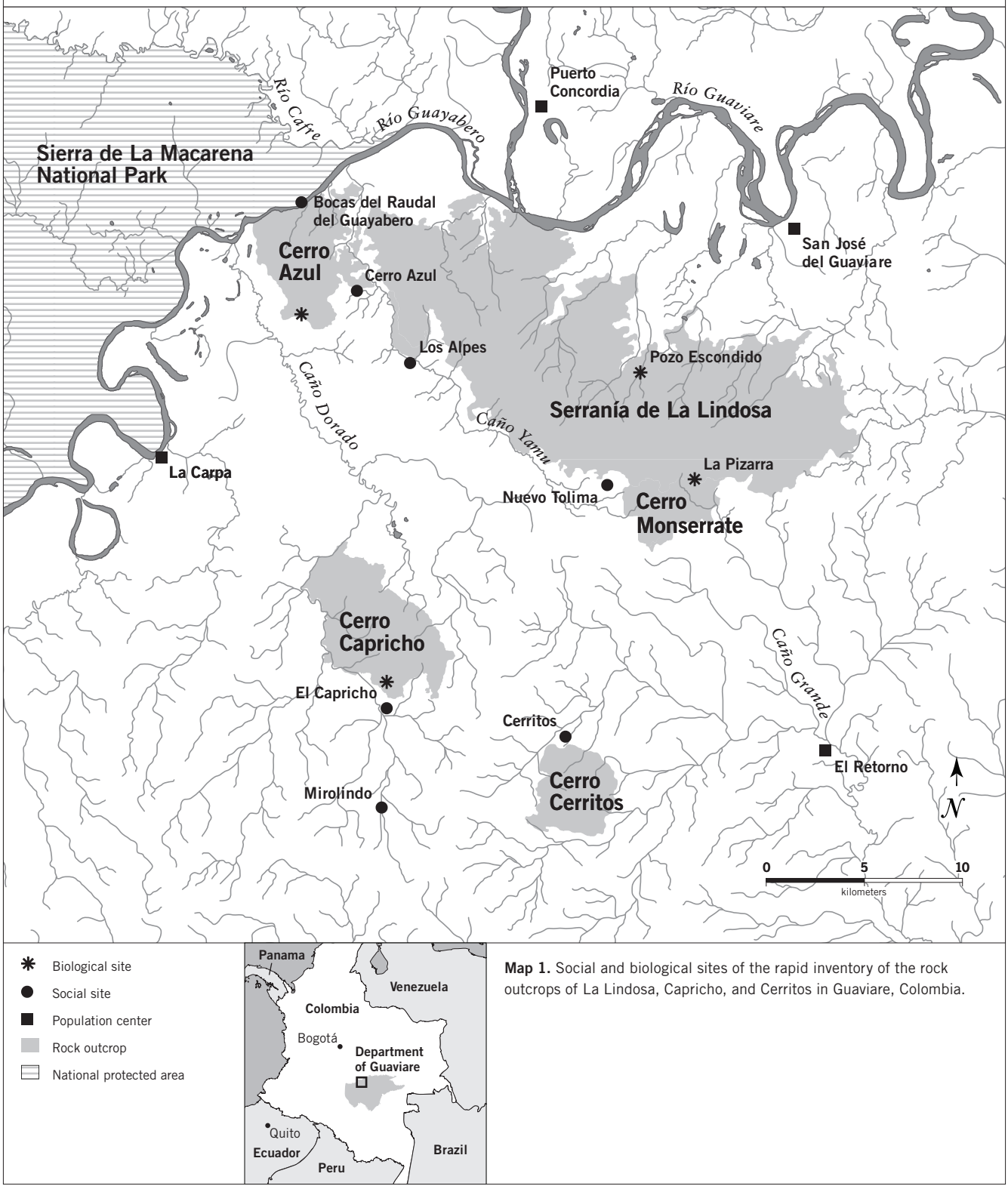
REPORT AT A GLANCE: LA LINDOSA, CAPRICHO, CERRITOS

Dates of fieldwork 18–28 October 2016



Map 1. Social and biological sites of the rapid inventory of the rock outcrops of La Lindosa, Capricho, and Cerritos in Guaviare, Colombia.

REPORT AT A GLANCE

Region

La Lindosa, Capricho, and Cerritos are located in southeastern Colombia, in the northwestern portion of the department of Guaviare, near its western border with the department of Meta. These rock outcrops rise some 640 m above the lowland plains of the Orinoco watershed, but are just a few kilometers from the northern edge of the Amazon basin. Together with Mirolindo, these four rock outcrops are drained by tributaries of the Inírida and Guayabero rivers and are accessible by a short car trip from the cities of San José del Guaviare and El Retorno. Although Cerro Azul is separated from the rest of La Lindosa by the Caño Yamu creek, it is part of the same outcrop. From the air, what one sees of this landscape is an archipelago of wooded islands and savannas surrounded by pastures, rural settlements, and unpaved roads.

Guaviare has long been one of the epicenters of Colombia's armed conflict, during which it was considered the territory of the Eastern Bloc of the Revolutionary Armed Forces of Colombia (FARC). The landscape around La Lindosa, Capricho, and Cerritos has been occupied by the FARC's Seventh Front for decades. Today, about 4,500 *campesinos* who were uprooted by violence from other parts of Colombia live in and around these outcrops.

Sites visited

Campsites visited by the biological team:

Cerro Capricho	19–21 October 2016
Cerro Azul	21–24 October 2016
La Pizarra/Pozo Escondido	24–28 October 2016

We also visited multiple sites in the vicinity of Cerritos: the geological team on 20 October 2016 and the ichthyological team on 21–22 October 2016. All teams except the botanical team visited Nuevo Tolima on 28 October.

Sites visited by the social team:

Núcleo Veredal El Capricho	19 October 2016
Núcleo Veredal Mirolindo	20 October 2016
Núcleo Veredal Cerritos	21–22 October 2016
Núcleo Veredal Nuevo Tolima	23–24 October 2016
Núcleo Veredal Bocas del Raudal del Guayabero	25–27 October 2016

On 28 October the team met with institutions in the city of San José del Guaviare.

Biological and geological inventory focus

Geomorphology, stratigraphy, hydrology, and soils; flora and vegetation; fishes; amphibians and reptiles; birds; large and medium-sized mammals

Social inventory focus

Social and cultural assets; governance, demography, economy, and natural resource management systems

Main biological results

La Lindosa, Capricho, and Cerritos harbor plant and animal species from the Amazon, the Orinoco basin, the Andes, and the Guyana Shield. This intersection of four large biogeographic regions has created a unique mix of species that do not typically occur together. The resulting diversity is moderate compared to the Amazon and the Andes but high compared to the Orinoco basin and the Guyana Shield.

During the inventory **we recorded 884 species of plants and 449 species of vertebrates**. Based on these numbers, we expect that 1,800 species of vascular plants and up to 813 species of vertebrates occur in the region.

	Species recorded during the inventory	Species estimated for the region
Vascular plants	884	1,800
Fishes	89	250
Amphibians	30	60
Reptiles	56	90
Birds	226	360
Large and medium-sized mammals	48	53
Total number of vascular plant and vertebrate species	**1,333**	**2,613**

Geology and soils

We visited three isolated rocky outcrops at the edge of the Vaupés-Amazonas sedimentary basin, with elements of the Guyana Shield and the sedimentary basin of Colombia's eastern plains. The closest analogs are the rocky outcrops 100 km to the south in Serranía de Chiribiquete National Park and 80 km to the east in Nukak National Park. The topography of the area varies from low, flood-prone areas (150–200 masl) and gentle hills (200–300 masl) to escarpments that reach an elevation of 640 masl. These mountains can be rounded, as in the case of Cerritos and Cerro Capricho (of igneous origin), or angular, as in the case of Cerro Azul and La Lindosa (of sedimentary origin).

The geology of the Colombian Amazon is dominated by the igneous metamorphic rocks that form part of the pre-Cambrian (>636 million years ago) crystalline basement that underlies the Amazon basin. Upon this basement lie sedimentary rocks that were formed between the Paleozoic and the Cretaceous (541–66 million years ago). These rocks make up outcrops such as the sandstones of Chiribiquete and La Lindosa (which have a similar shape and composition), as well as the more recent deposits along rivers and on slopes. We observed four geological units around San José del Guaviare. La Lindosa and Cerro Azul are composed of Cretaceous sedimentary rock (113–66 million years old) of the San José Sandstone Formation, while Capricho and Cerritos are much older (~577 million years) and formed by the igneous bodies or intrusions of the San José del Guaviare Nepheline Syenite Formation. Nepheline syenite rocks are found nowhere else in Colombia, and at only 20–25 sites around the world. The other two formations on this landscape are 1) a sequence of gravels,

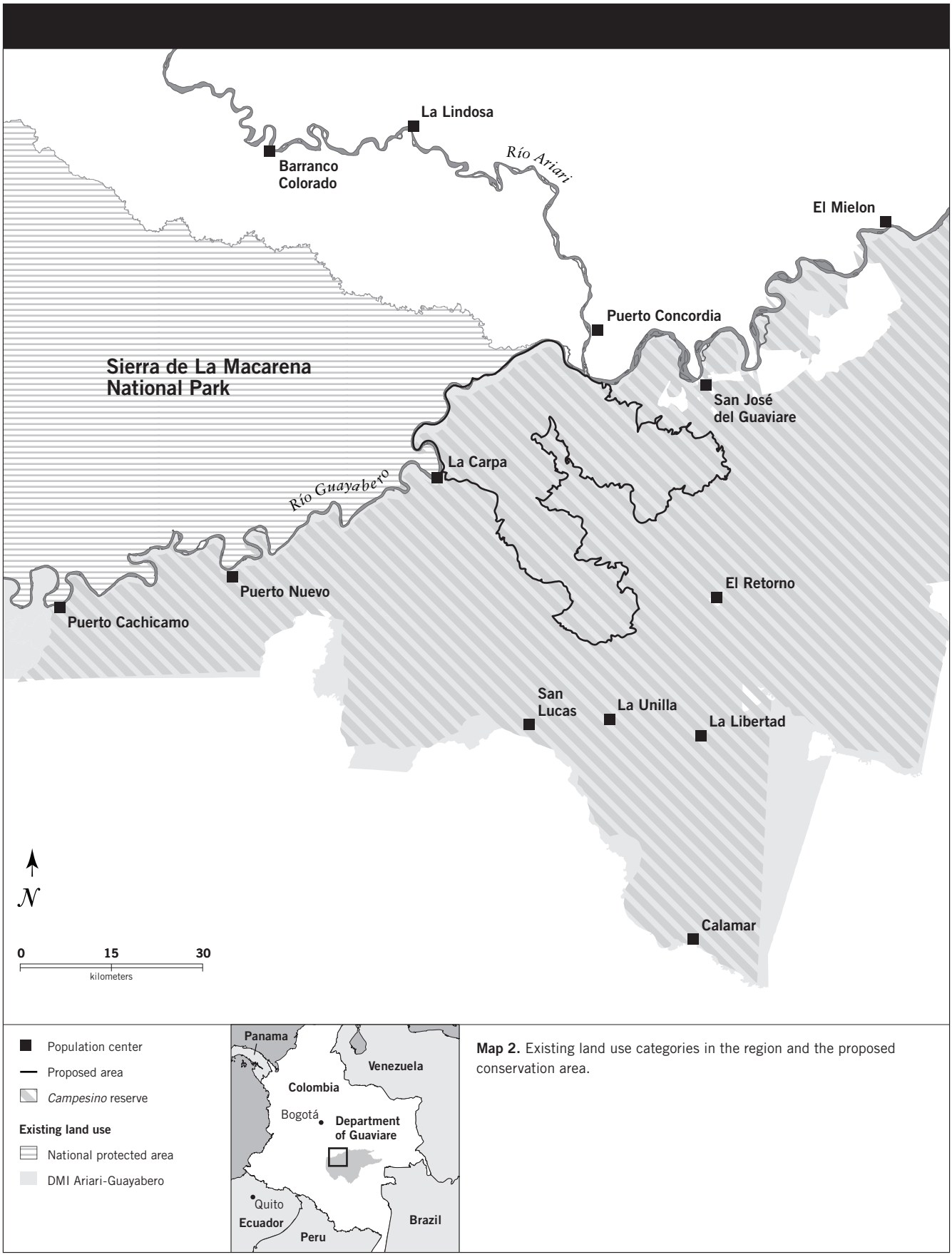
REPORT AT A GLANCE	
Geology and soils (continued)	sandstones, and arcillites of Paleogenic age (23–5 million years) that make up hills and fill valleys, and 2) rocks of Quaternary age (≤2 million years) in the sediments of the active alluvial floodplains of rivers and colluvial piedmont deposits. The influence of geological faults on the landscape is seen in riverbed alignments and persistent fractures throughout the rocky massif—these visible from the air—responsible for block erosion that forms irregular rock formations and caves. These fractures are also important for flow and groundwater recharge in the region. At greater depths, these faults are the source of the thermal water in El Retorno and the hydrocarbon seeps along the western banks of the Guayabero River. Soils are typical of those throughout the Colombian Amazon: loamy-sandy and moderately drained with low to moderate nutrient levels. Soil depth varies across the landscape, from up to 2 m in flat areas and floodplains to 0–60 cm in the hills, where there are patches of bare rock with no vegetation. One of our most important findings were the anthropogenic *terra preta* soils at the base of the outcrops and rock paintings at Cerro Azul and La Pizarra. These apparent anthrosols suggest that at one time the region was home to human populations for at least 1,000 years.
Vegetation	This region harbors a mosaic of vegetation types, ranging from forests typical of the Amazon to savannas typical of the Orinoco to stunted vegetation on rocky outcrops typical of the Guyana Shield, all of this within a matrix of cropland and pastures. During the rapid inventory we tallied 12 vegetation types: tall slope forest, flooded *várzea* forest, gallery forest, forest on rocky soils, forest growing in the fissures of rocky outcrops, grasslands and shrublands growing on the outcrops, mixed *Mauritia* palm swamps on sandy soils, Orinoco-type savanna, savanna on rocky soils, tall regrowth, other secondary vegetation, and relict vegetation in croplands and pastures. Near Cerritos grow nearly monotypic stands of *Mauritia* palms (in swamps) and *Guadua* bamboo; these were only visited by the geological and ichthyological teams.
Flora	Over nine days of sampling plant communities in La Lindosa, Capricho, and Cerritos we collected 473 specimens, most with fruits or flowers. Previous studies of La Lindosa by the Instituto SINCHI, which focused on plants growing on the rocky outcrops, had yielded a total of 807 plant species. Our inventory recorded an additional 271 species, 199 of which have been identified to species and 72 to genus or family. Most of these new records are from the forests surrounding the outcrops, but at least 20 are from the outcrops themselves. We recorded the shrub *Bernardia* cf. *amazonica* for the first time in Colombia; it was previously known only from outcrops in Venezuela. Another notable record is the liana *Chaunochiton angustifolium*, previously known from other Amazonian outcrops and now also recorded at La Lindosa. We recorded the four new species previously highlighted by Cárdenas López et al. (2008): *Raputia* sp. nov. (Rutaceae), *Siphanthera* sp. nov. (Melastomataceae), cf. *Meriania* sp. nov. (Melastomataceae), and *Zamia* sp. nov. (Zamiaceae). Populations of timber species are sparse in the region, both because those species are naturally rare and because of past logging.

Fishes	This rapid inventory marked the first time that fishes had been studied in and around these outcrops. We sampled fishes at 15 sites located in the headwaters of the Inírida River and in tributaries of the Guaviare River; all sites were in the Orinoco watershed. Water at the sites was clear or black, with high acidity (pH 5–6.5) and low conductivity (0.9–14 µS/cm). Streams in the region run through a matrix of agricultural lands, and riparian vegetation ranges from forest to natural savanna to cattle pasture with exotic grasses. During the inventory we recorded 84 small and medium-sized fish species that are typical of headwater streams; these belong to 6 orders and 22 families. Of these, 14 species are endemic to the Orinoco watershed and 5 are migratory species fished by local residents. *Prochilodus mariae*, *Salminus hilarii*, and *Bujurquina mariae* are conservation targets in the Orinoco basin due to their popularity as food and their importance in the food chain. Fifteen other species in the genera *Astyanax, Hemigrammus, Knodus, Odontostilbe, Phenacogaster, Characidium, Bunocephalus, Imparfinis, Mastiglanis, Stauroglanis, Tridens, Hypostomus*, and *Anablepsoides* appear to be new to science. We recorded the genus *Stauroglanis* for the first time in Colombia and extended the distributions of two species: *Tyttocharax metae*, previously known only from the piedmont region of the Guaviare River, 250 km away, and *Bryconops humeralis*, previously known only from the confluence of the Inírida and Orinoco rivers, 600 km away. We estimate that this region contains 250 fish species. The high diversity may reflect its location in a transition zone between the Orinoco and Amazon watersheds, where streams drain both Andean and Amazonian geological formations. The isolation of headwater streams fosters speciation, which makes these habitats key to conserving the region's fish fauna. These aquatic habitats are vulnerable, especially near cattle pastures where they lack riparian vegetation and gallery forests, and restoring them is a high priority.
Amphibians and reptiles	We recorded 86 of the 150 species expected to occur in the region: 30 of the 60 expected amphibians and 56 of the 90 expected reptiles. These species are a mix of Amazonian, Orinocan, and Guianan elements. Notable records include the lizards *Plica medemi* and *Lepidoblepharis nukak*, both endemic to Colombia, as well as two undescribed species: an amphibian in the genus *Leptodactylus* and a snake in the genus *Dendrophidion*. We extended the geographic range of the frogs *Allobates picachos* and *Osteocephalus deridens*. The presence of bushmasters (*Lachesis muta*), especially at Cerro Capricho, indicates abundant prey populations and thus high habitat quality. One record of concern is *Hemidactylus frenatus*, a lizard native to southeast Asia that has been introduced throughout Colombia and that we observed in the remote settlements of El Capricho and Cerro Azul. There also appears to be an illegal trade in *Lachesis muta,* probably for medicinal purposes or to extract venom. Local residents fear snakes, indicating a need for special strategies

REPORT AT A GLANCE	
Amphibians and reptiles (continued)	for snake conservation. Two of the turtle species we recorded (*Podocnemis unifilis* and *Chelonoidis denticulatus*) are classified as threatened at the national and/or global level (Morales-Betancourt 2015, UICN 2016), while six species are listed in CITES Appendix II (CITES 2016), a global agreement that restricts the commerce of threatened wildlife. Three species of caiman (*Caiman crocodilus*, *Paleosuchus trigonatus*, and *P. palpebrosus*) are occasionally hunted for food.
Birds	We recorded 222 of the 360 bird species estimated to occur in the region. Three of these are classified as globally Vulnerable (*Contopus cooperi*, *Patagioenas subvinacea*) or Near Threatened (*Falco deiroleucus*). We also extended the geographic range of six bird species that are poorly known in this region. La Lindosa, Capricho, and Cerritos are visited by both boreal and austral migrants, and during the inventory we observed these 11 species: *Actitis macularius, Catharus ustulatus, Contopus cooperi, Contopus virens, Lathrotriccus euleri, Myiarchus swainsoni, Piranga olivacea, Piranga rubra, Setophaga ruticilla, Setophaga striata*, and *Tyrannus savana*. Several bird species are used by the local population as food, pets, or in illegal trade; these include Tinamidae (tinamous), Cracidae (guans and curassows), Ramphastidae (toucans), and Psittacidae (macaws, parrots, and parakeets). The avifauna of the region is a mixture of species typical of the Amazon or the Guiana Shield, as well as a smaller component related to the Orinoco and the Andes. These outcrops, and especially La Lindosa, have excellent potential for bird-based ecotourism thanks to a number of showy birds like Cock of the Rock (*Rupicola rupicola*), White-browed Purpletuft (*Iodopleura isabellae*), Orange-breasted Falcon (*Falco deiroleucus*), Cliff Flycatcher (*Hirundinea ferruginea*), and Black-and-white Hawk-eagle (*Spizaetus melanoleucus*).
Large and medium-sized mammals	During the rapid inventory we focused on large and medium-sized terrestrial mammals, and also did a quick survey of bats. We recorded 9 orders, 19 families, 26 genera, and 30 species of mammals. These included most of the ungulates typical of Amazonian and Orinocan habitats, such as collared peccaries (*Pecari tajacu*), white-lipped peccaries (*Tayassu pecari*), lowland tapir (*Tapirus terrestris*), and two deer species (*Mazama nemorivaga* and *Odocoileus virginianus apurensis*). We recorded six primate species in three families: Cebidae (*Sapajos apella*, *Saguinus inustus*, and *Saimiri sciureus*), Pithecidae (*Callicebus torquatus*), and Atelidae (*Alouatta seniculus* and *Lagothrix lagotricha*). The primate diversity we observed accounts for 40% of all species recorded to date in the department of Guaviare. We recorded two carnivore species (*Eira barbara* and *Nasua nasua*), as well as an unidentified predator that is most likely an oncilla (*Leopardus tigrinus*, Felidae). We recorded the world's largest rodent, the capybara (*Hydrochoerus hydrochaeris*), and healthy populations of lowland paca (*Cuniculus paca*) and black agouti (*Dasyprocta fuliginosa*). Most of the recorded species have a broad distribution across the Orinoco and Amazon basins, except for the subspecies of white-tailed deer (*O. v. apurensis*), which has an Orinocan distribution. Woolly monkey (*Lagothrix lagotricha*) and two ungulates

	(*Tapirus terrestris* and *Tayassu pecari*) are considered globally Vulnerable by the IUCN. We recorded the marsupial *Glironia venusta* (Didelphidae), which is rare in museum collections and whose ecology is very poorly known. The species was recorded in the town of El Capricho, where it appears to be common; the town offers an excellent opportunity for future research. Although we did not record the same mammal species at the three sites we visited, we believe that our species list is representative of the region. Despite the fragmented condition of the region's forests, they still harbor large animal populations—even of hunted species like primates, peccaries, large rodents, and deer.
Human communities	The study area includes two municipalities in the department of Guaviare: San José del Guaviare, with a population of 59,284 (39,718 urban, 19,566 rural), and El Retorno, with a population of 12,564 (3,991 urban, 8,573 rural). Within these municipalities, the social inventory tallied roughly 40 towns and settlements (*veredas*; total pop. 5,600) lying in and around La Lindosa, Capricho, and Cerritos. The social team worked with 22 *veredas* organized around 5 *núcleos veredales* (El Capricho, Mirolindo, Cerritos, Nueva Tolima, and El Raudal). The *campesinos* in these towns have lived in the region for about 60 years. The population grew sharply after 1968, when the Colombian government began to promote directed colonization as a strategy to populate largely 'empty' landscapes in the country. As part of that strategy, *campesino* families from central Colombia, especially the departments of Boyacá, Cundinamarca, Santander, and Tolima, moved to this part of Guaviare. In the 1980s, the coca boom in Guaviare brought another wave of *campesino* migration to the area and solidified the presence of FARC guerrillas. There is evidence that this region has long been home to indigenous populations, and some of that evidence is 7,000 years old: large rock paintings and archeological artefacts. Studies have not yet confirmed who created these or where they came from. The current residents of the landscape have two hypotheses: that they were made by the Carijona indigenous peoples, or that the region was once a meeting place for a large number of peoples and that the rock paintings mark the sites of large shamanistic rituals. Although there are not currently long-term indigenous populations in the study area, close to El Capricho is a settlement of Nukak indigenous people who were forcibly moved there from their ancestral territory by guerrilla and paramilitary elements during the conflict. As in other regions of the Amazon, residents here have lived through a number of economic boom and bust cycles, from rubber to animal pelts to coca. The leading economic activity today is cattle ranching, both beef and dairy. Ranching has grown in importance over the last 10 years, gradually replacing the coca-based economy, and the establishment of managed cattle pasture with exotic grasses is the main driver of deforestation in the region. Most beef cattle are trucked to markets in Villavicencio and Bogotá. Milk is sold to local factories that produce excellent cheeses; some of these are eaten locally but most are sold in Villavicencio and Bogotá. Both beef and

REPORT AT A GLANCE	
Human communities (continued)	dairy ranching are made possible by the roads that connect this region with central Colombia. Most local farms grow subsistence crops like corn, plantain, and manioc. We observed small-scale initiatives to promote alternative crops such as cacao, rubber, and sacha inchi, initiatives to promote sugarcane for brown sugar and molasses, and initiatives to establish agroforestry and silvopastoral systems. There is also a growing movement among local residents to farm fish in ponds, both for food and to sell locally and in San José del Guaviare. Ecotourism is also on the rise, especially in La Lindosa; it primarily benefits the landowners whose properties are visited, and tour operators based in San José del Guaviare. While the families living around tourist attractions and the towns close to La Lindosa, Capricho and Cerritos can potentially also profit from tourism, it is important for operations to be well planned and regulated. In the towns of Bocas del Raudal del Guayabero and Bocas del Guayabero, both of which are located on the Guayabero River, the primary economic activities are fishing and river transport.
Current status	The Colombian government has recognized the conservation value of La Lindosa, Capricho, and Cerritos for more than three decades. Two official land use designations currently overlap these outcrops and the surrounding landscape: 1) the Ariari-Guayabero Integrated Management District (Southern Restoration Zone for Production), a protected area designation with a management plan adopted in 2015, and 2) the Campesino Reserved Zone, created in 1997 to strengthen the area's rural economy. At present, these outcrops are in a legal limbo. A long-term conservation solution could potentially be implemented as part of the peace accord signed on 30 November 2016.
Major conservation targets	**01** Valuable ecosystem services for local towns, the city of San José del Guaviare, and the rest of the department of Guaviare **02** A rare convergence of geological formations, including the only nepheline syenite rocks in all of Colombia **03** A hugely important archeological heritage **04** Stunning rock outcrop landscapes that are major tourist attractions **05** A diverse mosaic of forests, savannas, and shrublands with elements of the Orinoco, the Andes, the Amazon, and the Guyana Shield **06** A diverse and poorly known flora and fauna, including at least 21 new species discovered during the inventory, 4 vertebrates considered endemic to Colombia, and at least 14 plant and animal species classified as globally threatened **07** Animal populations that remain well preserved despite the fragmented condition of the forests, including significant populations of species that are typically overhunted



Map 2. Existing land use categories in the region and the proposed conservation area.

REPORT AT A GLANCE	
Principal assets for conservation	**01** *Campesino* communities with a strong sense of territory and strong local organizations **02** Government recognition of the importance of protecting these outcrops, via the Ariari-Guayabero Integrated Management District *Distrito de Manejo Integrado* **03** An area singled out by government agencies as important for maintaining connectivity between the Andes, the Amazon, and the Orinoco basin, and identified by the Ministry of the Post-Conflict as a key region for addressing land use issues in the implementation of the peace accord **04** A high potential for tourism (archeological, geological, and ecological), and emerging local initiatives to promote tourism **05** National and international interest in the region, backed by funds to promote tourism, alternatives to ranching, technical education, the eradication of illicit crops, etc.
Main threats	**01** The lack of a formal land use designation to protect La Lindosa, Capricho, and Cerritos **02** The rapid, unplanned spread of the agricultural frontier due to unlicensed road construction, illegal property sales, the spread of ranching, and uncontrolled burning **03** Minefields and other serious social problems created by decades of war and violence **04** Strong, long-standing distrust between local communities and government agencies **05** An asphalt-mining operation in El Capricho that is legal but lacks environmental oversight, as well as new applications to mine sand, gravel, and asphalt without environmental impact assessments **06** The persistence of illegal crops and the market for them **07** A general lack of information about the region and inconsistency between datasets used at different levels of government (local, regional, and national), which hampers effective decision-making
Principal recommendations	**01** Establish a ~54,000-hectare regional protected area to safeguard La Lindosa, Capricho and Cerritos **02** Protect the area from the impacts of extractive industries such as mining, oil, and gas **03** Respect current *campesino* settlements in and around the outcrops **04** Promote dialogue between key players (government, *campesinos*, indigenous peoples, guerrillas, the United Nations) to air concerns and proposals regarding land use issues in the implementation of the peace accord **05** Update the Multipurpose Rural Cadastre in the region via participatory field work

06 Carry out *vereda*-level planning processes to plan sustainable development based on current land use (agriculture, pasture, hunting, fishing, forests, etc.), in which each *vereda* has an opportunity to envision the future of its territory

07 Identify key areas for maintaining and reestablishing forest connectivity between these outcrops, and between these outcrops and Sierra de La Macarena National Park and the Ley Segunda Forest Reserve

08 Promote sustainable and well-organized ecotourism as a regional path towards sustainable development

09 Take urgent action to preserve the region's archeological heritage, based on the recommendations of the consortium formed by the National University of Colombia, the departmental government, and the Colombian Institute of Anthropology and History (ICANH)

10 Design a collaborative plan to diversify the region's economy

11 Build the Marginal de la Selva highway using environmentally sensitive criteria (e.g., incorporating animal passages and maintaining healthy streams and rivers)