14.4 (2.0%)
Gran Chaco	3.5		2.7		6.5	12.7 (1.8%)
Impenetrable Corridor	1.3	0.4	0.9	0	4.3	6.9 (1.0%)
Selva Maya	1.7	0.2	1		3	5.9 (0.8%)
Sierra de las minas Biosphere Reserve	2.3	0	0.4		1	3.7 (0.5%)
Eastern & Coastal Amazon	0.4		2.4		0.9	3.7 (0.5%)
Southern Guianas	1.1		1		1.5	3.6 (0.5%)
Southern Amazon Mosaic	0.6		0.5		1.6	2.6 (0.4%)
Total (%)	38.4 (5.4%)	16.8 (2.4%)	135.1 (19.1%)	12.4 (1.8%)	505.9 (71.4%)	708.3 (100.0%)

Source: Own elaboration with data from CEPALSTAT (www.statistics.cepal.org) and different sources at the national level.

Local economies in Jaguar Priority Landscapes are diverse in their sectoral composition (Figure 3). Though the financial and other services sector represent over 50% of the economy in most landscapes, agriculture or industry are also significant in Sierra de las Minas and Eastern and Coastal Amazon.

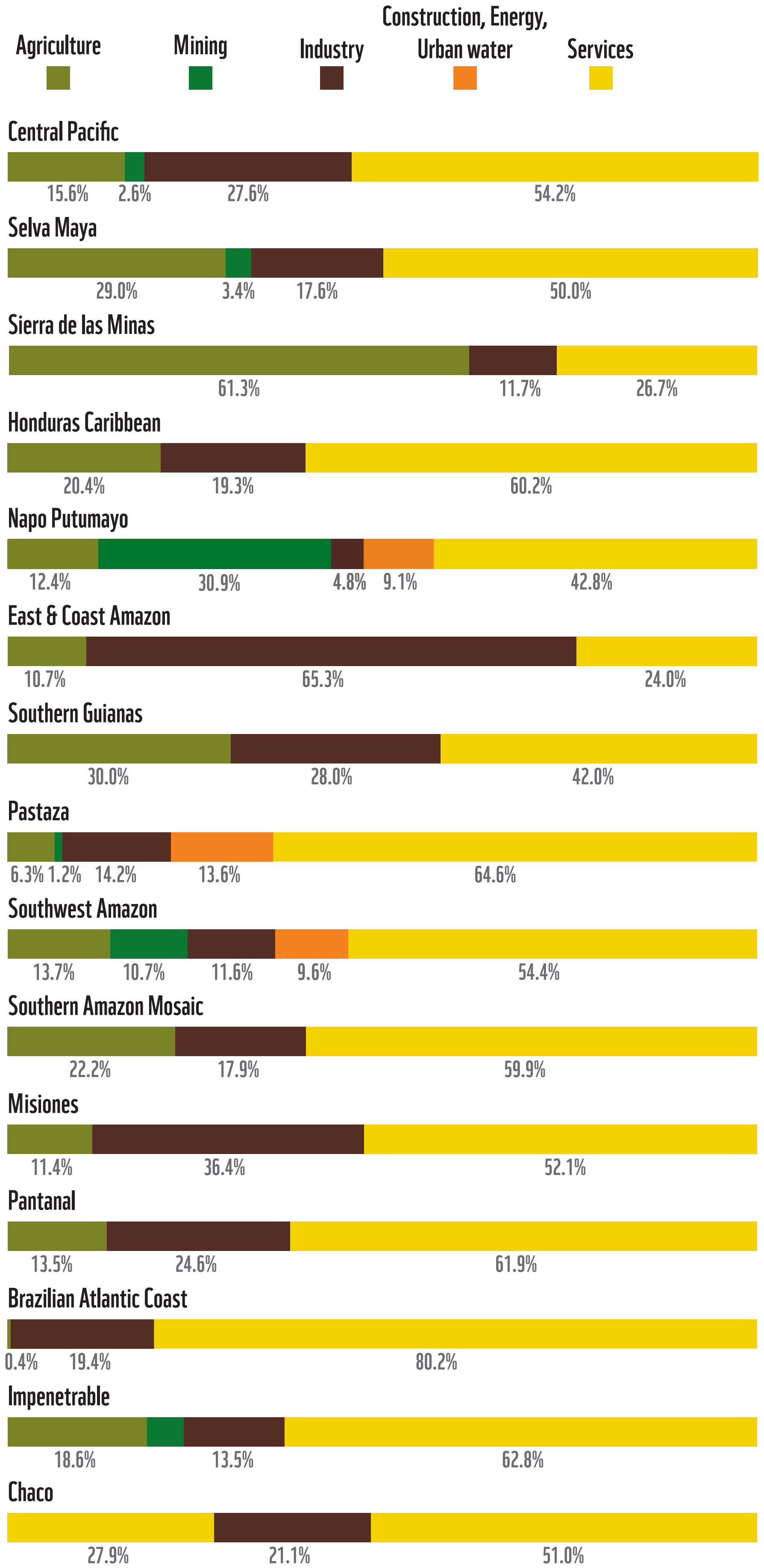
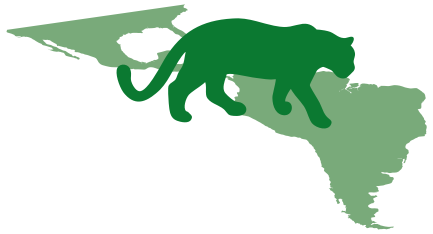


Figure 3. Relative importance of economic sectors in WWF's 15 Jaguar Priority Landscapes.

Source: own elaboration with data from CEPALSTAT (www.statistics.cepal.org) and different sources at the national level.



To date, 48.5% of the Jaguar Priority Landscapes fall within Protected Areas.

To date, across the 14 countries spanning Jaguar Priority Landscapes, 1.178 million km² within these landscapes are under protection (Table 3). This means that 48.5% of the Jaguar Priority Landscapes fall within Protected Areas. This finding resonates with the scientific literature noting that about 50% of current jaguar distribution falls within Protected Areas (Jędrzejewski et al., 2018). At a national level, Bolivia, Colombia, French Guiana, Brazil, Belize, and Guatemala have more than 50% of their Jaguar Priority Landscapes protected, while Peru, Ecuador, Honduras, Paraguay, Suriname, and Mexico have between 26% and 47% of these landscapes protected, and Guyana and Argentina only have a small fraction protected (17% and 7.7%, respectively). This disparity indicates a need for targeted conservation efforts in jaguar habitats, particularly in sites with lower levels of Protected and Conserved Areas.

Overall, the 14 countries that encompass Jaguar Priority Landscapes hold 6.061 million km² of Protected Areas. We grouped countries into three categories based on the proportion of lands in Protected Areas within Jaguar Priority Landscapes relative to the total lands in Protected Areas at the national level (Table 4). The first group of countries includes Guyana, Suriname and Paraguay, where 80% of the national Protected Area land coverage is located within the Jaguar Priority Landscapes. The second group of countries includes Colombia, Belize, Bolivia, Peru, Guatemala and French Guiana, where between 27% and 75% of Protected Areas are located within Jaguar Priority Landscapes; and lastly, Argentina, Mexico, Honduras, and Brazil have the least amount of their Protected Areas within Jaguar Priority Landscapes, between 3 and 12.5%. This finding suggests that countries in the second and third groups would benefit from more focalization, since many existing lands in Protected Areas lie outside the Jaguar Priority Landscapes.

© Christian Braga / WWF-Brazil

Table 3. Area of Jaguar Priority Landscapes overlapping with Protected Areas (km²) under IUCN Categories and percentage of Jaguar Priority Landscapes under protection.

Country	Ia	Ib	II	III	IV	V	VI	Other/Not Reported	Total Area	Percentage of jaguar priority landscapes protected
Argentina	128.36	27.88	4,611.18	1.67	190.8	120.26	1,140.07	3,145.16	9,365	7.70%
Belize	406.65		1,242.05	24.82	1,586.18		2,989.50	0	6,249	52.30%
Bolivia					2,718.26			267,528.13	270,246	62.90%
Brazil	25,770.30	21.28	109,898.19	66.47	2,994.65	37,869.62	91,194.33	131,144.29	398,959	59.20%
Colombia			83,070.65				796.71	53,266.06	137,133	62.00%
Ecuador		1,139.21	25,194.50			3.95	6,513.51	4,267.55	37,119	45.30%
French Guiana		392.26	20,218.00		1,161.46	13,632.15		0	35,404	60.90%
Guatemala		40.34	8,974.20	142.73	9.16	189.49	610.66	6,008.54	15,975	51.40%
Guyana							16,629.27	0	16,629	16.90%
Honduras			2,805.51		122.27		659.44	504.38	4,092	39.60%
Mexico	8,742.06		70.83	69.88			19,334.07	13,533.43	41,750	26.90%
Paraguay	19.81		15,005.64	2,180.06	2,373.81	3.93		45,763.00	65,346	33.00%
Peru			55,282.65	865.01			32,078.76	22,866.35	111,093	47.00%
Suriname			11,591.00		1,007.84			16,164.00	28,763	28.00%
Grand total	**35,067**	**1,621**	**337,964**	**3,351**	**12,164**	**51,819**	**171,946**	**564,191**	**1,178,124**	**48.50%**

Source: own elaboration with data from WDPA.

Table 4. Area of Protected Areas per country (km2) and percentage of PA containing Jaguar Priority Landscapes.

Country	Ia	Ib	II	III	IV	V	VI	Other/Not Reported	Total Area	Percentage of jaguar priority landscapes protected
Argentina	7,503.61	1,412.35	56,508.32	1,158.82	6,152.78	10,557.95	130,581.06	87,766.04	301,641	3.10%
Belize	426.41		2,144.80	24.83	4,795.90	51.08	3,834.23	1,481.68	12,759	49.00%
Bolivia					5,095.33			417,248.88	422,344	64.00%
Brazil	177,825.89	43.71	373,953.43	123,202.93	7,495.50	514,790.00	770,376.43	1,230,457.34	3,198,145	12.50%
Colombia	19,707.68		134,213.45	572.5	27,950.54	771.48	34,148.42	289,453.69	506,818	27.10%
Ecuador		5,893.02	46,256.72	34.38	1,861.88	140,783.18	8,657.29	155,695.95	359,182	10.30%
French Guiana		666.72	20,218.29		3,854.90	19,822.83		2,459.91	47,023	75.30%
Guatemala		599.7	11,751.60	4,463.64	536	618.65	1,174.96	8,420.41	27,565	58.00%
Guyana							17,858.94	0	17,859	93.10%
Honduras	674.02	484.86	8,327.46	55.77	2,448.81	35.73	23,745.97	7,035.41	42,808	9.60%
Mexico	314,302.82	224	6,383.66	141.05	2,551.31		154,319.63	182,239.78	660,162	6.30%
Paraguay	19.81		19,912.46	2,275.91	4,111.54	4.49	700.72	48,746.94	75,772	86.20%
Peru			103,678.51	3,631.99	207.7	7,116.59	128,200.46	111,327.59	354,163	31.40%
Suriname			11,735.39		3,256.45		2,126.16	17,843.72	34,962	82.30%
Grand total	**520,460**	**9,324**	**795,084**	**135,562**	**70,319**	**694,552**	**1,275,724**	**2,560,177**	**6,061,203**	**19.40%**

Source: own elaboration with data from WDPA.

© WWF-US / Yawar Films

In the Latin American region as a whole, public spending in environmental protection by central governments has stagnated since 2013 following significant growth in the previous decade. As shown in Figure 4, annual spending grew from less than USD $2.5 billion in 2000 to about USD $9 billion (2020 prices) in 2013. Since then, investment levels remained constant until 2018 when a downward trend ensued. In terms of contribution to GDP, public spending on environmental protection has remained very low at below 0.2% for the period 2000-2021. We note that these figures are for the entire Latin American region as disaggregation to the level of the Jaguar Priority Landscapes is not possible due to data limitations. Also, these figures include only spending by central governments, which exclude other public institutions and additional funding by other actors like multilaterals, civil society, and the private sector.

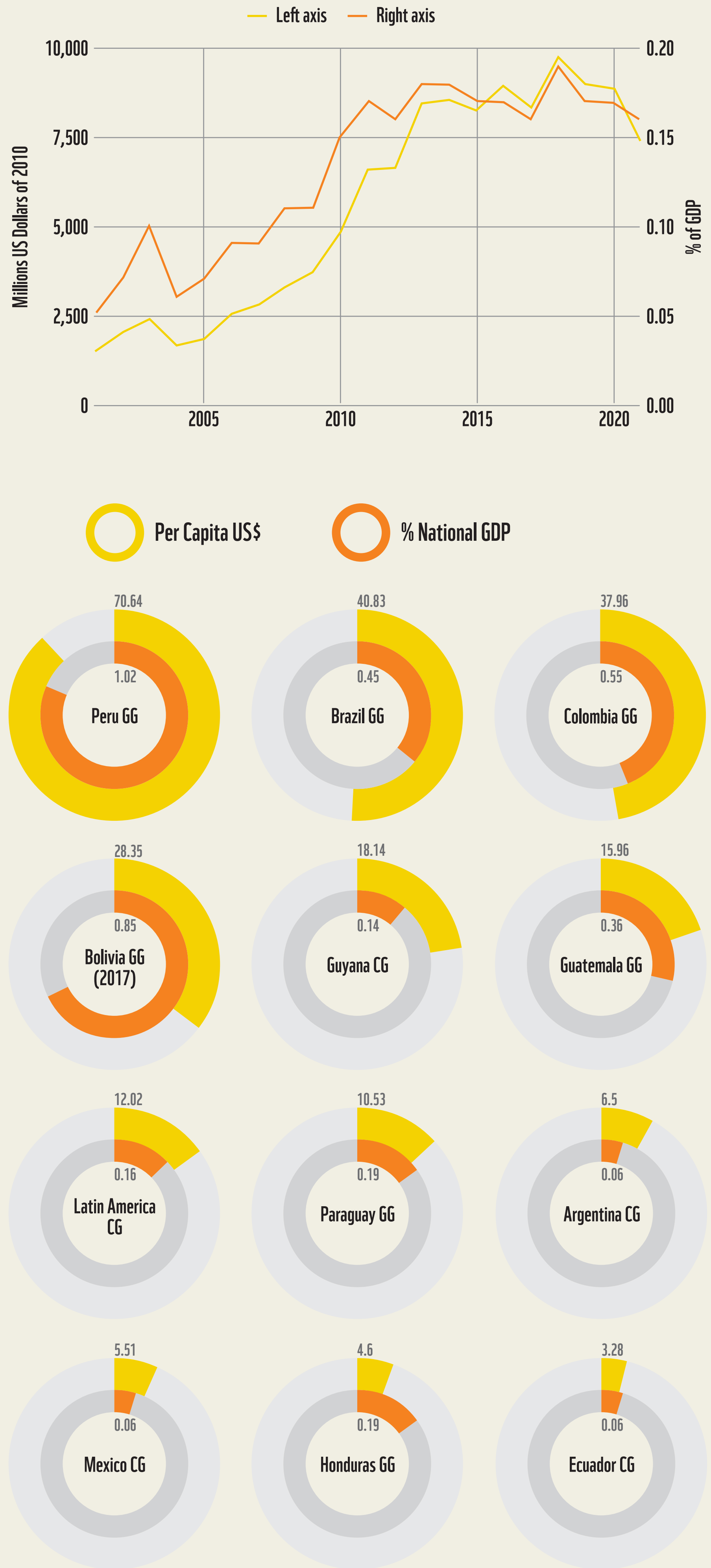


Figure 4. Spending on environmental protection in Latin America. Top: spending by central governments 2000-2021. Bottom: spending by central and/or general governments in 2021 for selected countries.

Notes top: Central governments defined as budgetary and non-budgetary funding for centralized administrations and decentralized entities. Latin America includes countries with and without Jaguar Priority Landscapes. % of GDP is computed as the average of relative participation in national economies.

Source top: own elaboration with data from CEPALSTAT (www.statistics.cepal.org). Note bottom: Figures in per capita USD of 2010 and as a % of national GDP. Central Government (CG)=Budgetary and non-budgetary funding for centralized administrations and decentralized entities. General Government (GG)= CG + Subnational governments. Source: own elaboration with data from CEPALSTAT (www.statistics.cepal.org).

2.2. ECONOMIC VALUATION OF FOREST ECOSYSTEM SERVICES

We followed a three-step approach to estimate the economic value of forest ecosystem services in the Jaguar Priority Landscapes (see Appendix B for further methodological details).

1. Collection, filtering, and calculation of economic valuation from the Ecosystem Service Valuation Database (ESVD) (Brander et al., 2024), which contains a global repository of primary valuation studies disaggregated by biome and by different ecosystem services types (i.e. provision, regulation, cultural; see Glossary);
2. Collection, filtering and calculation of land cover surface from Globeland30 (2020) (Jun et al., 2014), which contains a global database containing multiple land cover classifications at a 30-meter resolution;
3. Merging of valuation and land cover data for the Jaguar Priority Landscapes to obtain an economic valuation of forest ecosystem services in the region.

We focus our economic valuation analysis exclusively on forests (i.e. tropical and temperate forests) for two main reasons: i) land cover: forests represent the largest land cover share across landscapes at 177.1 million hectares (72.5% of total) (Figure 5); ii) valuation data limitations: the most relevant valuations from the ESVD in the landscape countries focus on forests (see Appendix B).

Relevant studies from ESVD yield annual per hectare economic valuations of forest ecosystem services as follows: i) USD $15,800 for studies that focus on temperate forests only (2020 international dollars); ii) USD $16,900 for studies that focus on tropical forests only; iii) USD $22,200 for studies that assess both temperate and tropical forests (Table 5). Per hectare valuations are based on a relevant sample of 219 valuations –i.e. 178 valuations from tropical forests and 41 from temperate forests– (see Appendix B for the filters applied). We note that our relevant sample of valuations is highly geographically concentrated as it: i) only includes data from ten countries, with three of them dominating in terms of numbers: Brazil (n=123), Guatemala (n=41), Colombia (n=26), Mexico (n=10), Ecuador (n=9), Peru (n=3), Paraguay (n=3) Honduras (n=2), Argentina (n=1), Bolivia (n=1); ii) does not include a single study from four countries: Belize, French Guiana, Suriname, Guyana.

© Luis Barreto / WWF-UK

© Adriano Gambarini / WWF-Brazil

© Santiago Gibert / WWF-México

These data limitations required us to use regional averages for estimating the value of forest ecosystem services for all countries except for Brazil, Guatemala, and Colombia where there is a large number of valuations that enable a country-specific estimation. The per-hectare estimates for these three countries are: i) USD $2,900 to $17,800 for Brazil; ii) USD $13,200 for Guatemala; iii) USD $12,500 for Colombia. We note that these per-hectare figures assume that all hectares of forest deliver all ecosystem services, a strong assumption that may not always hold as there can be significant spatial variation in the provision and use of different ecosystem services.

Regulating services represent the most important category in terms of both per hectare value and number of relevant studies, followed by provisioning services and lastly cultural services. For the total sample, the contributions to mean per hectare valuations for each category of ecosystem service are as follows: i) 84% from regulating services (n=105), where climate regulation and erosion prevention are the most important; ii) 14% for provisioning services (n=92), where water, genetic resources, raw materials, and food are the most important; iii) 2% for cultural services (n=22), though this likely does not capture their full value because many cultural services are difficult to express economically (see Glossary for a definition of each type of service; see Appendix B for a list of specific services).

Table 5. Mean values per ecosystem service and region and biome combination. Values in 2020 international dollars per hectare.

Ecosystem services / Regions and biomes		Total sample						Brazil						Guatemala		Colombia	
		Aggregate data: includes both tropical and temperate forests		Tropical and subtropical forests		Temperate forest and woodland		Aggregate data: includes both tropical and temperate forests		Tropical and subtropical forests		Temperate forest and woodland		Tropical and subtropical forests		Tropical and subtropical forests	
		Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count	Mean	Count
Cultural	Existence, bequest values	433	20	433	20			49	2	49	2			73	2	557	15
	Opportunities for recreation and tourism	0.13	2	-	2			0.09	1	0.09	1						
Provisioning	Food	341	20	341	20			5	1	5	1			1	7	1,007	3
	Genetic resources	508	4	508	4			508	4	508	4						
	Ornamental resources	13	1	13	1									13	1		
	Raw materials	458	34	473	31	307	3	706	21	773	18	307	3	59	11		
	Water	1,885	33	5,869	9	391	24	391	24			391	24			10,426	5
Regulating	Biological control	15	1			15	1	15	1			15	1				
	Climate regulation	6,199	33	6,805	30	147	3	821	8	1,225	5	147	3	10,961	18		
	Erosion prevention	11,420	4	1,924	1	14,585	3	14,585	3			14,585	3	1,924	1		
	Maintenance of genetic diversity	323	4			323	4	323	4			323	4				
	Maintenance of soil fertility	196	1	196	1									196	1		
	Moderation of extreme events	42	1	42	1			42	1	42	1						
	Pollination	269	51	269	51			301	44	301	44					90	2
	Regulation of water flows	72	7	72	7			11	6	11	6					442	1
	Waste treatment	10	3			10	3	10	3			10	3				
Cultural total		**433**	22	**433**	22			**50**	3	**50**	3			**73**	2	**557**	15
Provisioning total		**3,205**	92	**7,204**	65	**697**	27	**1,610**	50	**1,286**	23	**697**	27	**83**	19	**11,433**	8
Regulating total		**18,547**	105	**9,308**	91	**15,080**	14	**16,107**	70	**1,579**	56	**15,080**	14	**13,081**	20	**532**	3
Grand total		**22,185**	219	**16,945**	178	**15,778**	41	**17,767**	123	**2,915**	82	**15,777**	41	**13,238**	41	**12,522**	26

Notes: 1) Total sample includes all relevant valuations from the ESVD database, which includes valuations from the following countries (numbers in brackets indicate the number of valuations per country): Brazil (n=123), Guatemala (n=41), Colombia (n=26), Mexico (n=10), Ecuador (n=9), Peru (n=3), Paraguay (n=3) Honduras (n=2), Argentina (n=1), Bolivia (n=1); 2) Filters applied are discussed in Appendix B.

Source: own elaboration based on ESVD data.

Forests are the most important land cover category among the Jaguar Priority Landscapes (Figure 5). Based on Globeland30 data, we found that forests represent 72.5% of the entire surface (177.1 million hectares) of the Jaguar Priority Landscapes, and the main land cover in every landscape. Our analysis yields a total of 244.3 million hectares across landscapes, with values ranging from 50.6 million hectares in Southwest Amazon to 355.8 thousand hectares in Sierra de las Minas Biosphere Reserve.

Forests are the most important land cover category among the Jaguar Priority Landscapes.

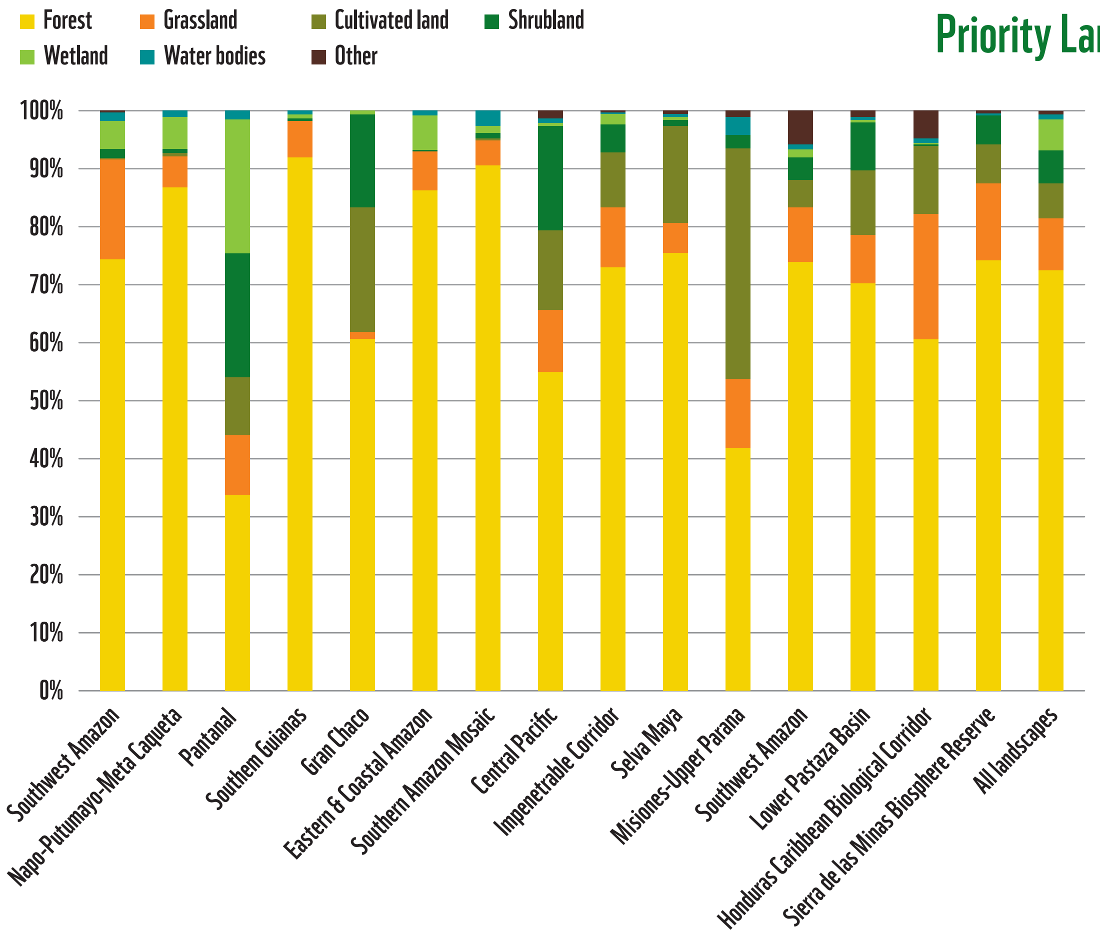


Figure 5. Land cover composition in Jaguar Priority Landscapes.

Note: 'other' includes artificial surfaces, bare land, and permanent snow and ice.

Source: own elaboration based on Globeland30 data.

© Emmanuel Rondeau / WWF France

© Emmanuel Rondeau / WWF France

© Jacqueline Lisboa / WWF-Brazil

Combining ESVD valuation data with land cover data from Globeland30, enabled us to provide an estimated annual economic value of forest ecosystem services in the Jaguar Priority Landscapes (Table 6). We developed value estimates disaggregated by category of ecosystem service by multiplying the value per hectare for each category of ecosystem service with the number of hectares. The lower and upper bounds we applied are based on Table 5. Due to the limited availability of valuation studies in most countries, we applied the aggregate value from the entire sample to all countries, except for Brazil, Guatemala, and Colombia, where more specific data were available.

For provisioning and cultural services combined, our analysis yields a range between USD $0.3 and $1.1 trillion (2020 international dollars as per the ESVD). These ecosystem services, which include direct benefits like food, water, and existence values, have a direct impact on the livelihoods of local communities and on regional economies. **In turn, regulating services, such as climate regulation and erosion prevention, are valued between USD $1.1 and $2.8 trillion.** Regulating services may be less visible to local communities and other stakeholders but are essential public goods that benefit society at large, contributing to global ecological stability and climate resilience.

The total value of forests amounts between USD $1.5 and $4 trillion.

Assuming all hectares of forest provide all types of ecosystem services including in relevant valuations (i.e., provisioning, cultural, and regulating), the total value amounts between USD $1.5 and $4 trillion. In each case, the highest contributors are Southwest Amazon, Napo-Putumayo-Meta-Caqueta, and Southern Guianas. However, there is significant variation between the lower and upper bounds due to differences in per hectare valuations from the ESVD database, particularly for provisioning and cultural services.

Table 6. Economic valuation of forest ecosystem services in the Jaguar Priority Landscapes.

Landscape	Country	Forest cover (thousand hectares)	Provisioning and cultural services: Value per hectare (international 2020 dollars)[1]		Provisioning and cultural services: Value per country-landscape combination (international 2020 dollars, figures in billions)		Provisioning and cultural services: Total value per landscape (international 2020 dollars, figures in billions)		Regulating services: Value per hectare (international 2020 dollars)[1]		Regulating services: Value per country-landscape combination (international 2020 dollars, figures in billions)		Regulating services: Total value per landscape (international 2020 USD dollars, figures in billions)		Total: Total value per landscape (international 2020 dollars, figures in billions)	
			Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
Brazilian Coastal Atlantic Forest	Brazil	4,648	697	1,660	3.2	7.7	3.2	7.7	1,579	16,107	7.3	74.9	7.3	74.9	10.6	82.6
Central Pacific	Mexico	6,361	697	7,637	4.4	48.6	4.4	48.6	9,308	18,547	59.2	118.0	59.2	118.0	63.6	166.5
Impenetrable Corridor	Argentina	6,482	697	7,637	4.5	49.5	4.5	49.5	9,308	18,547	60.3	120.2	60.3	120.2	64.9	169.7
Eastern & Coastal Amazon	Brazil	13,447	697	1,660	9.4	22.3	10.3	32.6	1,579	16,107	21.2	216.6	33.7	241.5	44.0	274.1
	French Guiana	1,023	697	7,637	0.7	7.8			9,308	18,547	9.5	19.0				
	Suriname	319	697	7,637	0.2	2.4			9,308	18,547	3.0	5.9				
Gran Chaco	Bolivia	5,139	697	7,637	3.6	39.2	7.8	84.9	9,308	18,547	47.8	95.3	103.5	206.3	111.3	291.3
	Paraguay	5,985	697	7,637	4.2	45.7			9,308	18,547	55.7	111.0				
Honduras Caribbean Biological Corridor	Guatemala	9	156	156	0.0	0.0	0.4	4.8	13,081	13,081	0.1	0.1	6.0	11.9	6.5	16.7
	Honduras	633	697	7,637	0.4	4.8			9,308	18,547	5.9	11.7				
Lower Pastaza Basin	Ecuador	3,142	697	7,637	2.2	24.0	2.2	24.0	9,308	18,547	29.2	58.3	29.2	58.3	31.4	82.3
Misiones Upper Parana	Argentina	2,176	697	7,637	1.5	16.6	2.1	21.2	9,308	18,547	20.3	40.4	25.7	55.9	27.8	77.2
	Brazil	368	697	1,660	0.3	0.6			1,579	16,107	0.6	5.9				
	Paraguay	521	697	7,637	0.4	4.0			9,308	18,547	4.8	9.7				
Napo-Putumayo-Meta-Caqueta	Brazil	2,129	697	1,660	1.5	3.5	233.4	317.6	1,579	16,107	3.4	34.3	123.6	264.0	356.9	581.6
	Colombia	18,651	11,990	11,990	223.6	223.6			532	532	9.9	9.9				
	Ecuador	3,413	697	7,637	2.4	26.1			9,308	18,547	31.8	63.3				
	Peru	8,435	697	7,637	5.9	64.4			9,308	18,547	78.5	156.4				
Pantanal	Bolivia	5,379	697	7,637	3.8	41.1	6.7	62.7	9,308	18,547	50.1	99.8	75.6	174.4	82.4	237.1
	Brazil	1,829	697	1,660	1.3	3.0			1,579	16,107	2.9	29.5				
	Paraguay	2,436	697	7,637	1.7	18.6			9,308	18,547	22.7	45.2				
Selva Maya	Belize	982	697	7,637	0.7	7.5	3.2	32.7	9,308	18,547	9.1	18.2	62.1	101.3	65.3	134.1
	Guatemala	1,720	156	156	0.3	0.3			13,081	13,081	22.5	22.5				
	Mexico	3,269	697	7,637	2.3	25.0			9,308	18,547	30.4	60.6				
Sierra de las Minas Biosphere Reserve	Guatemala	264	156	156	0.0	0.0	0.0	0.0	13,081	13,081	3.5	3.5	3.5	3.5	3.5	3.5
Southern Amazon Mosaic	Brazil	14,529	697	1,660	10.1	24.1	10.1	24.1	1,579	16,107	22.9	234.0	22.9	234.0	33.1	258.1
Southern Guianas	Brazil	1,562	697	1,660	1.1	2.6	17.9	186.7	1,579	16,107	2.5	25.2	226.9	472.3	244.8	659.0
	French Guiana	5,727	697	7,637	4.0	43.7			9,308	18,547	53.3	106.2				
	Guyana	8,557	697	7,637	6.0	65.3			9,308	18,547	79.6	158.7				
	Suriname	9,825	697	7,637	6.9	75.0			9,308	18,547	91.5	182.2				
Southwest Amazon	Bolivia	18,502	697	7,637	12.9	141.3	26.3	251.0	9,308	18,547	172.2	343.2	303.1	684.7	329.4	935.6
	Brazil	6,229	697	1,660	4.3	10.3			1,579	16,107	9.8	100.3				
	Peru	13,005	697	7,637	9.1	99.3			9,308	18,547	121.0	241.2				
Total							332.8	1,148.3			-		1,142.7	2,821.1	1,475.5	3,969.4

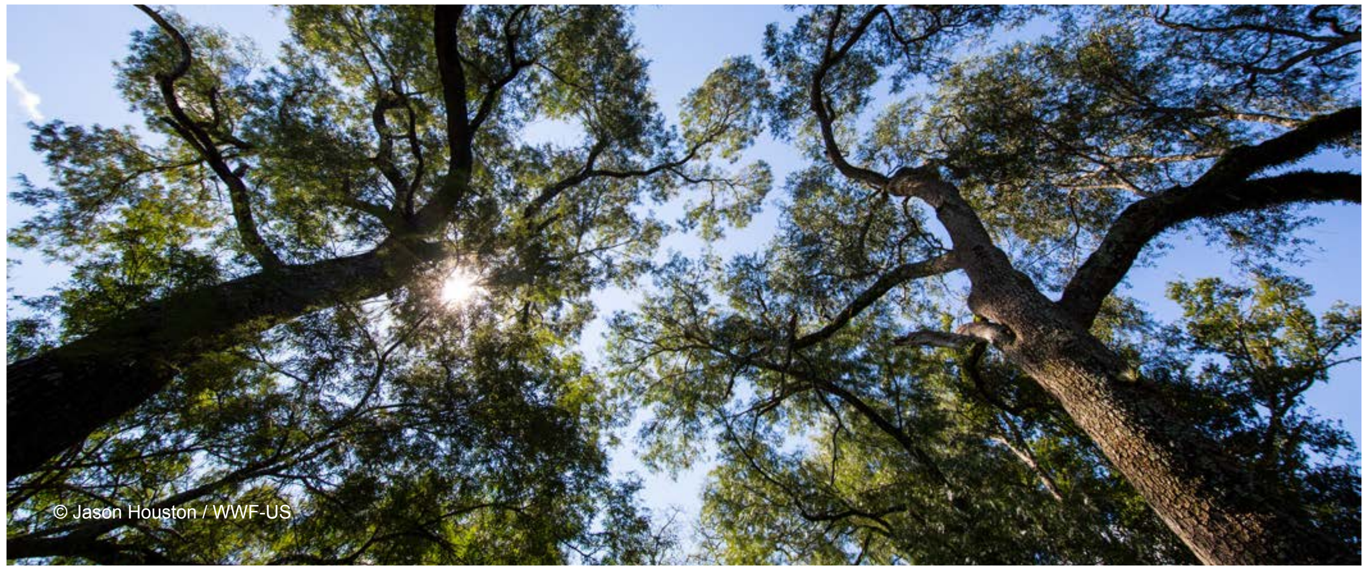
Notes: 1) Specific country-level valuations applied for Brazil, Colombia, and Guatemala because these countries contain a large number of valuations. For other countries a regional average applies. The relevant per.hectare valuations applied are presented in Table 5.

Source: own elaboration with data from ESVD and Globeland30.

Our estimated value of provisioning and cultural services from forests in the Jaguar Priority Landscapes ranges from 0.5 to 1.6 times the region's total economic output, valued at USD $0.7 trillion (Table 7; see also Figure 3). **With regards to regulating services, the value is even higher, between 1.6 and 4 times the region's economic activities.** This separation underscores the different roles that these categories of ecosystem services play at the local level: provisioning and cultural services are vital for the economic resilience of local communities and other local stakeholders, while regulating services provide essential support for broader societal and ecological functions, though with potential delays or indirect benefits for local populations.

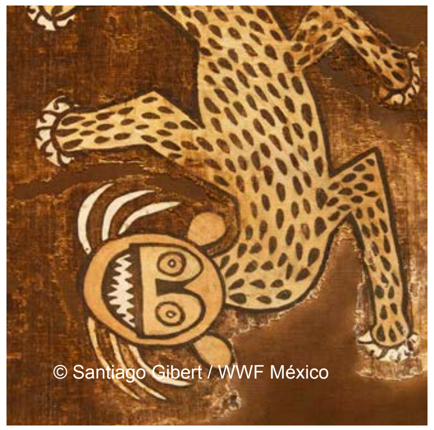
Considering all ecosystem services, the total value of forest ecosystem services is 2.1 to 5.6 times greater than the region's aggregate economic output. However, the ratio between all forest ecosystem services and economic values varies widely between individual landscapes. Whereas in Southern Guianas the value of all forest ecosystem services (average of USD $452 billion between the lower and upper bound) is 125 times larger than regional GDP (USD $3.6 billion), in the Brazilian Coastal Atlantic Forest –which contains the large regional economy associated with the metropolitan areas of São Paulo and Rio de Janeiro– the value of ecosystem services (USD $47 billion) represents only 9.9% of the value of economic activities (USD $468 billion). There are other landscape areas where the value of ecosystem services and economic activities are more balanced, like the cases of Honduras Caribbean Biological Corridor or Sierra de las Minas Biosphere Reserve, in Guatemala. Considering only provisioning and cultural services, landscapes where the value of ecosystem services as a percentage of economic output is similar include: Central Pacific at 72%; Misiones Upper Parana at 80%; and Pantanal at 166%.

The total value of forest ecosystem services is 2.1 to 5.6 times greater than the region's aggregate economic output.



© Jason Houston / WWF-US

© Santiago Gibert / WWF México



© Santiago Gibert / WWF México

Table 7. Comparison between value of forest ecosystem services and economic output across Jaguar Priority Landscapes

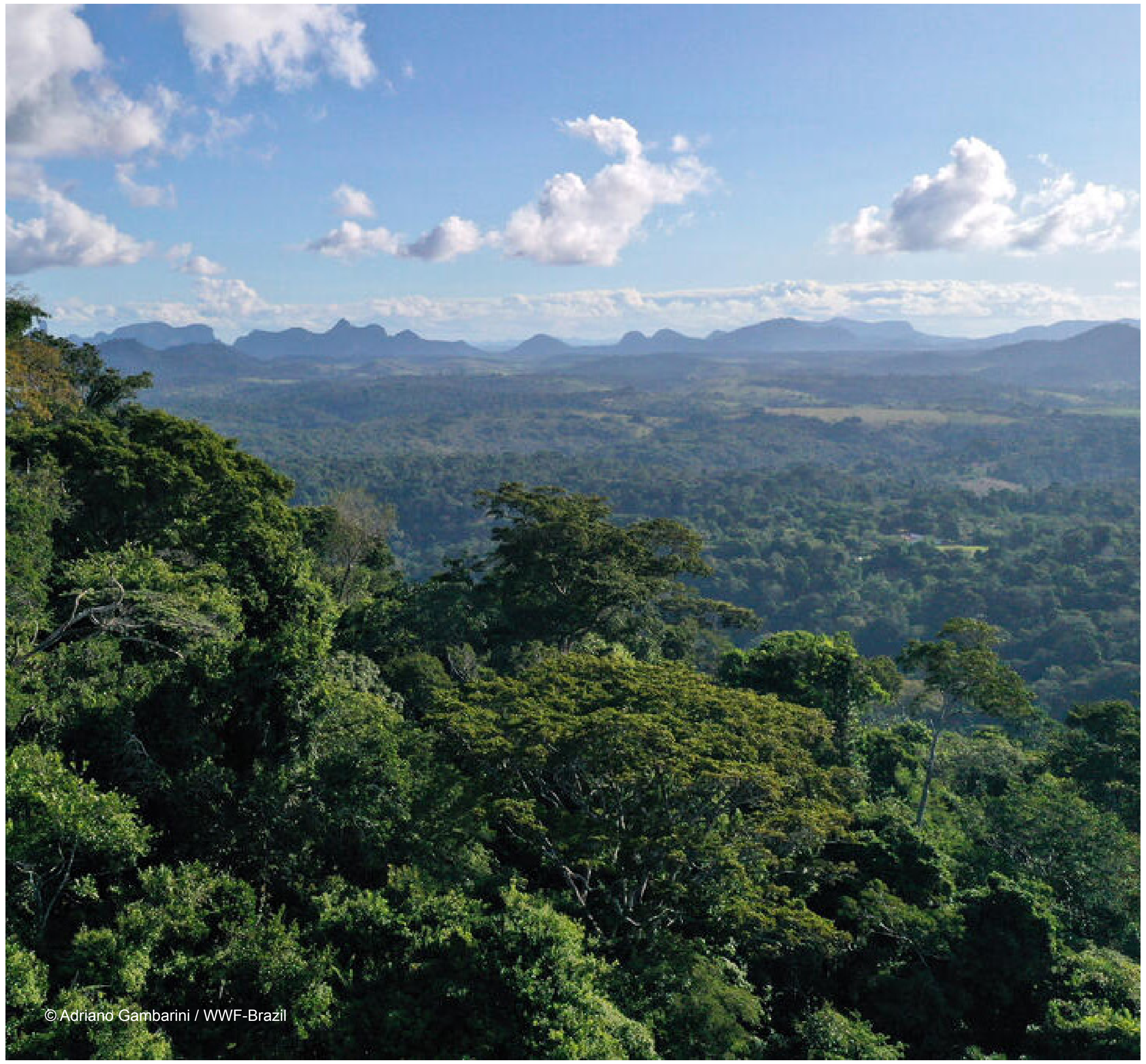
Landscape	Economic output (2017 USD, figures in billions)	Ratio (value of ecosystem service / economic output)					
		Provisioning and cultural services		Regulating services		All ecosystem services	
		Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
Brazilian Coastal Atlantic Forest	468.2	0.0	0.0	0.0	0.2	0.0	0.2
Central Pacific	36.8	0.1	1.3	1.6	3.2	1.7	4.5
Impenetrable Corridor	6.9	0.7	7.2	8.7	17.4	9.4	24.6
Eastern & Coastal Amazon	3.7	2.8	8.8	9.1	65.3	11.9	74.1
Gran Chaco	12.7	0.6	6.7	8.2	16.2	8.8	22.9
Honduras Caribbean Biological Corridor	14.4	0.0	0.3	0.4	0.8	0.4	1.2
Lower Pastaza Basin	39.9	0.1	0.6	0.7	1.5	0.8	2.1
Misiones Upper Parana	14.6	0.1	1.5	1.8	3.8	1.9	5.3
Napo-Putumayo-Meta-Caqueta	32.9	7.1	9.7	3.8	8.0	10.8	17.7
Pantanal	20.9	0.3	3.0	3.6	8.3	3.9	11.3
Selva Maya	5.9	0.5	5.5	10.5	17.2	11.1	22.7
Sierra de las Minas Biosphere Reserve	3.7	0.0	0.0	0.9	0.9	0.9	0.9
Southern Amazon Mosaic	2.6	3.9	9.3	8.8	90.0	12.7	99.3
Southern Guianas	3.6	5.0	51.9	63.0	131.2	68.0	183.1
Southwest Amazon	41.5	0.6	6.0	7.3	16.5	7.9	22.5
Total	**708.3**	**0.5**	**1.6**	**1.6**	**4.0**	**2.1**	**5.6**

Source: own elaboration based on data from ESVD and Globeland30 for value of ecosystem services, and on data from CEPALSTAT (www.statistics.cepal.org) and different sources at the national level for economic output calculations. See Tables 2 and 6.

While our analysis highlights the immense value of forest ecosystem services, it is important to recognize the limitations of assuming that all hectares of forest deliver all services equally. In our calculations, we separated the values of provisioning and cultural services from those of regulating services. This separation not only addresses potential overestimation but also highlights the distinct economic impacts at the local level. As noted earlier, provisioning and cultural services are more directly relevant for local populations, whilst regulating services function as public goods that benefit society at large.

To improve future valuation analyses, a more conservative approach could involve using the proportion of each ecosystem service represented in the ESVD valuation literature as a proxy for the actual level of service provision. This method would allow for more accurate estimates of how much each landscape contributes to various ecosystem services. Additionally, the high valuation we obtained for regulating services, particularly those related to climate, merits further investigation. These large figures may stem from the use of the social cost of carbon, which reflects the long-term global economic impacts of carbon emissions. Future analyses could refine these estimates by paying closer attention to the carbon market pricing approaches used in the valuation studies, as well as to whether studies focused on carbon sink capacity rather than total carbon stock. This latter distinction would clarify the annual value of regulating services by differentiating between carbon as an asset and carbon that is actively sequestered.

Finally, further investigation into the specific components of regulating services in the ESVD database is needed. For example, differentiating between studies that estimate the value of carbon stock (as a capital asset) and those that focus on carbon sink (the annual flow of carbon sequestration) could significantly impact the results. Incorporating these considerations in future analyses would yield more precise and nuanced valuations of the ecosystem services provided by forests across different landscapes.



© Adriano Gambarini / WWF-Brazil

2.3. EXPLORING LOCAL PERCEPTIONS IN FIVE JAGUAR PRIORITY LANDSCAPES

To elicit local perceptions related to ecosystem service provision, we conducted surveys (n respondents=105) in one or more areas located within five different Jaguar Priority Landscapes (Figure 6): i) Selva Maya in Mexico (n=23): Calakmul municipality, Campeche; ii) Lower Pastaza Basin in Ecuador (n=22): Pastaza, Morona Santiago and Tungurahua provinces; iii) Southwest Amazon in Bolivia (n=20): Filadelfia, Puerto Rico and Cobija, in the Pando department. iv) Pantanal in Paraguay (n=20): Carmelo Peralta district, Alto Paraguay Province; v) Misiones Upper Parana in Argentina (n=20): Comandante Andresito, San Pedro, Pozo Azul and El Soberbio municipalities. We collected data among a range of stakeholders in each area, including: i) local institutional authorities (n=26); ii) indigenous/community authorities and civil society organizations (n=28); iii) local producers in agriculture, industry, and forestry (n=41); iv) members of the general population (n=10). **We highlight that given the low number of surveys collected in each Jaguar Priority Landscape, our results are merely indicative of some patterns and processes.**

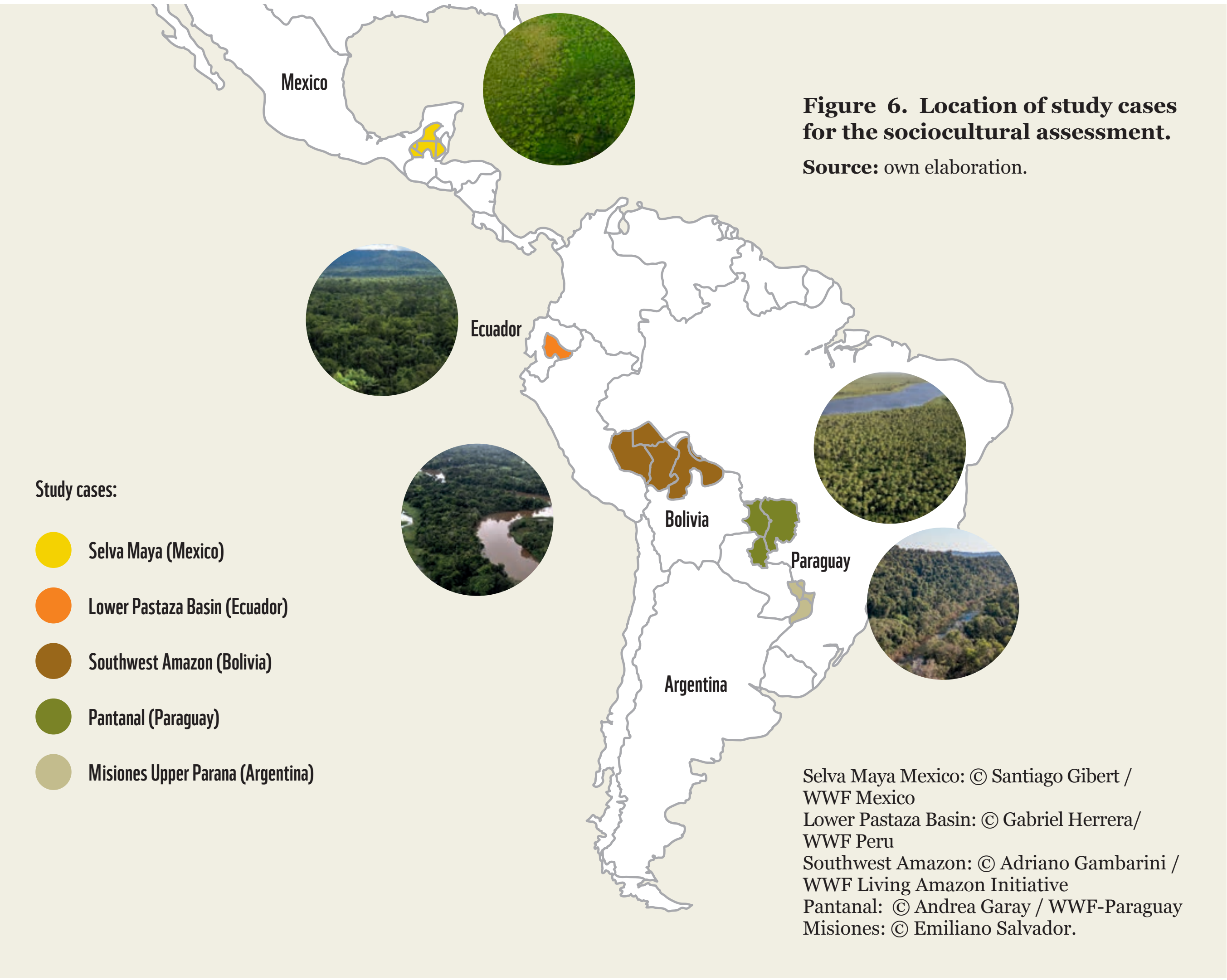


Figure 6. Location of study cases for the sociocultural assessment.

Source: own elaboration.

Selva Maya Mexico: © Santiago Gibert / WWF Mexico
Lower Pastaza Basin: © Gabriel Herrera/ WWF Peru
Southwest Amazon: © Adriano Gambarini / WWF Living Amazon Initiative
Pantanal: © Andrea Garay / WWF-Paraguay
Misiones: © Emiliano Salvador.

Selection of the Jaguar Priority Landscape for assessment of local perceptions was guided by geographic coverage and the feasibility of conducting local data collection activities. These selected landscapes involve 17 ecoregions, including the well-preserved massif of tropical moist and dry forests in Mexico's Selva Maya, the westernmost Amazon forest, in Ecuador's Lower Pastaza Basin, the southwestern Amazon Forest, in the intersection of Peru, Bolivia and Brazil (the Southwest Amazon), the dry forests adjacent to the Pantanal, in the intersection of Brazil and Paraguay, and the South American Atlantic Forests, in Argentina's Misiones province.

Our survey contained three main sections: i) *an ecosystem service preference assessment*, in which respondents were asked to state the importance of benefits from ecosystems to their wellbeing; ii) *a land use/ cover photograph elicitation assessment*, in which respondents were shown different photographs of local land uses/ covers relevant to their context and were subsequently asked to choose among them and to explain the reasons behind their selection; iii) *an ecosystem degradation assessment*, in which respondents were asked about perceived changes in the provision of ecosystem services and associated causes, consequences, and solutions (see Appendix C for further methodological details).

Responses related to the perceived importance of ecosystem services to wellbeing revealed similar patterns across Priority Landscapes by type of ecosystem service, though with some key differences and nuances across sites (Figure 7). Our analysis also revealed some differences in responses between groups of stakeholders, particularly regarding food for commercial service (See Appendix C). Although these results are based on a limited number of interviews conducted at each case study site and are thus indicative rather than definitive, they suggest that understanding the various perceptions of ecosystem benefits by different actors can offer a more comprehensive picture of local dependence on ecosystem services.

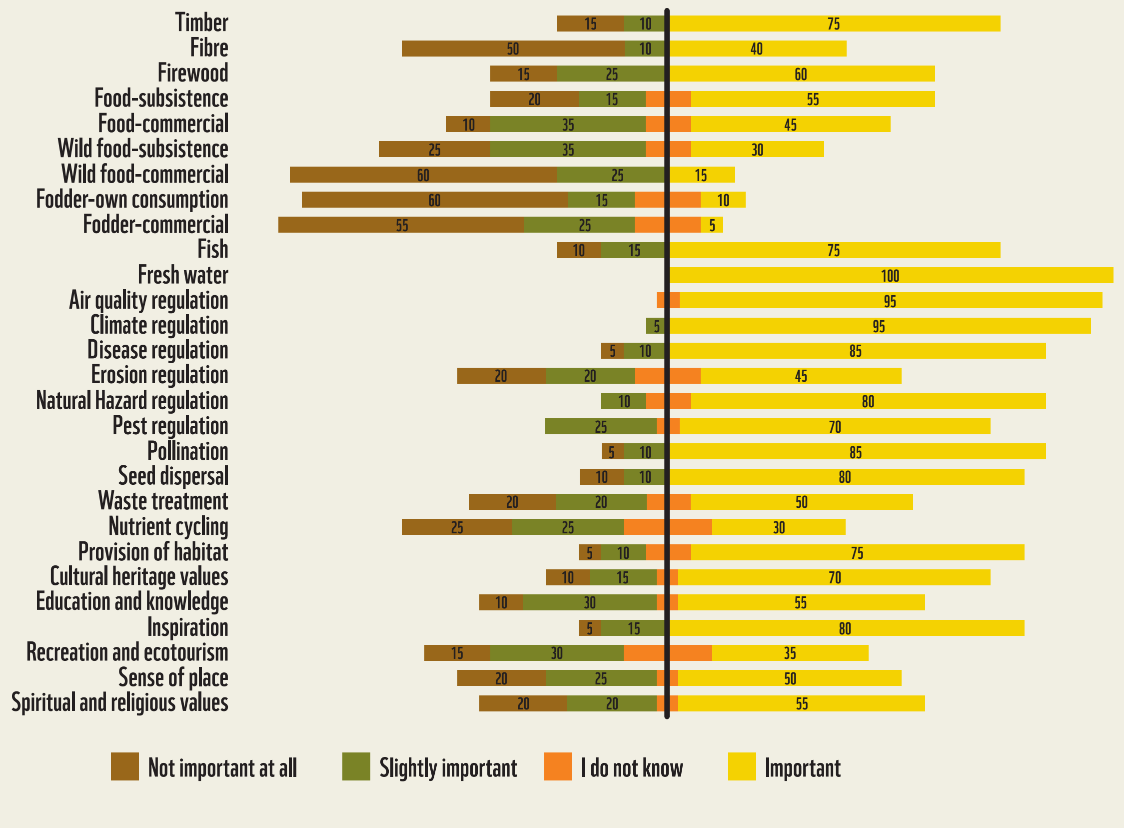
Provisioning services yielded mixed responses across Landscapes, with services related to food and firewood being perceived as important throughout whereas fodder for commercial or own consumption was mostly unimportant except in Ecuador. Wild food for commercial or own consumption was also mostly unimportant except for Bolivia and Mexico. Timber and fiber achieved medium-to-high scores across Landscapes. Fish was important in Paraguay, Ecuador, and Bolivia. Except for Mexico's Selva Maya where surface water is absent and groundwater is unsuitable for human consumption, provision of fresh water was also recognized across sites.

Regulating services were predominantly perceived as important across Landscapes, with a few exceptions. Air quality regulation, climate regulation, disease regulation, pollination, seed dispersal, and waste treatment have high scores across sites, except for Mexico where disease regulation and waste treatment were mostly unimportant. Natural hazard and pest regulation were high in all cases except for Mexico and Bolivia. This lower response can be indicative of a transformation of local practices in which these services are substituted by manufactured alternatives, such as chemical pesticides and fertilizers, a practice in fact reported by survey respondents.

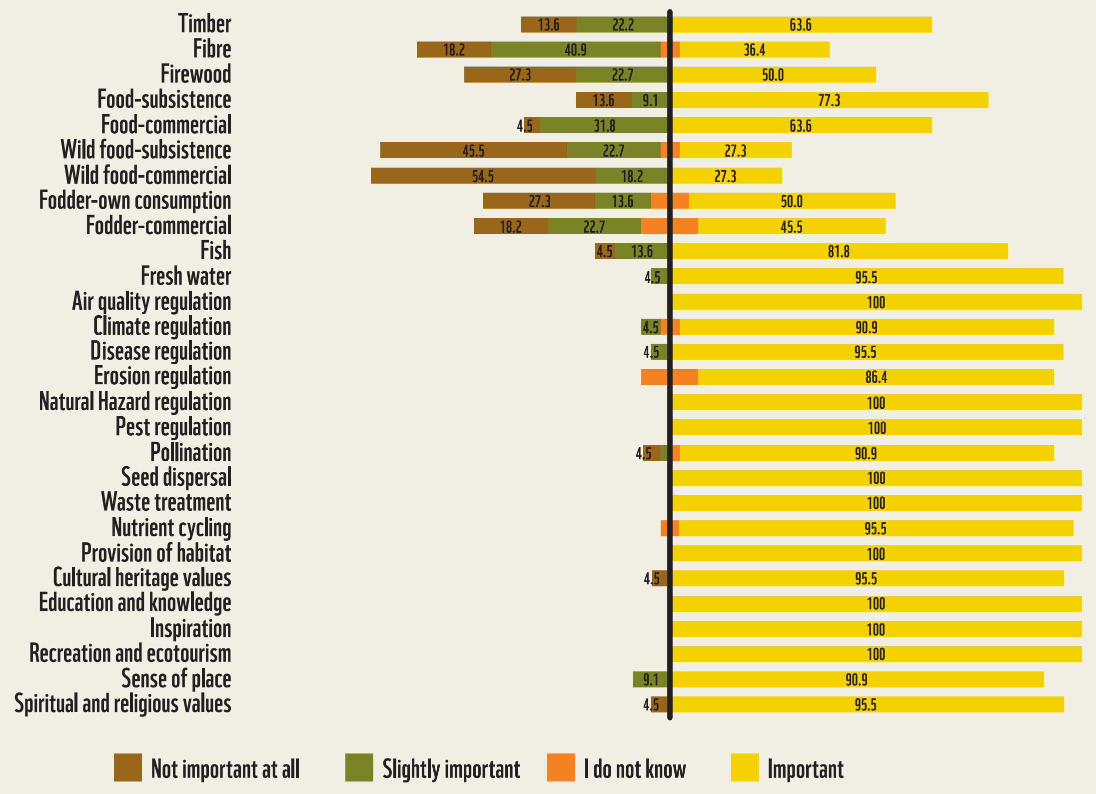
Supporting services were perceived as important across Landscapes, though provision of habitat achieved higher scores than nutrient cycling.

Cultural services were mostly perceived as important across Landscapes, except for spiritual and religious values which were mostly unimportant in Mexico, Argentina, and Paraguay. One possible reason for this difference is that these three Landscapes are relatively new settlements of late colonization, which previously were uninhabited or inhabited by small native populations that have been affected by the prevalence of a continuous inflow of migrants. Nonetheless, the fact that sense of place was one of the most highly rated as important across all sites suggests a process of rootedness among adult generations inhabiting these areas despite recent colonization.

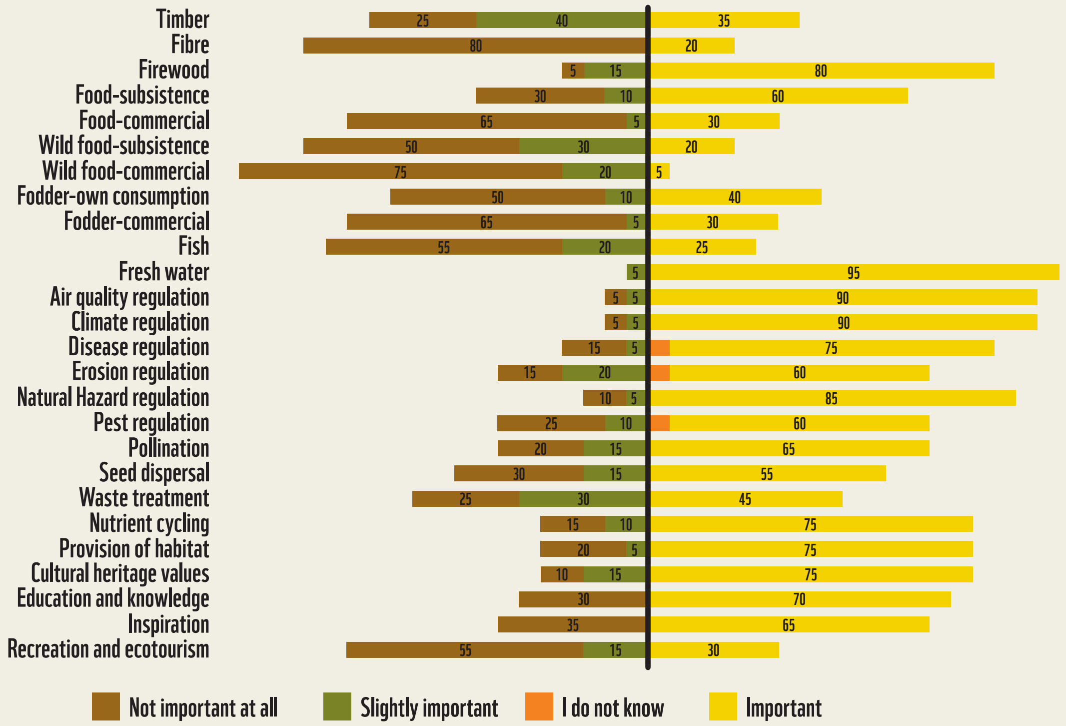
Pantanal (Paraguay):



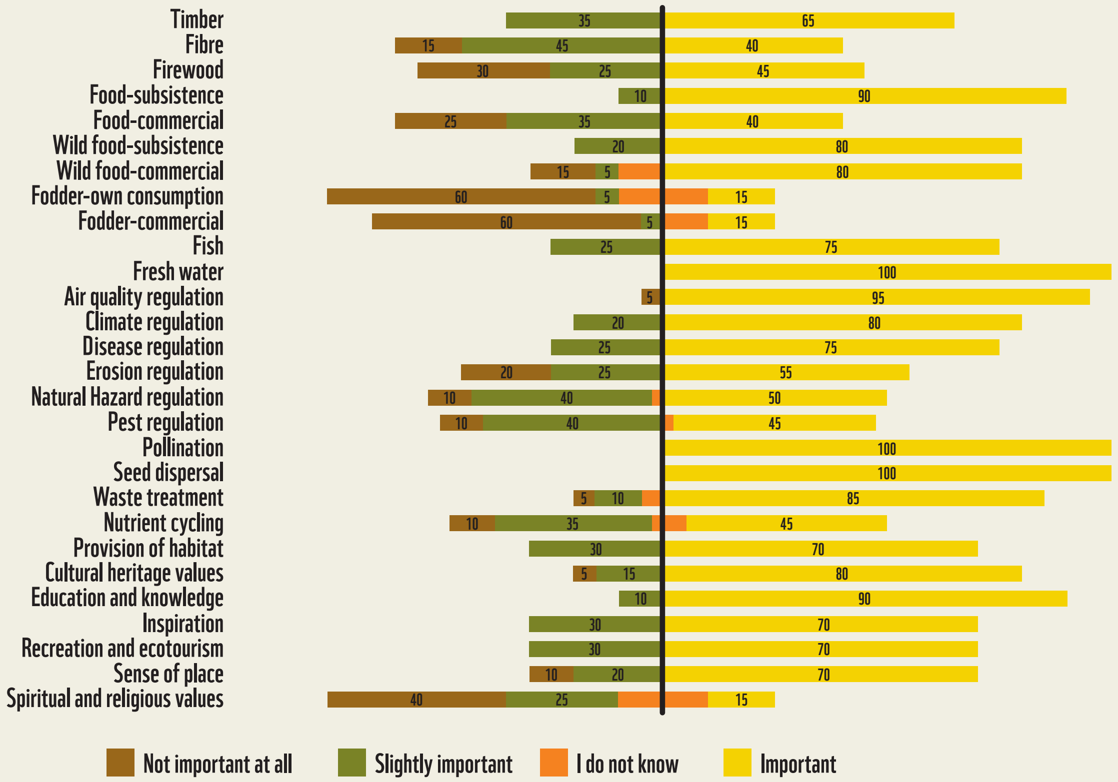
Lower Pastaza Basin (Ecuador)



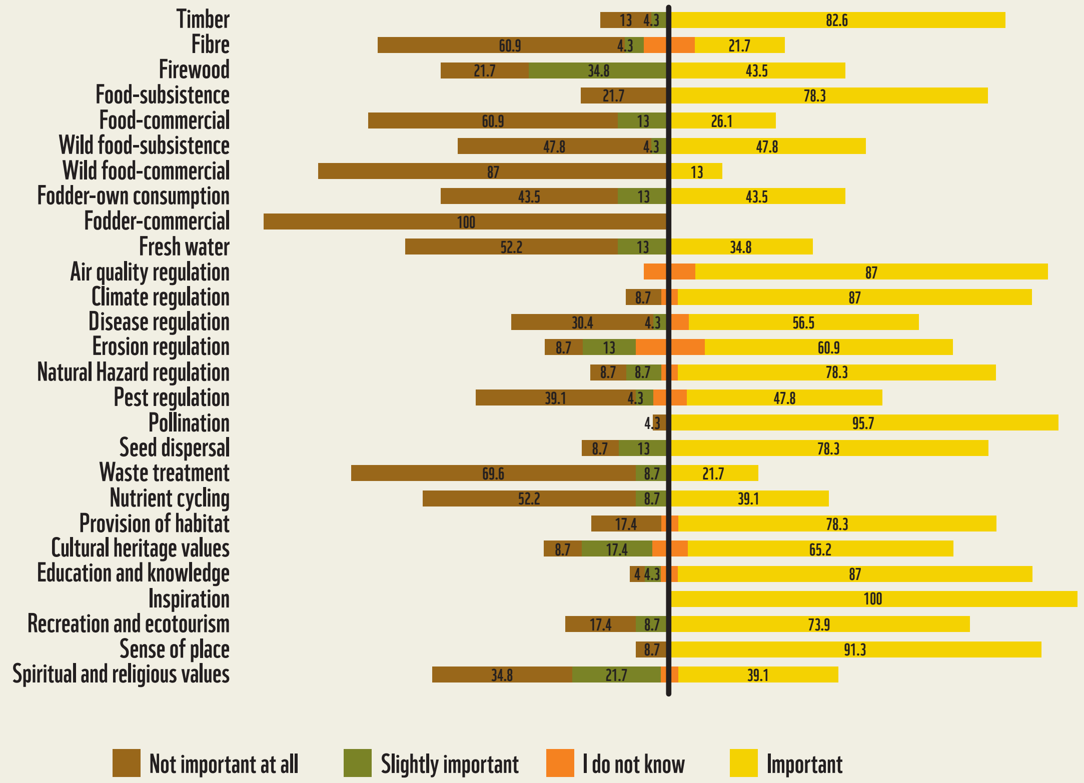
Misiones Upper Parana (Argentina)



Southwest Amazon (Bolivia)



Selva Maya (Mexico)



	Most Important*	Least Important*
Selva Maya	Cultural (except **Spiritual & religious values**), supporting (except **Nutrient cycling**), and regulating services (except **Pest regulation** and **Waste treatment**). 2 out of 11 provision services: **Food-subsistence** and Timber.	**Provision services** with **commercial purposes:** Fodder-commercial, Wild food-commercial, Food-commercial, among others such as Waste treatment, Fibre, Nutrient cycling, and Freshwater.
Lower Pastaza Basin	All supporting, cultural, and regulating services. 5 out of 11 provision services: Freshwater, **Food-subsistence,** Food-commercial, Fish, Timber.	**Provision service:** Wild food-commercial
Southwest Amazon	Cultural (except Inspiration, and **Spiritual & religious values**), regulating (except Natural hazard regulation and **Pest regulation**), and supporting services (except **Nutrient cycling**). 6 out of 11 assessed provision services: Freshwater, **Food-subsistence,** Wild food-commercial, Wild food subsistence, Fish, Timber.	**Provision services** related with **livestock** activity: Fodder-own consumption and Fodder-commercial.
Pantanal	Regulating (except Erosion regulation), supporting (except **Nutrient cycling**), and cultural services (except Recreation & ecotourism, Inspiration, and **Spiritual & religious values**). 5 out of 11 assessed provision services: Freshwater, **Food-subsistence,** Firewood, Fish, Timber.	**Provision services,** mainly those related with **livestock** activity: Fodder-own consumption and Fodder-commercial. Wild food-commercial was also one provision service qualified as least important for most respondents.
Misiones Upper Parana	Supporting, regulating (except **Waste treatment**), and cultural services (except Recreation and ecotourism). Only 3 out of 11 assessed provision services: Freshwater, **Food-subsistence,** and Firewood.	**Provision services,** mainly those with **commercial purposes:** Wild food-commercial, Fodder commercial, Food-commercial, Fiber, and Fish; and one cultural service: Recreation and ecotourism.

*The ecosystem services most and least important are based on the scores given by the majority (> 50%) of the respondents. Recurrent services in all sites are in bold letter

List of ecosystem services and land use/covers associated.

Provisioning services	Regulating services	Supporting services	Cultural services
Fibre	Air quality regulation	Nutrient cycling	Cultural heritage values
Firewood	Climate regulation	Habitat	Education and knowledge
Fodder - for own consumption	Disease regulation		Inspiration
Fodder - commercial	Erosion regulation		Recreation and ecotourism
Food - subsistence	Natural hazard regulation		Sense of place
Food - commercial	Pest regulation		
Fresh water	Pollination		
Timber	Seed dispersal		
Wild food - subsistence	Waste treatment		
Wild food- commercial			

Figure 7. The perceived importance of the ecosystem services in study sites.

Source: own elaboration.

The photographic elicitation assessment revealed that natural ecosystems like forests and water bodies were the most selected option for their direct contribution to respondents' wellbeing (Figure 8). In some cases, respondents selected these options together with cultivated land or backyard farms, which are vital activities in Selva Maya, Misiones Upper Parana, Lower Pastaza Basin, and Southwest Amazon. This selection is consistent with the high ratings given to *food-subsistence* service in the first section of the survey. In turn, cultivated pastures for livestock were the least selected option in four Landscapes (Selva Maya, Lower Pastaza Basin, Southwest Amazon, and Misiones Upper Parana). Interestingly, livestock pastures are prevalent in these territories, which suggests that respondents perceived a lack of benefits from this activity despite frequent engagement and transformation of forests into pastures. Similar dynamics were found with cultivated land used for pitahaya monocultures in Lower Pastaza Basin, with palm-oil monocultures in the Pantanal, and with *yerbales* (for industrial *mate* production), maize and exotic pine monocultures in Misiones Upper Parana. Thus, the findings above suggest a mismatch between some economic activities that are prevalent in the study sites –which can be dominant in terms of frequency, value, and area– and the actual activities from which local inhabitants perceive direct benefits for wellbeing.

	Most selected*	Least selected*
Selva Maya	Aguada (**water body**), **Forest, Backyard farm (family farm)** and **Cultivated land.**	Wetland and **Cultivated Pasture.**
Lower Pastaza Basin	**Water body (river), Forest,** and Indigenous territories.	Cultivated land (slash-cut-burn), **cultivated Pasture,** and **Cultivated land (Pitahaya).**
Southwest Amazon	**High-Forest, Water body (river),** and **Cultivated land (agroforestry-mostly for self consumption).**	**Cultivated pasture.**
Pantanal	**Water body (river)** and **Gallery Forest.**	**Cultivated land (Palmar).**
Misiones Upper Parana	**Native Forest, Water body (river),** and **Horticulture Land (family farm).**	**Cultivated Forest,** Capuera, Perennial **monoculture** (yerbales), Monoculture (maize), and **Pasture.**

*The landscapes most selected based the scores given by the majority (>50%) of the respondents. Recurrent landscapes in all sites are in bold letter.

Figure 8. The selection of ecosystems for their direct importance to local wellbeing.

Our ecosystem degradation assessment revealed that most respondents perceive ecosystem degradation to be prevalent across Landscapes (Figure 9). In every case, respondents perceived decreases in most ecosystem services except for some provisioning (e.g. food and fodder) and cultural services (e.g. recreation and ecotourism). Local water bodies and forests were selected as the most degraded or threatened across the studied sites, which is perceived as diminishing their ability to provide various ecosystem services. Respondents in each country mentioned multiple direct and indirect drivers of ecosystem degradations. **Argentina**: deforestation and the advance of the agricultural frontier, unsustainable agricultural practices such as use of agrochemicals or the development or monoculture tree plantations in the pulp and paper industry, government-led settlement processes and associated population growth and urbanization, loss of indigenous management practices and lack of incentives for conservation among producers, and the prevalence of an economic vision that supersedes environmental sustainability. **Paraguay**: forest conversion to cultivated pasture and hunting practices without appropriate regulation, land appropriation processes, and water pollution from organic and chemical discharges. **Ecuador**: population growth, human infrastructure, climate change, and lack of conservation policies. **Bolivia**: population growth, illegal logging, deforestation and burning, climate change, and mining activities. **Mexico**: deforestation and land use change, illegal activities, climate change, and overexploitation or poor care of certain species

Overall, respondents report accelerated population growth, and the accompanying ill-regulated urbanization, as key drivers for ecological degradation. Note that in many of these cases, accelerated population growth has been dominated by migratory flows as a consequence of colonization policies promoted by governments in the last 50 years. In fact, most of the localities visited were created in the second half of the 20th century, the most recent ones being Calakmul in 1996, in Selva Maya, and the Carmelo Peralta District in 2008, in Pantanal. This demographic trend has given rise to poorly regulated settlement processes where the inhabitants do not have basic services such as waste management or drainage. In addition, this urbanization process is accompanied by the expansion of the agricultural frontier based on a disorganized exploitation of resources.

This also represents a complex governance challenge: immigrants from different places usually have different visions ranging from land management and agricultural practices to different decision-making processes, as exemplified by Selva Maya and Misiones Upper Parana. Population growth has also given rise to the opening of industries and megaprojects from which local inhabitants do not necessarily feel benefited, including the remaining indigenous populations who feel threatened of being displaced from their lands. Industrial and infrastructural megaprojects with increased direct or indirect control of private or foreign capital include: the oil sector (Lower Pastaza Basin); agribusiness and the forestry-paper industry (Lower Pastaza Basin, Misiones Upper Parana); mining industry (Lower Pastaza Basin, Southwest Amazon); large-scale fishing (Pantanal); infrastructural megaprojects as the Maya Train (Mexico's Selva Maya); the opening of new road networks for the extraction of wood, minerals, oil and gas (Lower Pastaza Basin, Southwest Amazon, and Pantanal); and the construction of hydroelectric dams (Southwest Amazon).

In some cases, an important driver of ecosystem degradation is an economic vision that supersedes the environmental considerations and that does not incorporate local populations' viewpoints (Misiones Upper Parana, Lower Pastaza Basin and Selva Maya). Furthermore, the increase in population, the opening of new roads, and poor enforcement of regulations facilitate access to illegal activities such as illegal logging, poaching and extraction of wild flora and fauna, including for the jaguar itself (Selva Maya, Southwest Amazon, Pantanal, Misiones Upper Parana). Similarly, the expansion of the agricultural frontier has led to increasing deforestation, greater propensity for fires, overexploitation and contamination of ecosystems by the dangerous use of agrochemicals or the introduction of exotic crops and pastures. This could be the result of public programs (as in Selva Maya), or of production for global markets (Lower Pastaza Basin and Misiones Upper Parana, for the paper industry, or Pantanal, with transgenic soybeans, oil palms and other biofuel crops), and through the introduction of unproductive pastures destined for livestock activity (Selva Maya, Lower Pastaza Basin, Southwest Amazon, Pantanal).

Most respondents perceive ecosystem degradation to be prevalent across Landscapes.

Respondents report accelerated population growth, and the accompanying ill-regulated urbanization, as key drivers for ecological degradation.

Another set of common drivers includes the lack of monetary support to encourage conservation and a lack of support to facilitate transitions in production systems.

Another set of common drivers includes the lack of monetary support to encourage conservation (Selva Maya, Lower Pastaza Basin) and a lack of support to facilitate transitions in production systems, for instance to move from conventional, extensive cattle ranching to silvopastoral cattle raising suitable for tropical lands (Selva Maya). Also, respondents mentioned the lack of forest management plans at a local scale that take into account the particular characteristics of the territories, identifying their productive vocation and integrating both the environmental and the socioeconomic spheres (Selva Maya). Fig. 2.21 presents a thematic map with a summary of drivers for each of the sites visited.

© Ubiratan G. Surui / WWF-Brazil

Figure 9. Transformation of forests and water bodies. Transformations drivers (top) and solutions (bottom) as perceived by local actors.

Source: own elaboration.

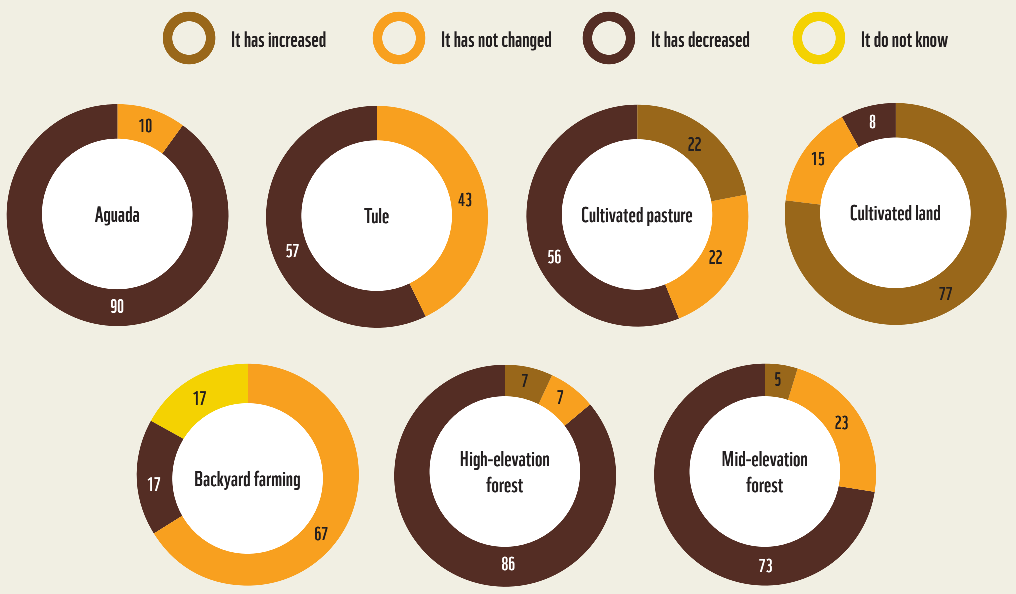
Pantanal (Paraguay)

Lower Pastaza Basin (Ecuador)

Misiones Upper Parana (Argentina)

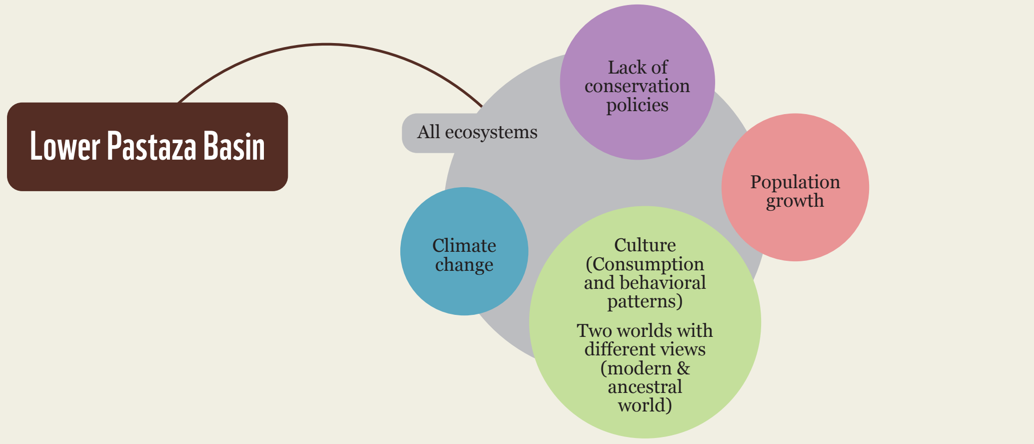
Southwest Amazon (Bolivia)

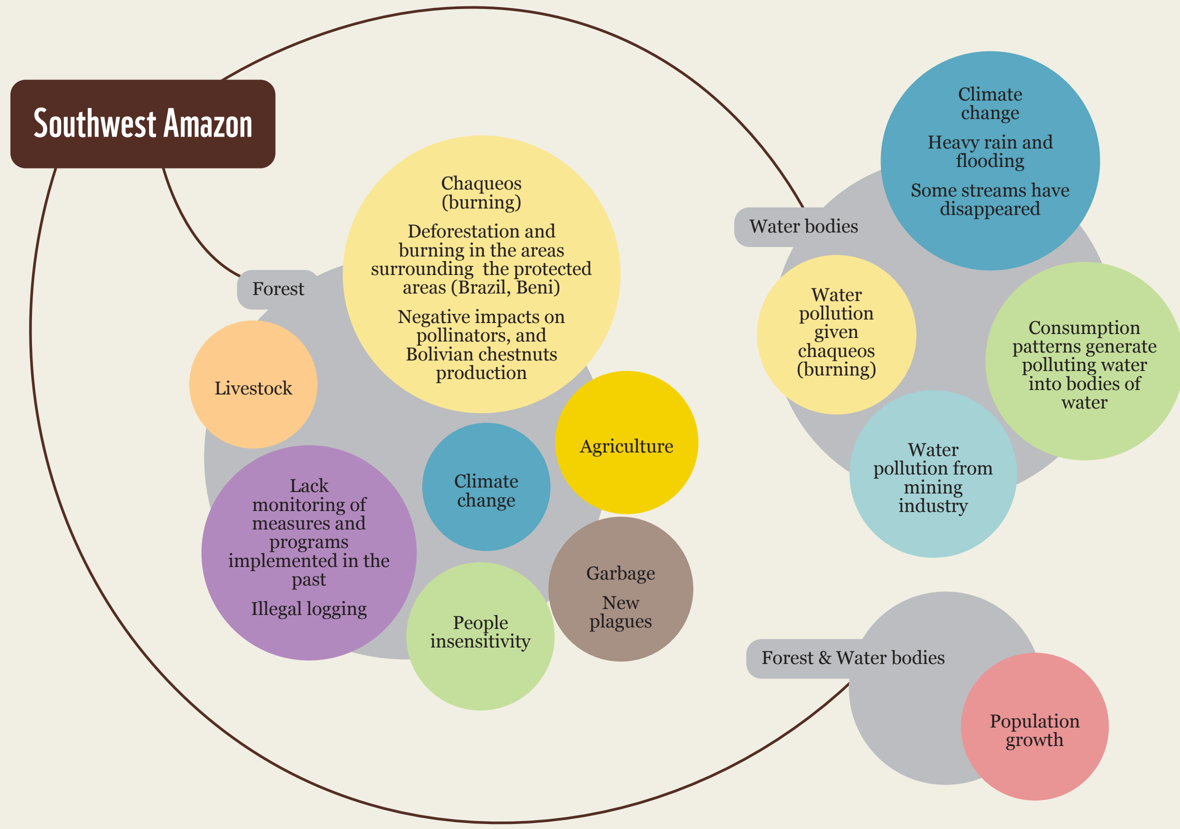
Selva Maya (Mexico)

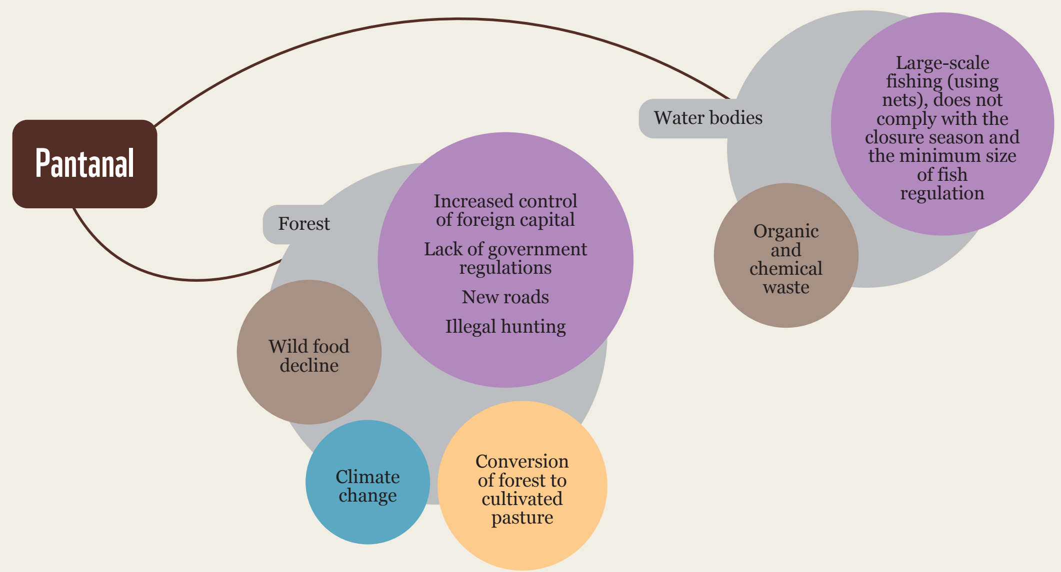


TRANSFORMATIONS DRIVERS

TRANSFORMATIONS DRIVERS

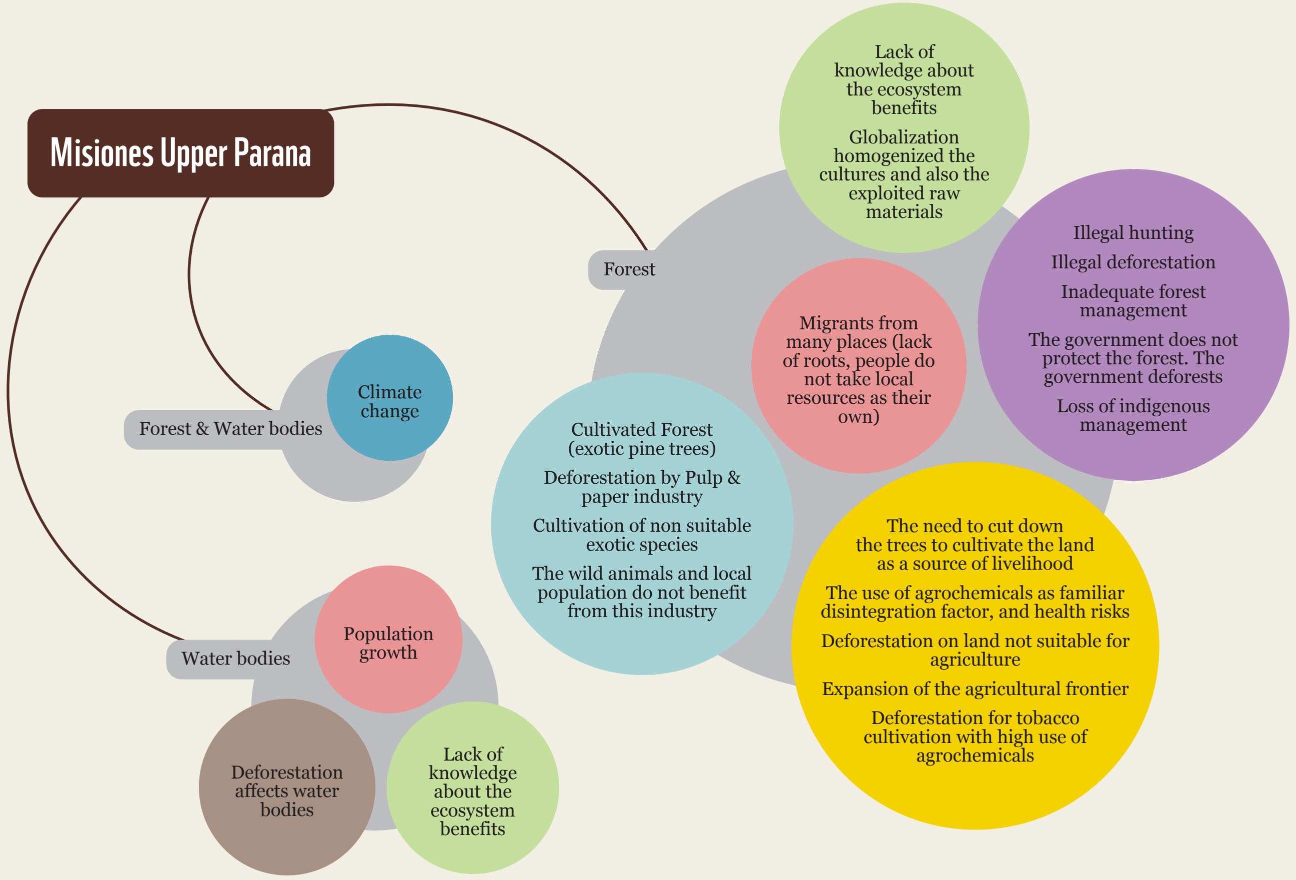




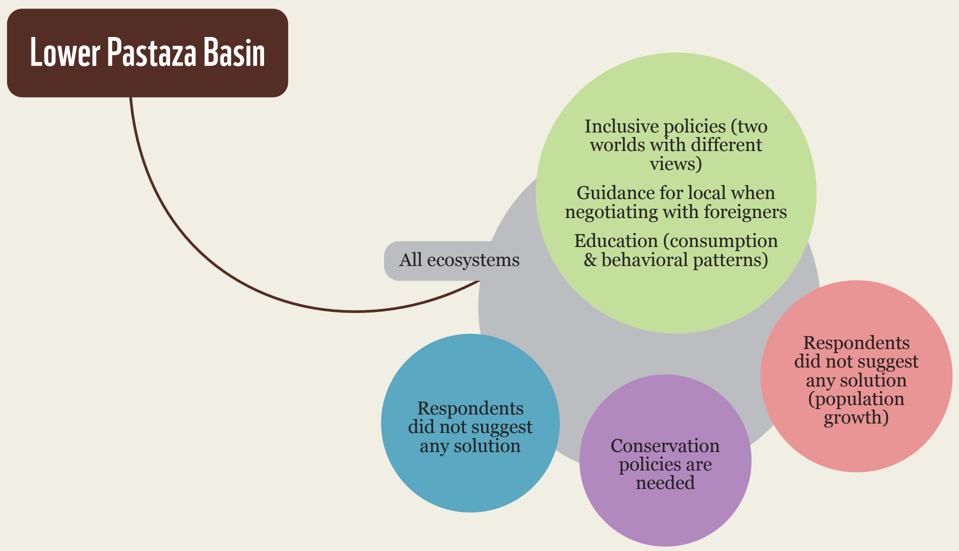


Agriculture | Livestock | Industry | Fires | Culture & Education
Public policy & Regulation | Demographics | Climate change | Other

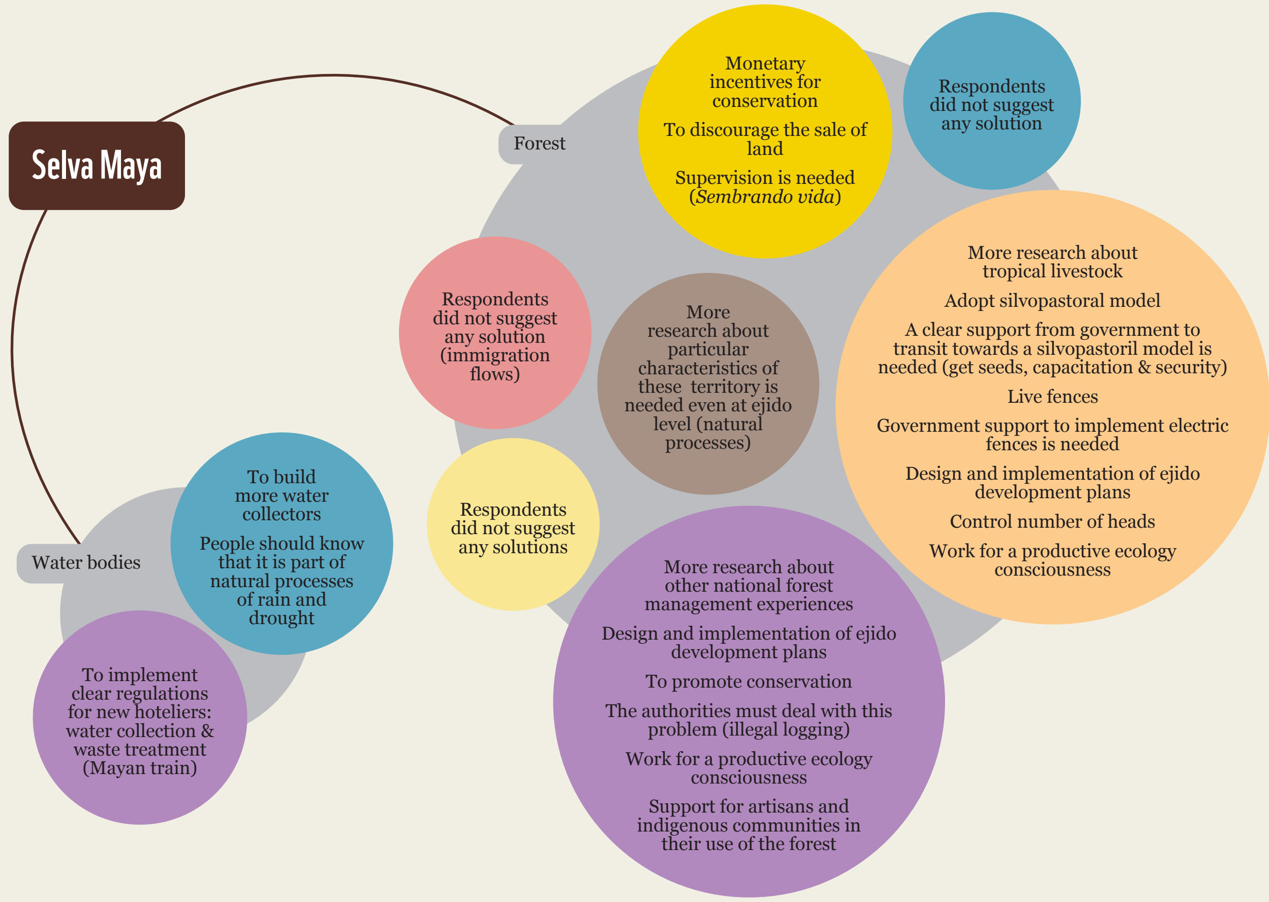
TRANSFORMATIONS DRIVERS

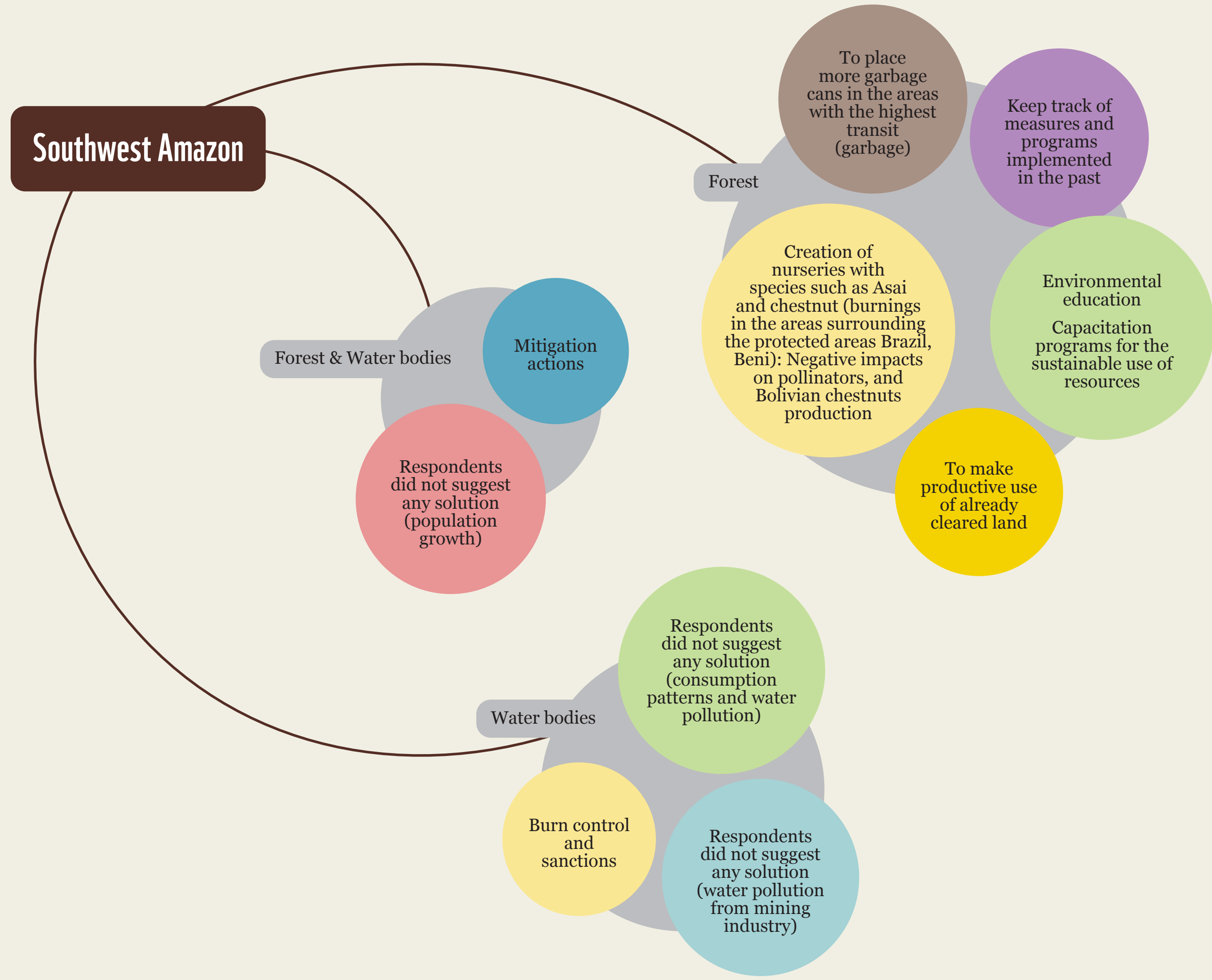


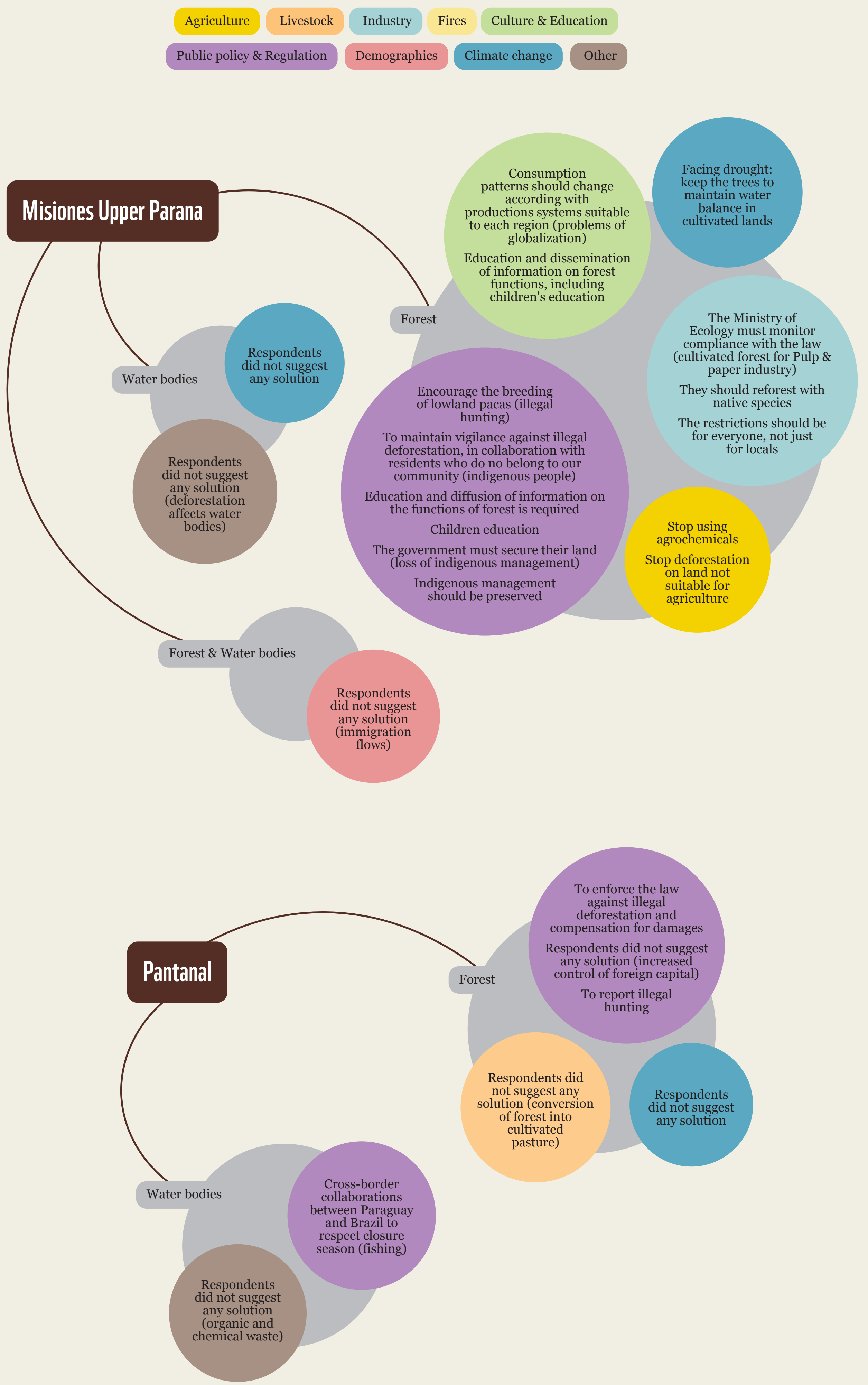
SOLUTIONS



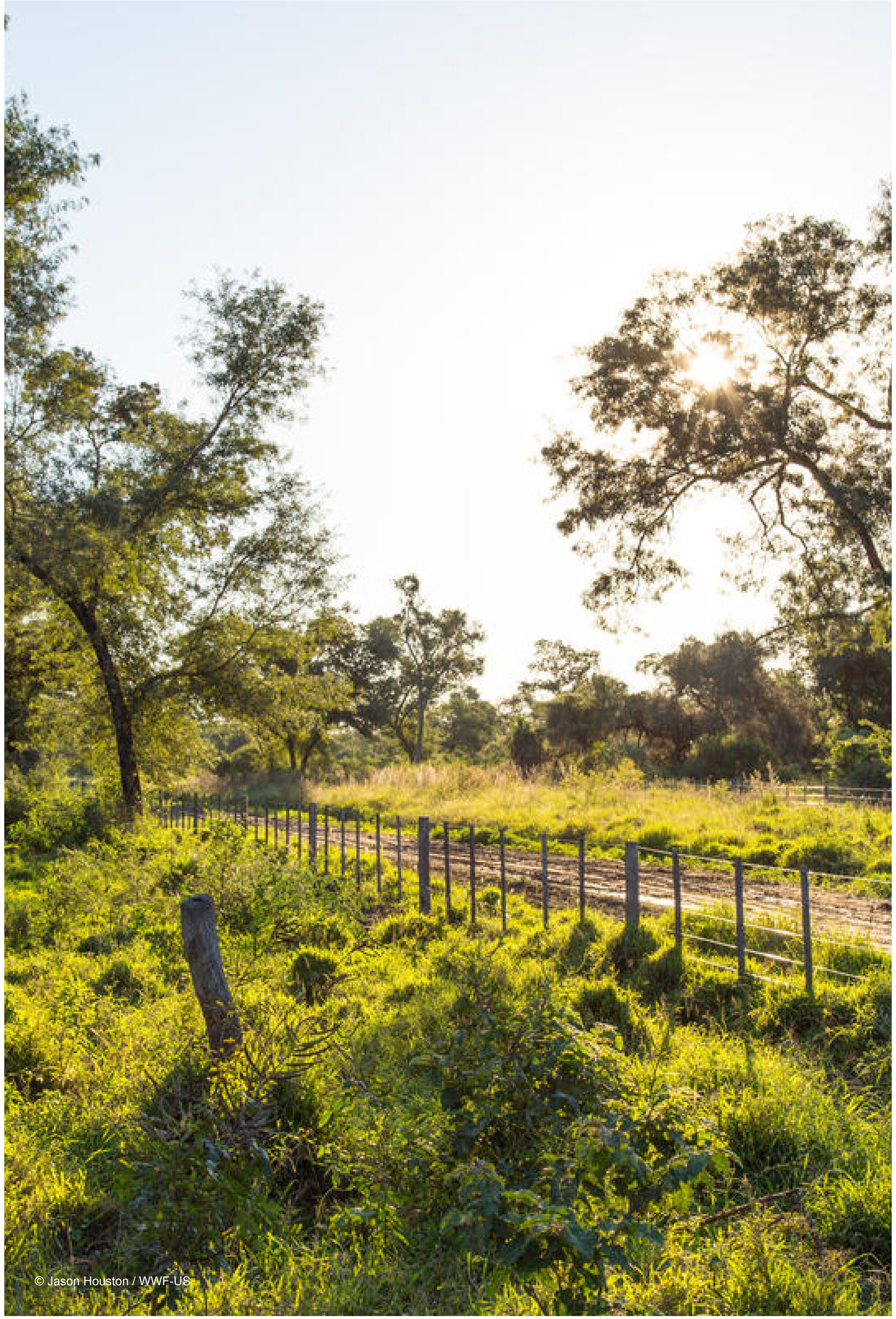
SOLUTIONS







Agriculture
Livestock
Industry
Fires
Culture & Education
Public policy & Regulation
Demographics
Climate change
Other
Misiones Upper Parana
Forest
Consumption patterns should change according with productions systems suitable to each region (problems of globalization)
Education and dissemination of information on forest functions, including children's education
Facing drought: keep the trees to maintain water balance in cultivated lands
The Ministry of Ecology must monitor compliance with the law (cultivated forest for Pulp & paper industry)
They should reforest with native species
The restrictions should be for everyone, not just for locals
Encourage the breeding of lowland pacas (illegal hunting)
To maintain vigilance against illegal deforestation, in collaboration with residents who do no belong to our community (indigenous people)
Education and diffusion of information on the functions of forest is required
Children education
The government must secure their land (loss of indigenous management)
Indigenous management should be preserved
Stop using agrochemicals
Stop deforestation on land not suitable for agriculture
Water bodies
Respondents did not suggest any solution
Respondents did not suggest any solution (deforestation affects water bodies)
Forest & Water bodies
Respondents did not suggest any solution (immigration flows)
Pantanal
Forest
To enforce the law against illegal deforestation and compensation for damages
Respondents did not suggest any solution (increased control of foreign capital)
To report illegal hunting
Respondents did not suggest any solution (conversion of forest into cultivated pasture)
Respondents did not suggest any solution
Water bodies
Cross-border collaborations between Paraguay and Brazil to respect closure season (fishing)
Respondents did not suggest any solution (organic and chemical waste)



© Jason Houston / WWF-US

In terms of potential solutions for ecosystem degradation, respondents mentioned three main types of actions.

- **Actions to enhance the design and enforcement of regulation schemes,** including for programs of compensation for damages, to stop illegal activities (including deforestation, poaching, fishing, extraction of wild flora and fauna, and unsupervised burning) (Selva Maya, Pantanal, Misiones Upper Parana). Respondents noted the need for such regulatory schemes to be inclusive and equitable in terms of the permits and restrictions dictated to industries, indigenous populations and the local population in general (Lower Pastaza Basin, Misiones Upper Parana). Also, active participation of communities was highlighted (Selva Maya, Misiones Upper Parana).
- **Actions to improve cultural aspects and environmental education**. Respondents cited the need to promote local consumption or behavioral patterns compatible with sustainable management of local ecosystems (Selva Maya, Lower Pastaza Basin, Misiones Upper Parana), and the need to disseminate more information and knowledge about the characteristics and functions of the surrounding ecosystems, both to the population in general and to producers in particular (Selva Maya, Lower Pastaza Basin, Southwest Amazon, Pantanal, Misiones Upper Parana). In this same vein, they placed emphasis on the need for scientific research that accounts for the characteristics of each site in order to rethink economic and productive models to be more suitable for the conservation and sustainable use of local ecosystems.
- **Actions to improve environmental policy related to forest management in ways that are consistent with local conditions**. Respondents identified specific environmental policy needs for their local contexts including: direct support to local producers as an incentive for conservation (Selva Maya, Lower Pastaza Basin, Misiones Upper Parana); the preservation of indigenous management models (Misiones Upper Parana, Lower Pastaza Basin); the identification of new areas subject to conservation (Southwest Amazon); the adequate monitoring of measures and programs implemented in the past (Southwest Amazon); the implementation of mitigation measures for climate change (Southwest Amazon); and to launch actions that reflect a clear commitment to the conservation of biodiversity (Pantanal).


© Christian Braga / WWF-Brazil


© Christian Braga / WWF-Brazil


© Silas Ismael / WWF-Brazil


© Daniel Martínez / WWF Perú

3. CONCLUSIONS AND NEXT STEPS

This report has provided a series of novel results and insights related to economic, demographic, environmental policy, and social dimensions across Jaguar Priority Landscapes. Below, we outline key conclusions and the next steps.

Our findings show that conserving jaguar habitats yields substantial economic benefits across the Jaguar Priority Landscapes, primarily through regulatory ecosystem services. Our estimates reveal that the value of forest ecosystem services surpasses the aggregate economic output. We also reveal the economic importance of regulating services like erosion prevention and climate regulation, as well as provisioning services like water, genetic resources, raw materials and food. These findings provide compelling evidence that the conservation of jaguar habitats yields significant economic gains that play a key role in sustaining local livelihoods and advancing broader environmental and climate initiatives. We note that our analysis did not include ecosystem services from other habitats such as freshwater and savannahs, as well as many other ecological gains from jaguar habitat conservation, including safeguarding wider biodiversity and contributing to regional and global climate regulation (Figel et al., 2019; Thornton et al., 2016; WWF et al., 2020).

Yet, our analysis suggests that key economic, demographic and environmental protection trends in the Jaguar Priority Landscapes can present emerging challenges for jaguar habitat conservation into the future. Rising urbanization, agricultural expansion and population growth is posing additional pressure on Jaguar Priority Landscapes, risking further encroachment and human-jaguar conflicts. Also, stagnant and deficient public budgets reduce government capacity to safeguard jaguar habitats. Jaguar conservation requires both to increase the territorial coverage, connectivity and effective management of Protected Areas and to promote conservation outside their boundaries, as with 'other effective-area based conservation measures' (OECMs, see Alves-Pinto et al., 2021). This situation presents opportunities for collaboration and innovation among governments, private, and financial sectors to support the conservation of jaguar habitats.

Finally, our case study analysis among 5 Jaguar Priority Landscapes reveals key insights for developing conservation activities and policies that are better suited to the local context, including: a need for tailored conservation strategies that align with local needs and economic realities, particularly focusing on services that support local livelihoods; policies that encourage nature-based solutions and sustainable practices to maintain ecological integrity enhancing ecological and social outcomes; the potential of incorporating cultural heritage into conservation efforts to bolster community engagement and conservation support; and the potential for education campaigns to raise awareness on environmental issues.

Conserving jaguar habitats yields substantial economic benefits across the Jaguar Priority Landscapes, primarily through regulatory ecosystem services.

© Jacqueline Lisboa / WWF-Brazil

© Luis Barreto / WWF-UK

We provide specific recommendations for further analysis and decision-making among five key types of stakeholders:

1. **Policymakers**

- **Expand Protected Areas coverage:** increase the spatial extent of protected areas to safeguard critical jaguar habitats, ensuring long-term conservation.
- **Implement land use planning policies:** ensure that land use planning policies are enforced and include priority areas for jaguar habitat conservation.
- **Stricter enforcement of environmental law:** strengthen the enforcement of environmental regulations to eliminate illegal deforestation and land conversion in jaguar habitats, ensuring compliance with conservation policies.
- **Leverage global trends for planning, monitoring and implementation**: the Global Biodiversity Framework Kunming-Montreal is a significant tool for the design of National Biodiversity S Action Plans (NBSAPs). Latin American governments are encouraged to use the Global Species Action to conserve and manage native wild species effectively, including the jaguar.
- **Tailor conservation strategies**: develop conservation strategies with engagement from local populations and that align with local needs and economic realities, focusing especially on provisioning services that support local livelihoods like water, raw materials, and food. Prioritize the protection of regulating services, especially erosion prevention and climate regulation.
- **Encourage sustainable practices**: encourage the adoption of nature-based solutions and sustainable practices to maintain the integrity of regulating services (e.g., climate regulation, erosion prevention) and provisioning services (e.g., water and food), which can enhance ecological health and local socioeconomic outcomes.
- **Cultural heritage integration**: incorporate cultural elements in conservation efforts to boost community engagement and support for conservation.
- **Educational campaigns**: promote education campaigns to enhance local awareness of environmental issues and the local benefits of jaguar habitat conservation.

2. **Civil society**

- **Collaborative efforts**: promote partnerships with various stakeholders –e.g. policymakers, communities, civil society, financial sector– to amplify conservation impacts, share resources, and unify strategies across different sectors to ensure a cohesive and effective approach to jaguar habitat conservation.
- **Monitoring and reporting**: implement systems that monitor both the socioeconomic and ecological impacts of regulating and provisioning services within jaguar habitats. This data will inform more nuanced conservation strategies and help track the benefits of services like climate regulation and resource provisioning, guiding policy decisions.
- **Capacity building**: organize training and capacity-building workshops for key local stakeholders like communities or local policymakers and decision makers to enhance their knowledge and skills related to jaguar conservation.
- **Legal and policy advocacy**: engage in advocacy to strengthen and enforce environmental laws and policies that protect jaguar habitats.
- **Fundraising and resource allocation**: Conduct fundraising campaigns to help fill gaps in the financial resources necessary for ongoing conservation efforts.

3. **Financial sector**

- **Risk disclosure**: disclose nature-related dependencies as well as the impacts, risks, and opportunities to better manage nature-related financial risks.
- **Investment in ecosystem services**: ensure that the economic value of regulating services (e.g., climate regulation, water purification) and provisioning services (e.g., raw materials, water) is fully integrated into risk assessments and investment strategies, recognizing their critical importance for long-term financial stability and conservation success.
- **Blended finance strategies**: promote blended finance strategies that combine capital from public, private, and philanthropic sources, thus helping to fund conservation projects that may not be commercially viable on their own and to unlock new investment opportunities.
- **Green bonds and impact investing**: Encourage the issuance of green bonds and support impact investing that explicitly targets conservation efforts in jaguar habitats, which can help mobilize substantial resources for jaguar conservation.
- **Incentives for conservation efforts**: work with governments to create financial incentives for local communities, companies, and investors to engage in conservation activities, such as tax breaks or reduced rates on loans for environmentally beneficial projects, or payments for ecosystem services (PES) schemes in which communities receive payments for voluntarily engaging in conservation.

4. **Private sector:**

- **Adopt policies to eliminate deforestation, conversion and human right abuses** from entire supply chains with a time-bound implementation plan that sets a clear cut-off date, target date and milestones. Require all direct and indirect suppliers to adopt and implement equivalent action across entire operations.
- **Require traceability** for all commodity volumes sources from direct and indirect suppliers to the level needed to ascertain compliance and ensure that traceability cascades upstream to the origin through supplier requirements and engagement.
- **Mobilize directly or in collaboration with the supply chain financial and technical support** for expansion of existing agricultural or degraded land and to incentivize producers to conserve and restore native vegetation on property beyond legal obligations.
- **Publicly advocate to producer and consumer governments and authorities** for binding regulations, enabling policies and investments that eliminate deforestation, conversion and human rights risks from commodity production and trade, and accelerate protection and restoration of forests and other natural ecosystems.
- **Collaborate with relevant stakeholders in production landscapes** including other companies, producers, government authorities, and civil society - to overcome systemic drivers of deforestation, conversion, and human rights abuses and to achieve long-term protection, restoration, and inclusive local development outcomes across these landscapes.


© WWF-US / Yawar Films

5. **Local communities**

- **Community engagement in conservation**: participate directly in conservation efforts that are localized and beneficial to community wellbeing, leveraging traditional knowledge and practices.
- **Benefit-sharing agreements**: devise adequate benefit-sharing agreements according to the local context, to ensure that engagement in conservation is beneficial and fair.

6. **Producers**

- **Adopt and implement deforestation and conversion free production and management,** respecting human rights.
- **Adopt responsible production practices** that enable sustainable intensification of production on already converted land, protect natural ecosystems, restore ecosystem services, reduce the use of chemical inputs and increase carbon sequestration in the soil.

7. **Academia**

- **Economic valuation analysis in understudied regions:** conduct additional analysis in geographic regions less studied in ESVD database.
- **Environmental history studies**: conduct detailed studies on the environmental history of jaguar habitats to understand the long-term dynamics between human communities and these ecosystems.
- **Economic analysis of global processes**: analyze local economic impacts of global processes, such as those related to biodiversity loss and climate change, to better represent these dynamics in economic valuation.
- **Policy analysis**: Study the political economy surrounding environmental protection policies to identify the main drivers and barriers to effective policy implementation.

METHODOLOGICAL APPENDICES

APPENDIX A - DEMOGRAPHIC CONDITIONS, ECONOMIC ACTIVITIES AND ENVIRONMENTAL PROTECTION TRENDS

A1. URBANIZATION TRANSITIONS

Figure A1.1. presents a framework for urbanization transitions outlining a general pattern regarding the dependency of economic needs on local ecosystems in the urban/rural continuum. Under this framework, rural communities strongly depend on local ecosystems for the provision of several services that are essential for survival and livelihood maintenance. In contrast, urbanizing communities start substituting local ecosystem services with goods and services produced commercially outside the local economy.

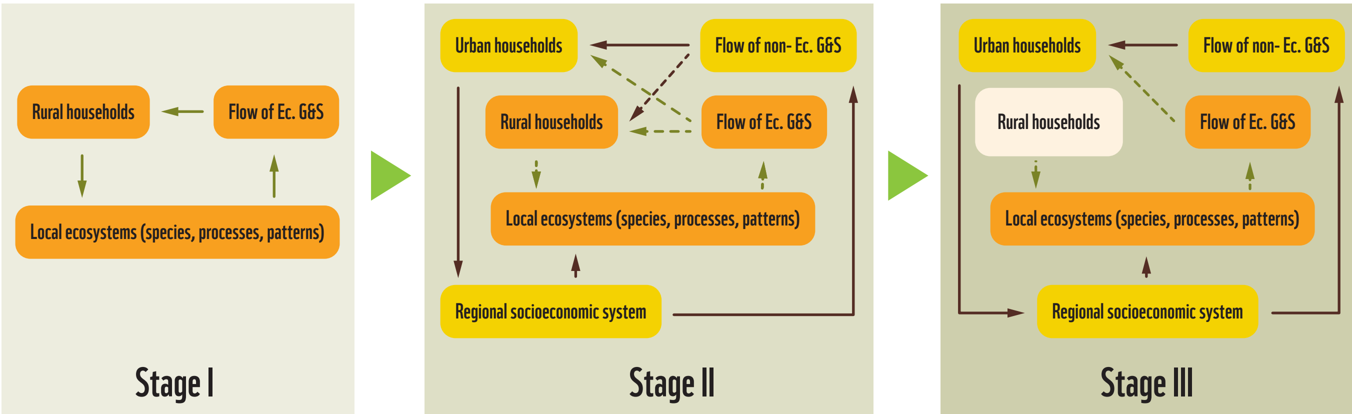


Figure A1.1. Urbanization transitions and dependence on ecosystem services.

Note: Ec.G&S: Ecosystem goods and services.

Source: adapted from Cumming et al. (2014).

In Stage I, the community remains mainly rural, its economy is determined locally and there is a high dependence on local ecosystems for food, materials, energy and other services. In Stage II, the community starts to grow and to urbanize, and therefore the total population now is divided among rural and urban localities. Urban economies are not necessarily self-sufficient for the satisfaction of their economic needs, and therefore import goods and services produced elsewhere in the regional economy. As the consumption patterns in both rural and urban households are now satisfied with a bundle of goods and services coming from both local ecosystems and from the regional economy, the links between households and ecosystems start to weaken (therefore the dashed lines in the diagram) and the service sector gains importance in the local economy. However, even if the contact of urban households with local ecosystems becomes scarce, their dependence cannot be null: some goods and services that are essential for urban life are provided by local ecosystems (water, energy, food, regulation of local climate, recreation opportunities, etc.). The interdependencies shown in Stage II can be unstable and unsustainable if the local economy continues to grow and urbanize, and therefore degrade the local ecosystem. Stage III shows a situation in which all the population resides in urban areas (like in a municipality pertaining to a large metropolis). Consumption patterns are largely satisfied with commercial goods and services coming from elsewhere in the regional economy, and even the requirements for food, energy or water are satisfied with flows originating from increasingly larger distances. The urban economy is characterized by a rapid process of land use change in which forested areas give way to the agricultural frontier and to urban settlements. The sustainability of local ecosystems is heavily compromised, and the urban population (much likely residing in a large metropolis) is increasingly alienated from its dependence on local ecosystems.

Based on this framework, we classified populations in each Jaguar Priority Landscape according to their urbanization stage (Table A1.1). Our results show that the majority of municipalities within jaguar landscapes (57%) classify in Stage II, that is, a situation in which rural and urban communities share the territory. In total, 12.9 million people live in these municipalities, exhibit an aggregate urbanization rate of 44%, and concentrate in Mexico's Central Pacific and Selva Maya, in Brazil's Southern Amazon Mosaic, in Ecuador's Lower Pastaza Basin, and tripartite Misiones Upper Parana. In general, agriculture contributes a smaller fraction of the local economy than in Stage I (a median of 45% versus 66%), whereas the service sector has a larger share than in stage I (45% versus 22%, see Figure A1.2). In these municipalities, settlements are transitioning into urbanization, meaning larger populations in cities with tens of thousands of inhabitants, a factor explaining the increasing predominance of the service sector in the local economy.

Table A1.1. Distribution of landscapes' municipalities among the three urbanization stages

	Landscape	I Rural / Local Economy			II Rural + Urban / Local & Regional Economy			III Urban / Regional Economy		
		# Mun.	Pop.	%Urban	# Mun.	Pop.	%Urban	# Mun.	Pop.	%Urban
1	Central Pacific	29	258,866	1	75	1,749,003	45.4	40	2,893,229	88.3
2	Selva Maya				30	1,830,282	37.6	5	654,814	85.4
3	Sierra de las Minas Biosphere Reserve	2	104,387	8.5	12	430,030	29.5	2	75,072	97.5
4	Honduras Caribbean Biological Corridor	1	8,150	0	17	926,201	48.5	9	1,622,282	88
5	Eastern and Coastal Amazon				12	288,921	57.3	6	562,279	95.4
6	Southwest Amazon	14	121,327	1.9	24	542,881	39.5	11	684,483	79.2
7	Southern Amazon Mosaic	12	66,972	0	35	1,174,290	46.4	7	631,203	90.6
8	Napo Putumayo Meta Caqueta	3	8,192	9.1	49	900,627	48.8	11	1,091,973	88.3
9	Lower Pastaza Basin	6	164,331	6.3	43	1,816,178	37.5	2	2,325,043	72.4
10	Gran Chaco	1	7,418	0	7	145,303	33.9	1	19,829	82.4
11	Impenetrable Corridor				7	229,148	59.5	3	635,858	96.6
12	Pantanal				31	418,481	41.1	17	1,227,251	91.7
13	Misiones Upper Parana				83	1,825,379	52.1	25	1,528,083	90.6
14	Brazilian Coastal Atlantic Forest				37	635,273	48.4	101	32,855,762	98.5
Total		**68**	**739,643**	**3.4**	**462**	**12,911,997**	**44.3**	**240**	**46,807,161**	**94.9**

Note: criteria stage classification are as follows: Stage I = rural population larger than 90%; Stage II = rural population between 30% and 90%; Stage III = rural population lower than 30%.

Source: Own elaboration with data from CEPALSTAT (https://statistics.cepal.org/portal/cepalstat/index.html?lang=es).

About a third of municipalities within jaguar landscapes classify under Stage III, representing the home of 75% of people living in these landscapes, or 46.8 million people. These include large population municipalities in Brazilian Coastal Atlantic Forest (including the São Paulo and Rio de Janeiro metropolitan areas), in Ecuador's Lower Pastaza Basin (including Quito's metropolitan area), in Honduras Caribbean Biological Corridor (including San Pedro Sula's metropolitan area), and in Mexico's Central Pacific (including the cities of Colima, Puerto Vallarta, Tepic and Lázaro Cárdenas). The urbanization rate is near total for these municipalities, and agriculture's contribution is usually less than 10% of local economies, whereas services contribute 60% or more to local economies (see Figure A1.3).

Only 8% of municipalities are classified under Stage I, concentrated in Mexico's Central Pacific, and the Southwest and Southern regions of the Amazon Basin. Together, these 68 municipalities are home to 740 thousand people (just below 10% the total population in Jaguar Priority Landscapes), while only 3.4% live in urban localities. In general, municipalities in Stage I have relatively scarce populations in rural communities and engage dominantly in agricultural activities.

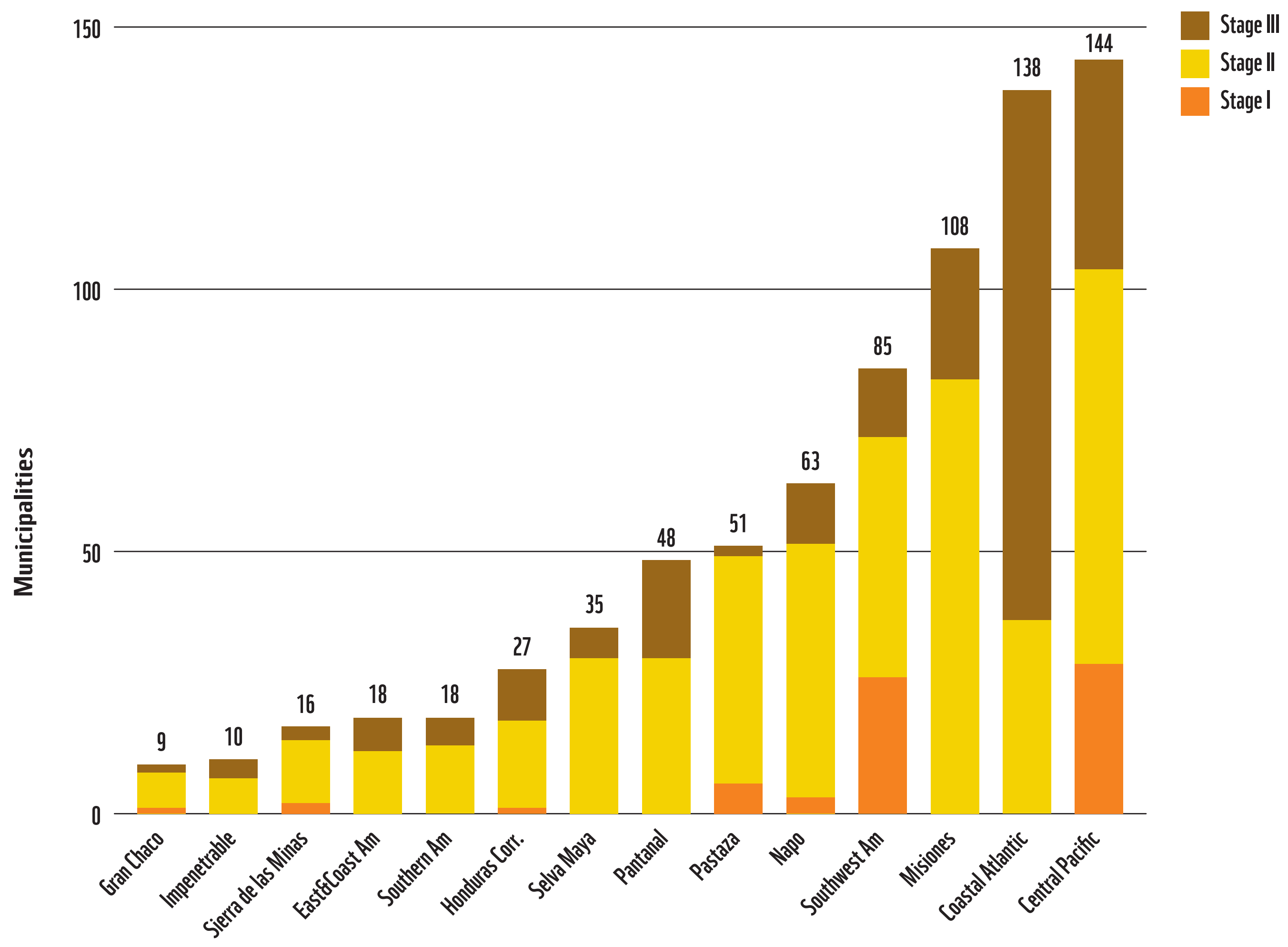


Figure A1.2. Distribution of Jaguar Priority Landscapes' municipalities in urbanization stages.

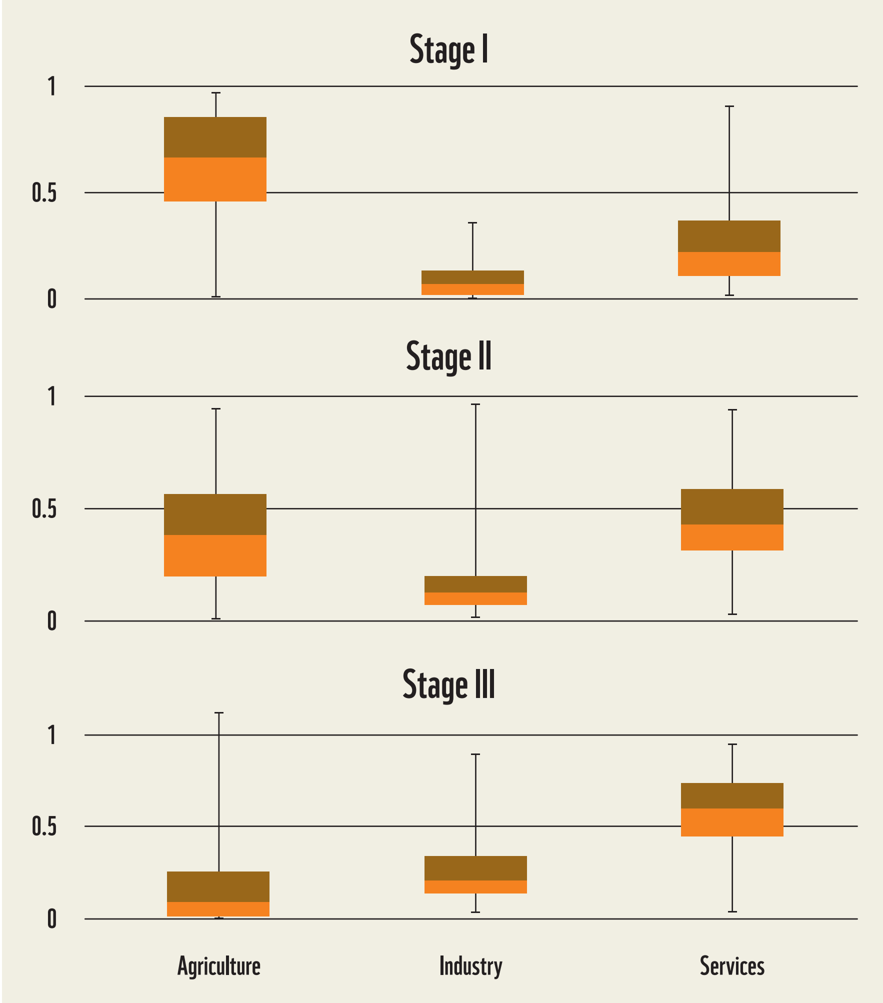
Note: criteria for stage classification are as follows: Stage I = rural population larger than 90%; Stage II = rural population between 30% and 90%; Stage III = rural population lower than 30%.

Source: Own elaboration with data from CEPALSTAT (www.statistics.cepal.org).

Figure A1.3. Relative importance of economic sectors in local economies among the three urbanization stages.

Note: criteria for stage classification are as follows: Stage I = rural population larger than 90%; Stage II = rural population between 30% and 90%; Stage III = rural population lower than 30%. Vertical lines show minimum and maximum values. Boxes are defined with the first and the third quartiles. The line inside the box is the median.

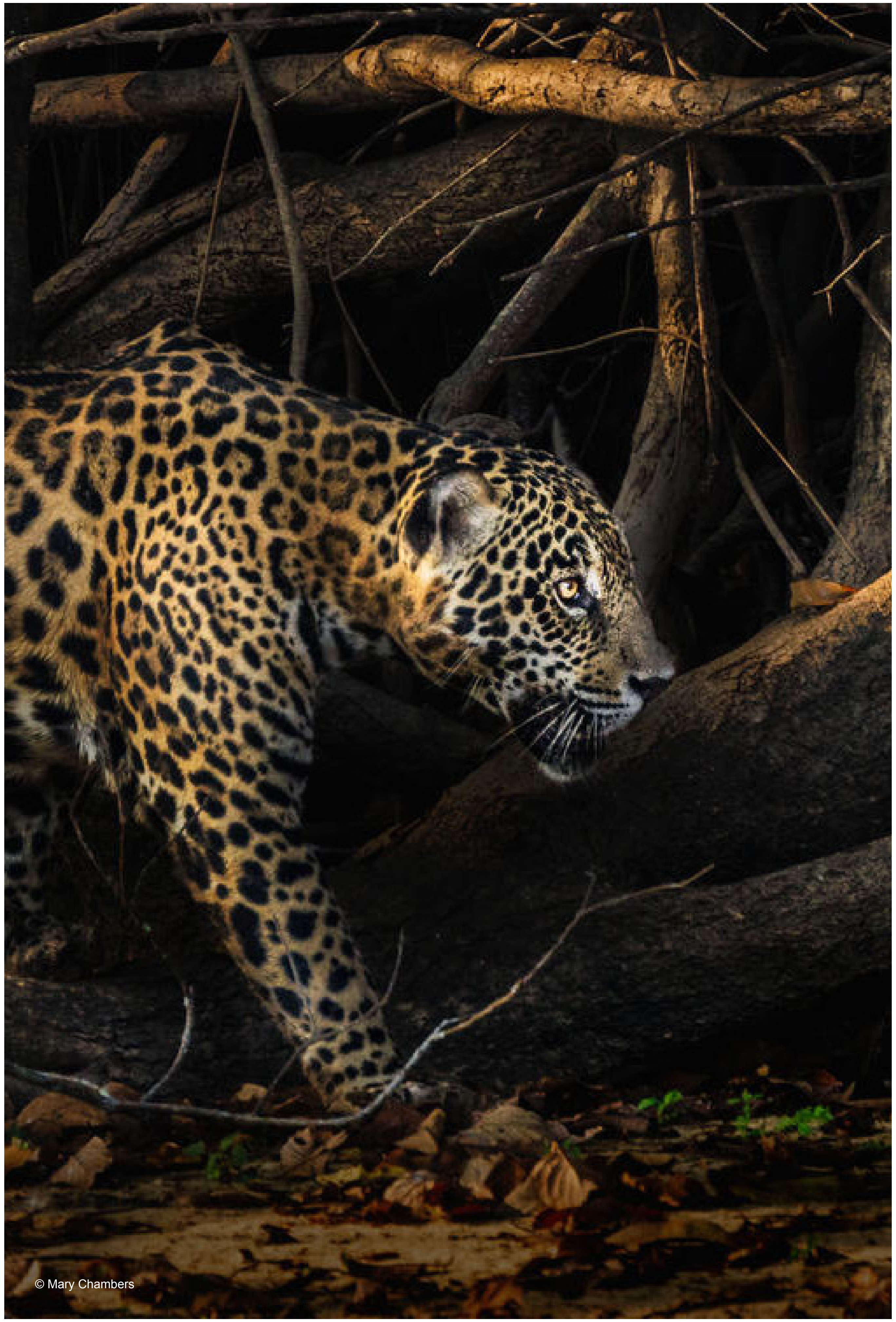
Source: own elaboration with data from multiple sources (ECLAC, 2022).



A2. PROTECTED AREAS

For our analysis of Protected Areas in the jaguar range, we identified non-marine Protected Areas offered by Álvarez-Malvido et al. (2021), and available in the World Database of Protected Areas (WDPA, see UNEP et al., 2024) for the 14 countries where Jaguar Priority Landscapes are located. For these countries, the WDPA reports close to 7,500 Protected Areas in 2020, comprising 6.06 million km² of non-marine terrestrial and coastal regions. They are cataloged under one of four governance arrangements: public (federal, state or municipal), private, mixed, or under local and indigenous management. According to Álvarez-Malvido et al. (2021), the extension and location of these areas ensure that the region fulfills the Global Biodiversity Framework targets of having at least 30% of marine and terrestrial areas under some form of protection, although these numbers do not necessarily hold nationally. For this report, we restrict the universe of Protected Areas under analysis to only include countries containing jaguar priority landscapes, but expand relative to Álvarez-Malvido et al. (2021) to include areas listed up to 2024. This filter yields 7,488 Protected Areas within the 14 countries containing jaguar priority landscapes, comprising 6.06 million km².

To further focus our analysis, we then filtered the database to include only Protected Areas in Jaguar Priority Landscapes, resulting in 857 Protected Areas spanning 1.178 million km².



© Mary Chambers

APPENDIX B - ECONOMIC VALUATION

This section provides additional methodological details associated with the procedures to estimate the economic value of ecosystem services in the Jaguar Priority Landscapes.

B1. DETAILS ON THE ESVD DATABASE

In this report, we use data from Ecosystem Service Valuation Database (ESVD) (Brander et al., 2024), the most comprehensive effort to date for a constantly updated global repository of primary valuation studies. The ESVD follows and updates the initiatives *The Economics of Ecosystems and Biodiversity* (TEEB, 2010) and the *Common International Classification of Ecosystem Services* (CICES, Haines-Young and Potschin, 2012) for their classifications of ecosystem services, of methods for economic valuation and of global biomes.

The starting point is constituted by the physical processes and structures of ecosystems. From society's point of view, these structures and processes are understood from a functional perspective and organized into four categories of services, as in the *TEEB* and *CICES* initiatives: provision, regulation, maintenance/habitat and cultural services. These processes and structures are also categorized into broad categories of biomes, so as to distinguish their main ecological features and their spatial specificity. We utilize the conventional eight categories of biomes, as presented in the ESVD. At the global level, the ESVD compiles over 9,400 valuation data points (as of late 2024) from the peer-reviewed literature or from official publications, and classifies them by service, biome and method while standardizing the monetary figures into international USD for 2020 (Table B1.1)

brasil Coastal atlantic forest © Adriano Gambarini WWF-Brazil

Table B1.1. Global biomes and ecosystem services in the ESVD database

Global biomes		Ecosystem services	
1. Open Ocean	11. Desert	**Provision**	**Habitat**
2. Coral reefs	12. Tundra	1. Food	16. Maintenance of life cycles of migratory species
3. Coastal systems	13. High mountain/ Polar systems	2. Water	17. Maintenance of genetic diversity
4. Tropical forest	14. Cultivated areas	3. Raw Materials	**Cultural**
5. Temperate forest	15. Urban green & blue infrastructure	4. Genetic resources	18. Aesthetic information
6. Woodland and shrubland	16. Inland unused or sparsely vegetated	5. Medicinal resources	19. Opportunities for recreation and tourism
7. Grass-rangeland		6. Ornamental resources	20. Inspiration for culture, art and design
8. Mangroves		**Regulation**	21. Spiritual experience
9. Inland wetlands		7. Air quality regulation	22. Information for cognitive development
10. Rivers and lakes		8. Climate regulation	23. Existence and bequest values
		9. Moderation of extreme events	
		10. Regulation of water flows	
		11. Waste treatment	
		12. Erosion prevention	
		13. Maintenance of soil fertility	
		14. Pollination	
		15. Biological control	

Source: own elaboration based on ESVD data retrieved in 2022.

The standard approach for economic valuation is built on the notion of "total economic value," which includes "use values" and "non-use values"**.** The former refers to social and economic activities in which ecosystem goods and services are actually utilized directly (as in the extraction of wood, of water or of fish), indirectly (as in the dependence of crops or fisheries upon pollination or mangroves), or optionally (as in the future possibility of direct or indirect uses). The latter refers to social and economic activities in which ecosystem goods and services are valued even if they are not subject to any type of direct, indirect or optional use (as in the social value or benefit coming from their mere existence).

Methods for economic valuation are classified by whether they are based on "revealed" or on "stated" preferences. Revealed preferences refer to the decisions of economic agents over environmental goods and services that are observable in existing markets. When environmental goods and services do receive a price, economic valuation is direct and based on standard market analysis, both for consumers (with demand theory) or for producers (with cost theory). Alternatively, for cases in which environmental prices do not exist, valuation is indirect and based on priced activities that are linked to the unpriced goods and services to be valued, as with the cost of travel or with hedonic pricing, in the demand side, or with the production function in the supply side. Other cost methods also based on observable market information display hypothetical situations, like the need for replacing a particular environmental good or service with a technological alternative.

For those environmental goods and services not subject to revealed preferences, economic valuation is based on stated preferences, or the active consultation to economic agents about their environmental preferences. These methods are direct in the sense that they extract the monetary figures from the agents' statements, and they are based on the design and implementation of surveys, as with contingent valuation or with choice experiments. All of these methods are understood as "primary," or the analysis of information about the economic behavior of agents, be it from observed data or from *ad-hoc* surveys and interviews, and they are specific for case studies, involving particular locations, populations, and points in time. These primary studies constitute the foundation for exercises of benefit transfer.

Despite many virtues, there are some methodological shortcomings that apply generally to this method, in particular to the simple implementations in which no adjustments to primary values are done when applying them to different locations or study sites. The most important ones are:

1. When monetary estimates refer to behavioral variables (such as stated willingness to pay), a simple benefit transfer assumes that the same socioeconomic factors explaining behavior in the primary study site are explanatory for other study sites. In other words, it assumes the constancy of preferences across regions and time.
2. Similarly, when monetary estimates refer to observed market variables (such as prices or production costs), a simple benefit transfer assumes that the market structures that are relevant in primary studies (regarding, say, regulation, rule of law, competition, etc.) are applicable to the sites and situations of secondary studies.
3. In large-scale valuation studies, it is common that divergent information about ecosystems and their monetary value are collapsed into a unique figure, say, $/hectare/year. A simple benefit transfer assumes homogeneity in ecosystems, tacitly assuming physical units that are unrealistically homogenous (as in 1 hectare of "forest," or "wetlands"), and in economic benefits, also assuming that one dollar of economic benefit obtained from mangroves in Florida, say, will be the same if obtained from mangroves in Brazil.

There are several procedures to deal with these methodological shortcomings of simple transfers. These range from straightforward numerical adjustments reflecting differences in inflation or purchasing power between primary and secondary sites, to the application in secondary sites of the value generating function applied in primary sites as well as study cases for specific geographies. While the latter might be preferable to the former, it requires more and consistent information from primary sites, which is not always the case, particularly with large-scale valuation studies. While there is not a unique recipe that is valid for every case and situation, there can be a trade-off between simplicity and accuracy of transfer exercises. This report attempts to overcome these challenges in two main ways:

1. The construction of the ESVD performs several standardizations of primary studies enhancing their comparability (Brander et al. 2024) including
   a. Physical units
   b. Beneficiaries
   c. Currency (with purchasing power parity, estimated in international USD)
   d. Price level (to 2020 as a base year)
   e. Temporal units
2. Our approach, shown in Figure 5, filters outliers and selects studies that are relevant to the ecosystems constituting jaguar's habitat in Latin America, such that the transfer exercise is based on local conditions (both ecological and social).

B2. FILTERING THE ESVD DATABASE

We downloaded a geographically filtered ESVD database with 1163 entries by selecting only countries from the 14 countries of the Jaguar Priority Landscapes (downloaded on 24 August 2024). We then applied the following filters to obtain a subset of relevant valuations:

1. Removed entries with missing values (n=475)
2. Removed entries that focused on multiple ecosystem services, to enable ecosystem service disaggregation (as per Brander et al. 2023) (n=110)
3. Removed entries that focused on multiple biomes, to enable biome disaggregation (as per Brander et al. 2023) (n=62)
4. Removed entries that focused on multiple countries, to enable country disaggregation (n=28)
5. Removed entries based on value transfer, to maintain only primary studies (as per Brander et al. 2023) (n=14)
6. Removed entries that do not focus on either temperate or tropical forests (n=244). We opted for focusing on forest for two main reasons: i) as shown in Figure 5, forests represent almost three quarters of all total land in the Jaguar Priority landscapes; ii) a matching exercise between biome categories from ESVD and land cover categories from Globeland30 revealed that 74% of the matched entries correspond to either tropical and temperate forests. We note, however, that the Globeland30 forest category does not distinguish between temperate and tropical forests. We therefore provide disaggregated measures by forest type, when possible.
7. Removed outliers outside 1.5 times the Inter Quartile Range (IQR) of log transformed values (n=219) (as per Brander et al. 2023).

This filtering exercise enabled us to obtain a filtered database sample containing 219 relevant valuation data points that focus on temperate or tropical forests.

These data points are not distributed evenly among countries or biomes, and rather reflect the level of academic and institutional literature included in the database. Tropical forests dominate this sample, representing 81.3% of all studies from ten countries, whereas the remaining 41 valuation points that focus on temperate forests are all based in Brazil. At the country level, 86.8% of all 219 valuations in the sample are based on three countries: Brazil (n=123), Guatemala (n=41), Colombia (n=26). An additional seven countries contain 14.2% of valuation data: Mexico (n=10), Ecuador (n=9), Peru (n=3), Paraguay (n=3) Honduras (n=2), Argentina (n=1), Bolivia (n=1). Yet, the valuation sample does not include a single study from four countries: Belize, French Guiana, Suriname, Guyana. This geographic concentration implied the need to make assumptions for assigning value

© Santiago Gibert / WWF Mexico

B3. USING LAND COVER DATA FROM GLOBELAND30

The second step consisted of the following:

1. Data collection. We downloaded the Globeland30 database (Jun et al., 2014), which contains a global database of different land covers at 30-meter resolution: forest, shrubland, cultivated land, artificial surfaces, bare land, grassland, wetland, water bodies.
2. Data filtering. We filtered the database geographically to include only areas contained within the Jaguar Priority Landscapes.
3. Surface calculation per land cover. Based on the filtered Globeland30 database, we calculated the amount of hectares per land cover category in the Jaguar Priority Landscapes. The data allows to disaggregate spatially to individual countries or Landscapes (Figure 5).

B4. MERGING ECONOMIC VALUATION AND LAND COVER DATA

The third step of our methodology (see Figure 5, Table 5) involves merging the economic valuation information from the ESDV database with the land cover information from the *Globeland30* (2020) database (Jun et al., 2014).

The result of this approach are per hectare multi-service annual values constructed with studies relevant for Latin America, defined in international 2020 USD, which are then multiplied by the relevant land covers across the Jaguar Priority Landscapes at a per hectare level. As noted in Section B2, we opted for focusing only on forests because of their importance across the landscapes in terms of land cover, as well as because most relevant studies from the ESVD focus on forests in these countries. This matching exercise enabled us to obtain a range of values as shown in Table 6.

© Audra Melton / WWF-US

APPENDIX C - ANALYSIS OF LOCAL PERCEPTIONS

C1. SURVEY PARTICIPANTS

In total, we conducted 105 surveys in the selected Jaguar Priority Landscape (Table C3.1). In all cases, we sought to survey different types of actors to obtain diverse opinions and perceptions related to ecosystem services.

Table C3.1. Surveys conducted

Jaguar Priority Landscape	Local actor				Grand Total
	Communal/indigenous authorities and NGOs	General population	Institutional authorities	Local producers	
Pantanal (Paraguay)	6		6	8	20
Lower Pastaza Basin (Ecuador)	9	3	5	5	22
Misiones Upper Parana (Argentina)	4	2	3	11	20
Selva Maya (Mexico)	3	4	5	11	23
Southwest Amazon (Bolivia)	6	1	7	6	20
Grand Total	**28**	**10**	**26**	**41**	**105**

C2. SURVEY STRUCTURE

SECTION 1: ECOSYSTEM SERVICE PREFERENCE ASSESSMENT

The first section of the survey contained a preference assessment in which the respondents were asked to rank the importance of benefits from ecosystems to their wellbeing using four assessment categories: "important," "slightly important," "not important at all," and "do not know." This first section of the survey allowed each respondent to become familiar with the full spectrum of services as potential options for the next set of questions.

SECTION 2: LAND USE/COVER PHOTOGRAPH ELICITATION ASSESSMENT

The second section consisted of a photographic elicitation assessment in which respondents were asked to choose between different photos of local land uses and covers that they are familiar with and that they recognize as important for their wellbeing. The respondents were asked to explain the reasons for their selections in terms of the benefits that the preferred land covers provide to their wellbeing. For this elicitation, the dominant landscapes of the studied sites were captured in a set of photographs (Figure C2.1). These local landscapes are identified with the following keys:

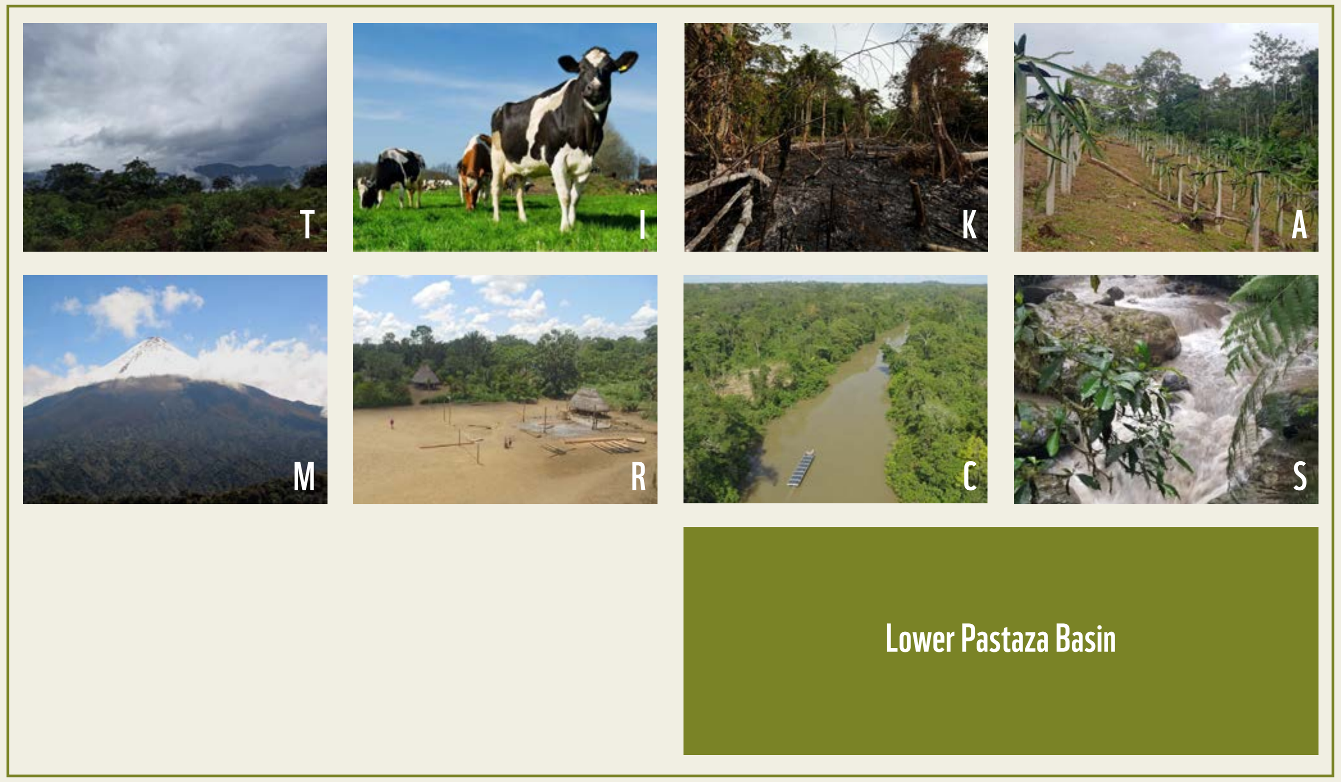
Selva Maya: *Aguada* (water body) (Ag), *Solar* (Backyard farming) (BF), Cultivated land (CL), Cultivated pastures (CP), High-elevation and Mid-elevation forest (HF and MF), and Wetlands (*Tule*/Reedbed) (T).

Lower Pastaza Basin: Forest (T), Cultivated pasture (I), Cultivated land (K), Cultivated land (*pitahaya*) (A), Sangay Volcano (M), Indigenous community and Achuar territory (R and C), Water body (river) (S).

Southwest Amazon: High-elevation and Low-elevation Forests (BA and BB), Cultivated land (Agroforestry) (AF), Cultivated pasture (PG), Water body (river) (RI).

Pantanal: Forest (A), Gallery Forest (F), Natural Savanna (H), Pasture (O), Cultivated land (palmar) (C), Water bodies: rivers and wetland (D and R).

Misiones Upper Parana: Native Forest (BN), Cultivated Forest (F), Perennial monoculture of *yerbales* (CP), Monoculture of maize (M), Horticulture land (AM), Capuera (C), Pasture (G), Water bodies: rivers and wetlands (A and H).



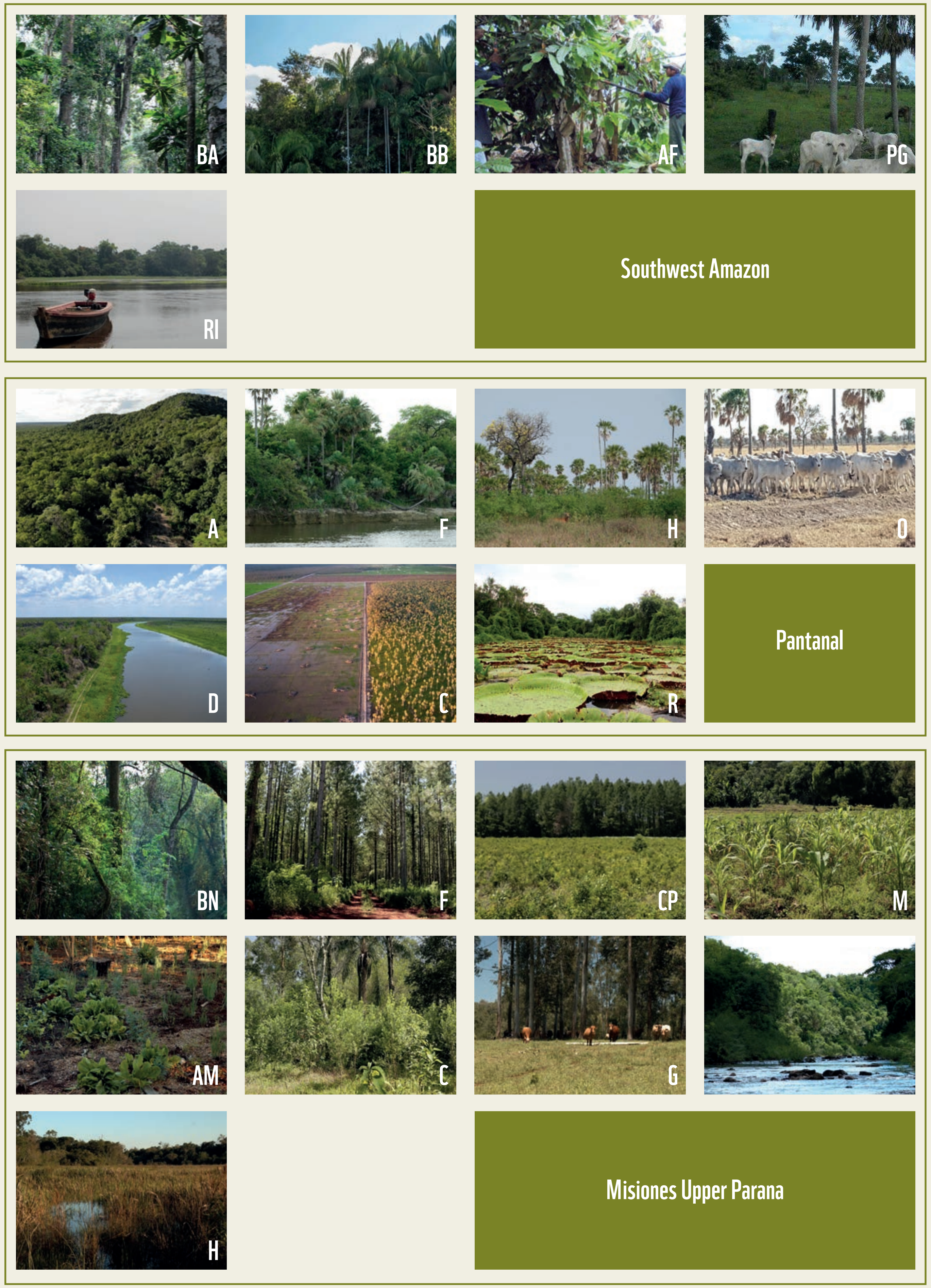


Figure C2.1. Photographs used in the study sites.

Note: PhotCos for Selva Maya by the consulting team. Photos for the rest of study sites provided by WWF.

Source: own elaboration.

SECTION 3: ECOSYSTEM DEGRADATION ASSESSMENT

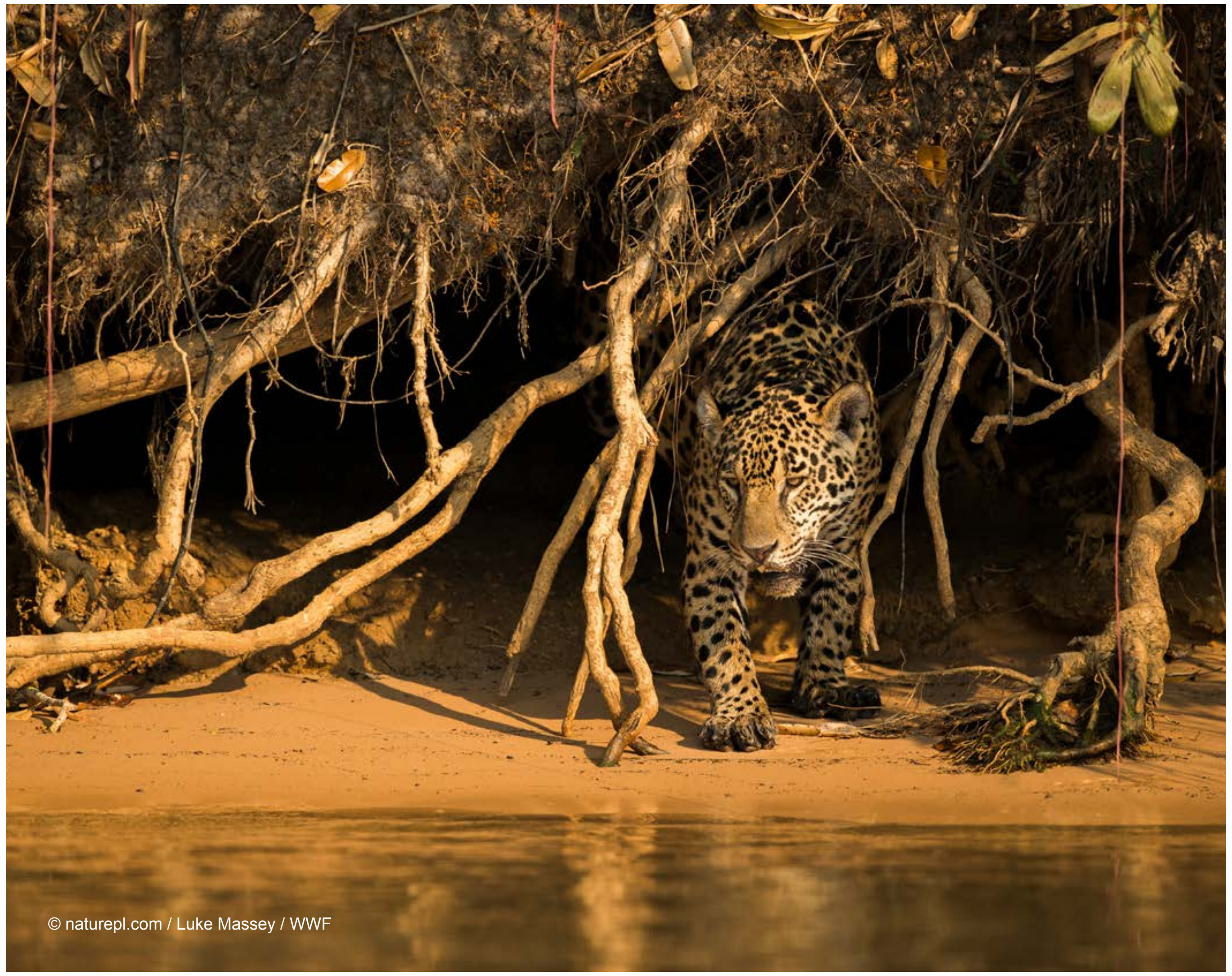
The third section inquired respondents on their perception regarding ecosystem degradation and potential trade-offs between the services provided by the ecosystems selected in the photographs. In particular, it asked respondents whether ecosystems and the provision of services "has decreased," "remains the same," or "has increased." Subsequently, open-ended questions gave the respondents the opportunity to explain why they considered that these ecosystems and their services have changed and how these transformations have affected their wellbeing. Finally, open-ended questions inquired about possible solutions to recover such ecosystems and their services based on their personal opinion.

C3. TESTING THE STATISTICAL SIGNIFICANCE OF DIFFERENCES IN RESPONSES BETWEEN TYPES OF ACTORS

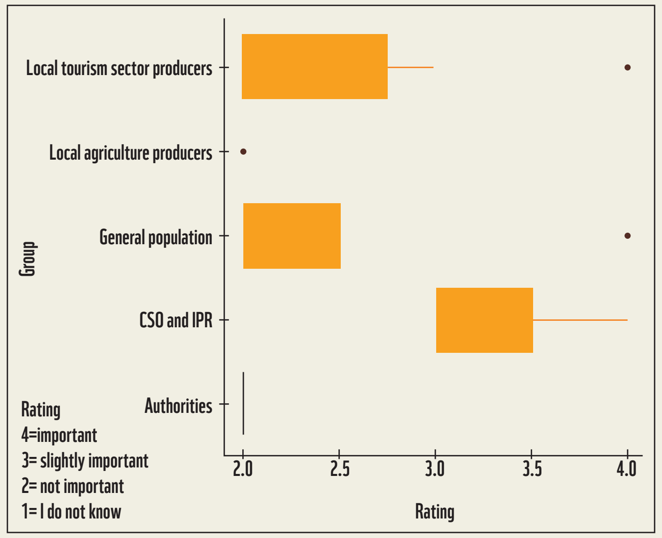
To test the statistical significance of differences between the preferences of different actors, we used the Kruskal-Wallis non-parametric *H-test*, which is analogous to the parametric one-way analysis of variance (ANOVA) test. This test is conventionally used for comparative analysis of the medians of two or more independent groups (the local actors) and when data is classified by hierarchical categorical variables with an ordinal measurement level (as the first sections of the survey). This test evaluates the differences in the answers of the different actors and informs if the perceptions between the different actors are similar or significantly different. Subsequently, the frequencies are compared for each case to identify in detail the actors and the services involved using a pairwise *Wilcoxon* test, and illustrated by boxplots. For the open-ended questions of the last section of the survey, we worked with the transcripts of the responses and undertook a thematic analysis. Thematic analysis is a qualitative method that looks at patterns (or themes) in a data set, grouping them based on similarities. By reviewing our data, we can identify themes that repeatedly arise within the data. A thematic analysis is quite useful to know the experiences, points of view and opinions of the different local actors interviewed.

RESULT SECTION 1: ECOSYSTEM SERVICE PREFERENCE ASSESSMENT

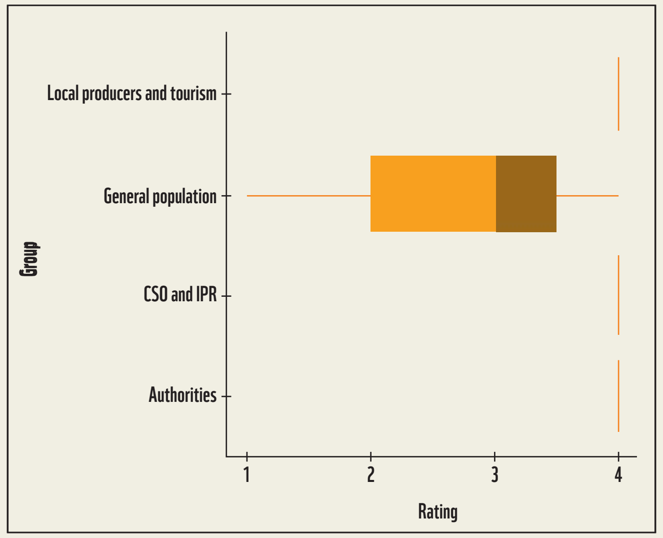
We carried out a Kruskal-Wallis test to identify statistically significant differences in the valuation of the ecosystem services between the different groups of local actors (Figure C3.1). We note that this analysis is informed by a low number of data points such that these conclusions should be taken cautiously. We found that provision services received different valuations by different groups. Additionally, the groups that differ in the value of a particular service are different across the study sites, suggesting heterogeneity in local social dynamics. An example of this is the *food-commercial* service, which pertains to the category of provision services, and reports marketing benefits from ecosystems for a diversity of food products (like maize, peppers, coconuts or harvested fruits from local, small-scale farming). In almost all study sites (Selva Maya, Southwest Amazon, Pantanal, and Misiones Upper Parana) this service received different valuations by actor groups, but in each site the group ranking it highly is different. Groups also differed in the valuation of some regulation services: *climate regulation* (in Lower Pastaza Basin), *nutrient cycling* and *pest regulation* (Southwest Amazon); whereas they differ in valuing the *inspiration* service (Southwest Amazon). It is interesting to note the role of local authorities suggested by these results. In almost all cases, local authorities recognize the importance of ecosystem services for the local community, even when for the rest of the community it is not very clear. In other cases (Selva Maya, Pantanal and Misiones Upper Parana) local authorities did not share the perception of the rest of the community. Overall, these results suggest that benefit perception can be different across groups of different actors, and that understanding these differences is instrumental for a complete picture of the dependence on ecosystem services at the local level.



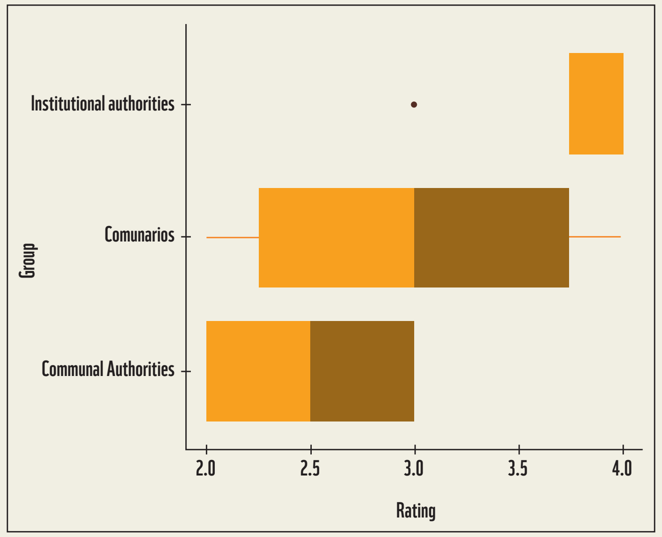
Selva Maya: Food-commercial service



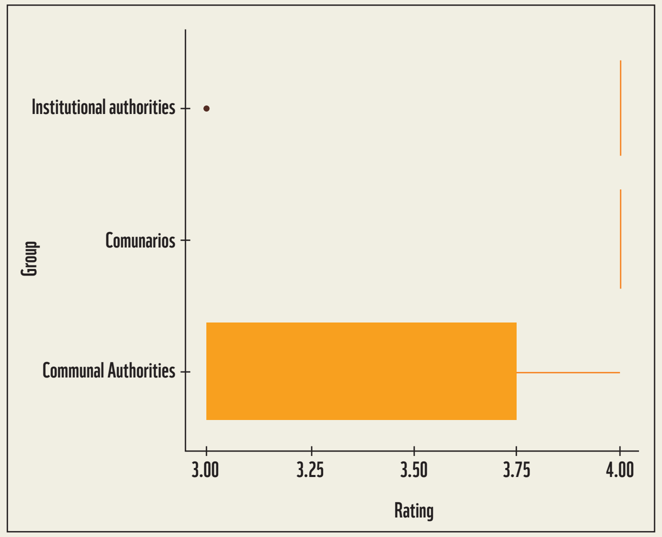
Lower Pastaza Basin: Climate regulation service



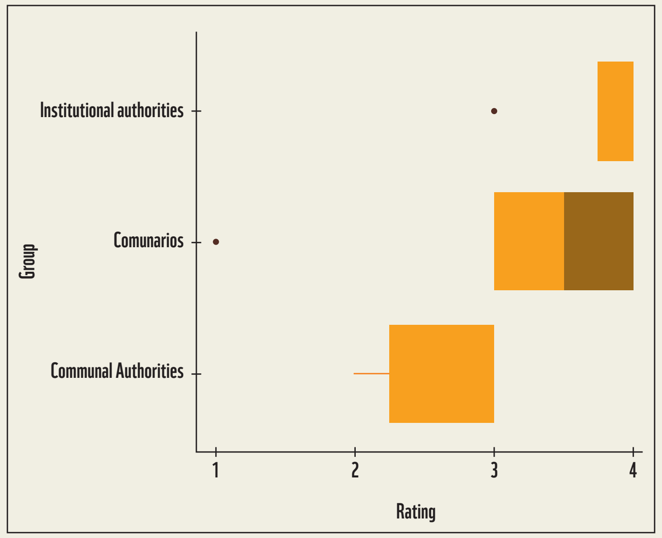
Southwest Amazon: Food-commercial service



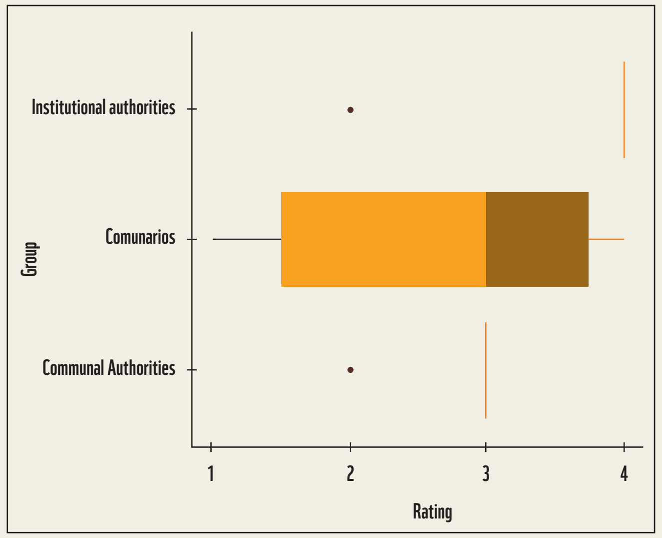
Southwest Amazon: Fish service



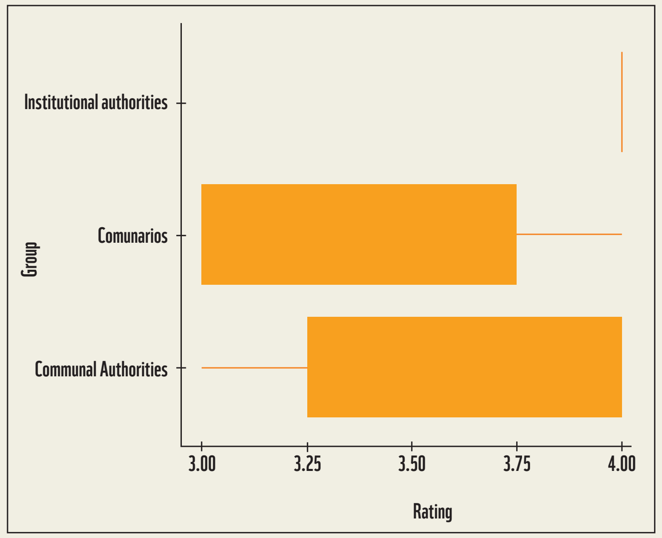
Southwest Amazon: Pest regulation service



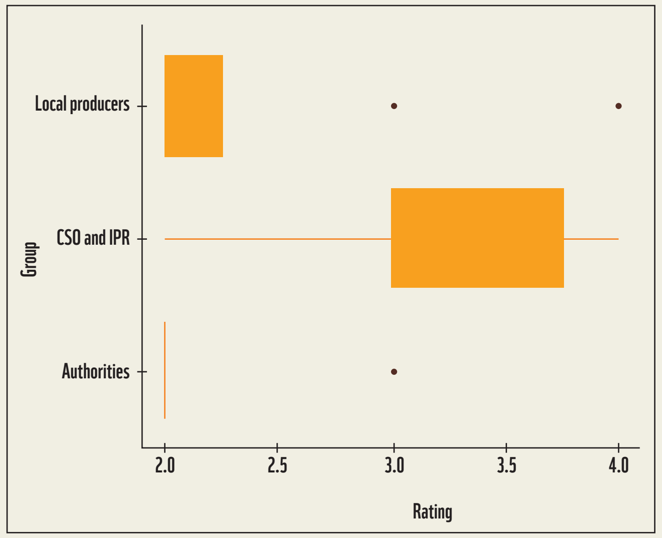
Southwest Amazon: Nutrient cycling service



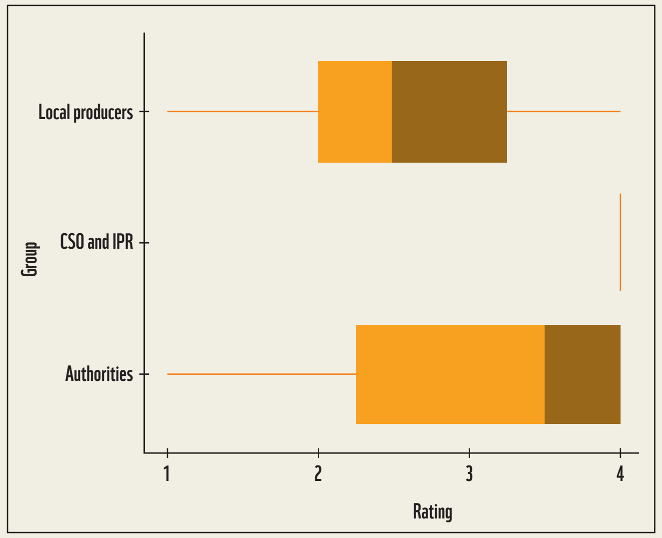
Southwest Amazon: Inspiration service



Pantanal: Food-commercial



Pantanal: Wild food-Subsistence service



Misiones Upper Parana: Food-commercial

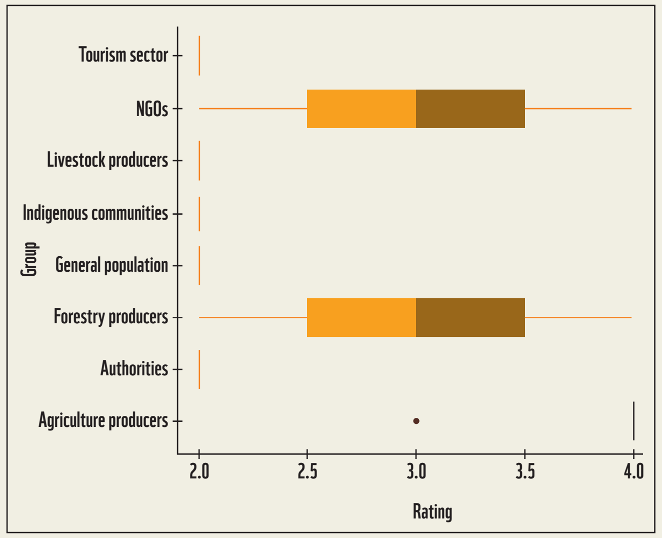


Figure C3.1. Ecosystem services:different perceptions across actor groups in the study sites.

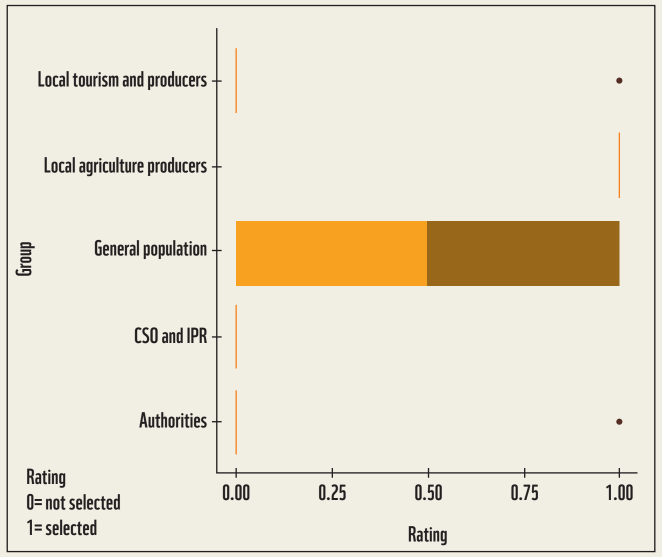
Note: CSO: Civil Society Organizations; IPR: Indigenous People Representatives.

Source: own elaboration.

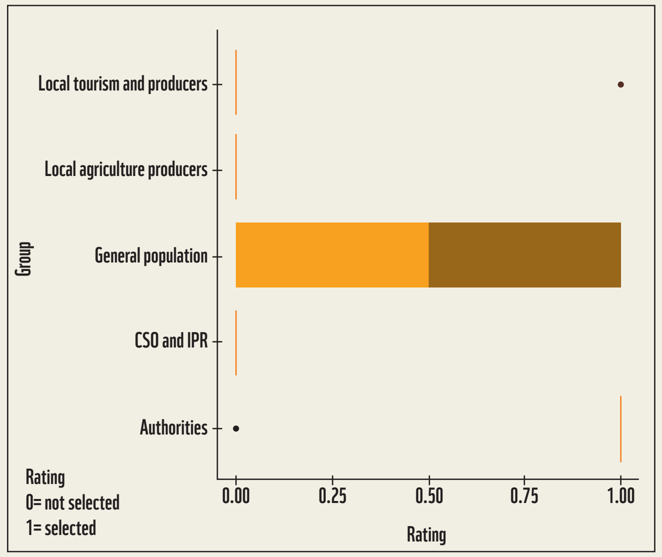
RESULT SECTION 2: LAND USE/COVER PHOTOGRAPH ELICITATION ASSESSMENT

We identified statistical differences between the preferences of different actors (Figure C3.2). The local landscapes that motivated differences are *cultivated land* and *cultivated pastures* in the Lower Pastaza Basin and in the Selva Maya landscapes, and with *Tule's wetland*, a rare wetland ecosystem in Mexico's Selva Maya. For the cases of *cultivated land and pastures*, the group consistently selecting them as important for their wellbeing is local producers, whereas for the case of Selva Maya's *Tule* wetlands, only local authorities selected it as important. In the studied sites of Southwest Amazon, Pantanal, and Misiones Upper Parana there were no differences in appreciation of photographs among groups.

Cultivated pasture



Wetland (Tule)



Cultivated land (pitahaya)

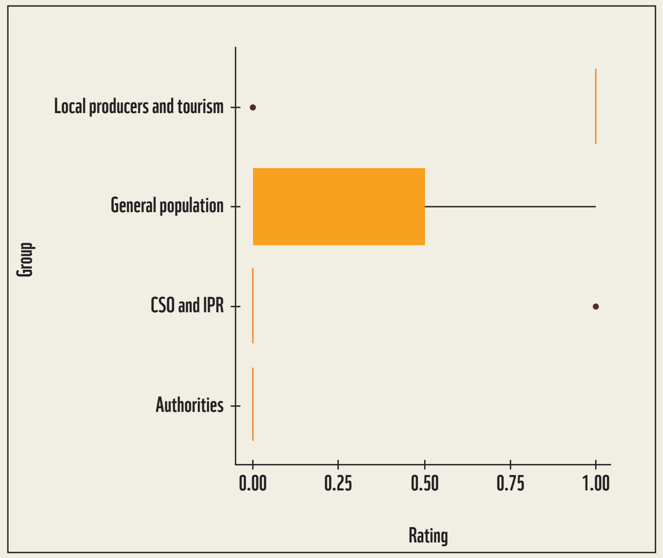


Figure C3.2. Ecosystem services: different preferences across groups in the study sites.

Source: own elaboration.

ACRONYMS

ESVD	Ecosystem Service Valuation Database
GDP	Gross Domestic Product
IUCN	International Union for Conservation of Nature
WWF	World Wildlife Fund
SDG	Sustainable Development Goals
ECLAC	United Nations Economic Commission for Latin America and the Caribbean

GLOSSARY

WWF's 15 Jaguar Priority Landscapes: crucial areas across Latin America that enhance ecosystem connectivity throughout the jaguar's range. These landscapes are located in priority areas for jaguars defined by jaguar scientists over the last 20 years and overlap with or are contiguous to jaguar corridor areas where jaguar conservation work is conducted (WWF, 2020).

Ecosystem services: "the benefits people obtain from ecosystems. These include *provisioning services* such as food, water, timber, and fiber; *regulating services* that affect climate, floods, disease, wastes, and water quality; *cultural services* that provide recreational, aesthetic, and spiritual benefits; and *supporting services* such as soil formation, photosynthesis, and nutrient cycling." (MA, 2005: v).

Kunming-Montreal Global Biodiversity Framework: an international agreement adopted by the 15th Conference of Parties (COP15) to the Convention on Biological Diversity (CBD) on 19 December 2022 aimed at reversing biodiversity loss and protecting ecosystems by setting global targets for conservation and sustainable use by 2030 (CBD, 2022).

Ecosystem Service Valuation Database (ESVD): a global repository of primary valuation studies disaggregated by biome and by different ecosystem services types (Brander et al., 2024).

Globeland30 database: a global database containing multiple land cover classifications at a 30-meter resolution (Jun et al., 2014)

Protected areas: regions designated and managed for the conservation of wildlife, natural resources, and biodiversity, often restricting human activity to preserve ecological integrity.

REFERENCES

Álvarez-Malvido, M., Lázaro, C., De Lamo, X., Juffe-Bignoli, D., Cao, R., Bueno, P., Sofrony, C., Maretti, C. y Guerra, F. (Editores). (2021). Informe Planeta Protegido 2020: Latinoamérica y el Caribe. Ciudad de México, México; Cambridge UK; Gland, Switzerland; Bogotá, Colombia: RedParques, UNEP-WCMC, CMAP-UICN, WWF, CONANP y Proyecto IAPA.

Alves-Pinto, H., Geldmann, J., Jonas, H., Maioli, V., Balmford, A., Latawiec, A. E., ... & Strassburg, B. (2021). Opportunities and challenges of other effective area-based conservation measures (OECMs) for biodiversity conservation. *Perspectives in Ecology and Conservation*, 19(2), 115-120.

Arias, M. (2021) The Illegal Trade in Jaguars (Panthera onca). CITES Secretariat, Geneva, Switzerland. www.cites.org [accessed May 2024]

Brander, L.M., de Groot, R., Schägner, J.P., Guisado-Goñi, V. van 't Hoff, V. & Solomonides, S. (2023). The role of forest ecosystem services to support the green recovery – Evidence from the Ecosystem Services Valuation Database. Forestry Working Paper, No. 38. Rome, FAO. www.doi.org

Brander, L. M., de Groot, R., Schägner, J. P., Guisado-Goñi, V., van't Hoff, V., Solomonides, S., ... & Thomas, R. (2024). Economic values for ecosystem services: A global synthesis and way forward. *Ecosystem Services*, *66*, 101606

CBD. (2022). Kunming-Montreal Global biodiversity framework: Draft decision submitted by the President. United Nations Environment Programme Convention on Biological Diversity (CBD).

Cumming, G. S., Buerkert, A., Hoffmann, E. M., Schlecht, E., von Cramon-Taubadel, S., & Tscharntke, T. (2014). Implications of agricultural transitions and urbanization for ecosystem services. *Nature*, 515(7525), 50-57.

de La Torre, J. A., González-Maya, J. F., Zarza, H., Ceballos, G., & Medellín, R. A. (2018). The jaguar's spots are darker than they appear: assessing the global conservation status of the jaguar Panthera onca. *Oryx*, *52*(2), 300-315.

ECLAC (2022), Redatam Microdata, CELADE, Population Division of United Nations Economic Commission for Latin America and the Caribbean (ECLAC). www.redatam.org

Figel, J. J., Botero-Cañola, S., Forero-Medina, G., Sánchez-Londoño, J. D., Valenzuela, L., & Noss, R. F. (2019). Wetlands are keystone habitats for jaguars in an intercontinental biodiversity hotspot. *PLoS One*, 14(9), e0221705.

Figel, J. J., Botero-Canola, S., Lavariega, M. C., & Luna-Krauletz, M. D. (2022). Overlooked jaguar guardians: Indigenous territories and range-wide conservation of a cultural icon. *Ambio*, *51*(12), 2532-2543.

Haines-Young, R., & Potschin, M. (2012). Common International classification of ecosystem services. Nottingham: Centre for Environmental Management, University of Nottingham.

Hoogesteijn, R., & Hoogesteijn, A. (2005). Manual sobre problemas de depredación causadas por grandes felinos en hatos ganaderos (No. 33135 Caja (503)).

Jędrzejewski, W., Carreño, R., Sánchez-Mercado, A., Schmidt, K., Abarca, M., Robinson, H. S., ... & Zambrano-Martínez, S. (2017). Human-jaguar conflicts and the relative importance of retaliatory killing and hunting for jaguar (Panthera onca) populations in Venezuela. *Biological Conservation*, *209*, 524-532.

Jędrzejewski, W., Robinson, H. S., Abarca, M., Zeller, K. A., Velasquez, G., Paemelaere, E. A., ... & Quigley, H. (2018). Estimating large carnivore populations at global scale based on spatial predictions of density and distribution–Application to the jaguar (Panthera onca). *PloS one*, 13(3), e0194719.

Jun, C., Ban, Y., & Li, S. (2014). China: Open access to Earth land-cover map. *Nature*, 514(7523).

Knox, J., Negrões, N., Marchini, S., Barboza, K., Guanacoma, G., Balhau, P., ... & Glikman, J. A. (2019). Jaguar persecution without "cowflict": insights from protected territories in the Bolivian Amazon. *Frontiers in Ecology and Evolution*, *7*, 494.

Martín-López, B., Iniesta-Arandia, I., García-Llorente, M., Palomo, I., Casado-Arzuaga, I., Amo, D. G. D., ... & Montes, C. (2012). Uncovering ecosystem service bundles through social preferences. *PLoS one*, *7*(6), e38970.

Millennium Ecosystem Assessment (MA) (2005). Ecosystems and human wellbeing (Vol. 5). Washington, DC: Island press.

Quigley, H., Foster, R., Petracca, L., Payan, E., Salom, R., & Harmsen, B. (2017). Panthera onca. The IUCN Red List of Threatened Species, 2017, e-T15953A123791436.

Ripple, W. J., Estes, J. A., Beschta, R. L., Wilmers, C. C., Ritchie, E. G., Hebblewhite, M., ... & Wirsing, A. J. (2014). Status and ecological effects of the world's largest carnivores. *Science*, 343(6167), 1241484.

Roberge, J. M., & Angelstam, P. E. R. (2004). Usefulness of the umbrella species concept as a conservation tool. *Conservation biology*, 18(1), 76-85.

Saunders, N. J. (2013). Icons of power: feline symbolism in the Americas. Routledge.

Seymour, K. L. (1989). Panthera onca. *Mammalian species,* (340), 1-9.

TEEB (2010) The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A synthesis of the approach, conclusions and recommendations of TEEB.

Terborgh J, Lopez L, Nunez P, Rao M, Shahabuddin G, Orihuela G, et al. (2001). Ecological meltdown in predator-free forest fragments. *Science*. 294(5548):1923–6. www.doi.org.

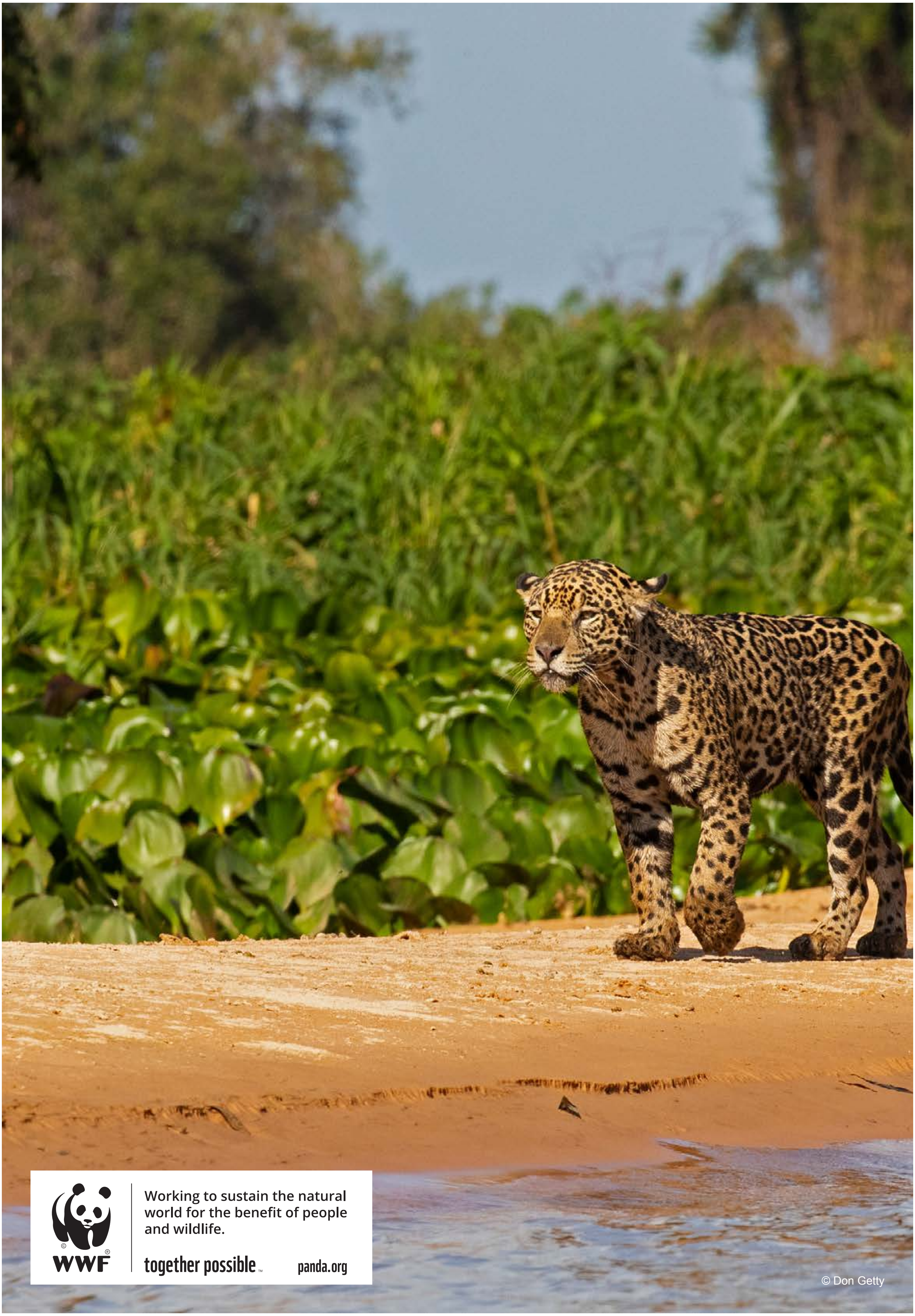
Thompson, J. J., Morato, R. G., Niebuhr, B. B., Alegre, V. B., Oshima, J. E. F., de Barros, A. E., ... & Ribeiro, M. C. (2021). Environmental and anthropogenic factors synergistically affect space use of jaguars. *Current Biology*, 31(15), 3457-3466.

Thornton, D.; Zeller, K.; Rondinini, C.; Boitani, L.; Crooks, K.; Burdett, C.; Rabinowitz, A. & Quigley, H. (2016). Assessing the umbrella value of a range-wide conservation network for jaguars (Panthera onca). *Ecological Applications*. 26 (4): 1112–1124. doi:10.1890/15-0602

UNEP, WCMC and IUCN (2022) Protected Planet: The World Database on Protected Areas (WDPA), December 2022, Cambridge, UK: United Nations Environmental Programme (UNEP), World Conservation Monitoring Centre (WCMC) and nternational Union for Conservation of Nature (IUCN). Available at: www.protectedplanet.net.

WWF, Panthera, WCS, and UNDP (2018). Jaguar 2030 Roadmap: Regional Plan to Save America's Largest Cat and its Ecosystems. World Wildlife Fund (WWF), Panthera, Wildlife Conservation Society (WCS), United National Development Programme (UNDP). www.wwflac.awsassets.panda.org [accessed May 2024].

WWF (2020). WWF Jaguar Strategy 2020-2030. World Wildlife Fund (WWF).



WWF

Working to sustain the natural world for the benefit of people and wildlife.

together possible. panda.org