

Are protected areas actually protecting our biodiversity?



Currently, there are 1,391 protected areas in Colombia, with many human activities taking place both within these areas and at their borders (buffer zones). Kristian Rubiano, a doctorate student at Facultad de Ciencias Sociales (Faculty of Natural Sciences), mapped 51 protected areas to determine trajectories in land use change. The results, which were presented at the 58th Annual Meeting of the Asociación para la Biología Tropical y Conservación (ATBC), showed that protected areas are partially fulfilling their role in ecosystem conservation.

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Notably, 2020 was not an easy year. While the whole world and social media were invaded by information related to COVID-19, a hashtag timidly started trending on Friday, June 5 of that year, which was World Environment Day: [#PararLa-DeforestaciónDelAmazonasYa](#) (Spanish phrase for “Stop Deforestation At The Amazon Now”). Amid the pandemic, Amazonia was stealing the little attention that was not paid on COVID-19. It was surely deserved, as, according to the [Sistema de Monitoreo de Bosques y Carbono](#) of the Instituto de Hidrología, Meteorología y Estudios Ambientales (Ideam), only during that year, [64% of the 171,685 hectares \(ha\) of deforested areas in Colombia were](#) within the Amazon Forest.

“But Colombia is not just Amazonia,” claims [Kristian Rubiano](#), doctorate student, Faculty of Natural Sciences at Universidad del Rosario. Rubiano, who is now undergoing his doctorate apprenticeship at the [Department of Physical Geography of the Stockholm University](#), Sweden, shows his concerns over the current decrease in natural vegetation coverage in several ecosystems across other regions of the country. “Although deforestation figures at Amazonia are alarming, the rest of the national territory is affected by the loss of ecosystems. As these ecosystems have less coverage than the Amazon rainforest, they are at risk of disappearing,” says Rubiano.

According to the results of the first chapter of his doctorate thesis (still under development), where he presents an analysis on the change trajectory in



In the Red List of Colombian ecosystems, 81 were registered, 53 of which fall within a threat category.



land coverage and use in 51 protected areas in Colombia between the years 2000 and 2018. The Caribbean region has been the most affected in terms of proportion of natural vegetation loss, at 5.4% (19,557 ha). In second place, we find the Andean region, with a 2.6% loss (58,420 ha). At Amazonia, however, loss percentage is lower, at around 0.7%, though in absolute terms, it is the region with the biggest natural vegetation loss. Parque Nacional Natural (PNN) Sierra de La Macarena, for example, has lost 50,553 ha (8.8% of natural vegetation loss) of the approximately 617,000 ha of the park.

“What happens with Amazonia is that due to its bigger land area, it reflects a large amount of natural vegetation loss,” explains [Juan Manuel Posada](#), head professor, Faculty of Natural Sciences, Universidad del Rosario and president of the Association for Tropical Biology and Conservation (ATBC), an entity that organized its [58th annual meeting](#) in July 2022, in Cartagena (Colombia), in collaboration with several institutions, such as Universidad del Rosario. The main theme of the event was *Conserving tropical biodiversity achieving socioecological resilience*.

There, Rubiano showed the [results of the first chapter of his doctorate thesis](#) on the trajectories of land use in protected areas in Colombia, which, according to the 1992 Convention on Biological Diversity ratified in this country via Act No.165, 1994, must “aim at the protection and conservation of biological diversity, and the related natural and cultural resources.”

Parks that take communities into account

The concept of “protected area” appeared in 1872 when the [Yellowstone National Park, the first of its kind in the world](#), was created in the United States. The purpose of the park was to prevent the exploitation of resources within this vast biodiversity sanctuary. The term “exploitation” refers to the “set of elements destined to benefit from a natural product.” All this is related to the concept of progress, traditionally seen as a way to move forward to a better or more developed status.

For this progress to happen, it is necessary to use the resources offered by ecosystems. But, as warned by [Yolanda Kakabadse](#), president of the World Wildlife Forum (WWF), in 2016 to *La Verdad*, a newspaper from Murcia (Spain), in the context of the celebrations for Earth Day, we are “consuming resources in



Land hoarding at PNN Sierra de La Macarena. Large patches of forest are turned into grasslands to settle livestock and claim land possession. Picture: Fundación para la Conservación y el Desarrollo Sostenible, 2017. Source: Clerici, N. et al. *Sci Rep* 10, 4971 (2020).

such an abusive and irresponsible manner that we are falling short.” Their depletion also produces a considerable reduction of habitat for countless species.

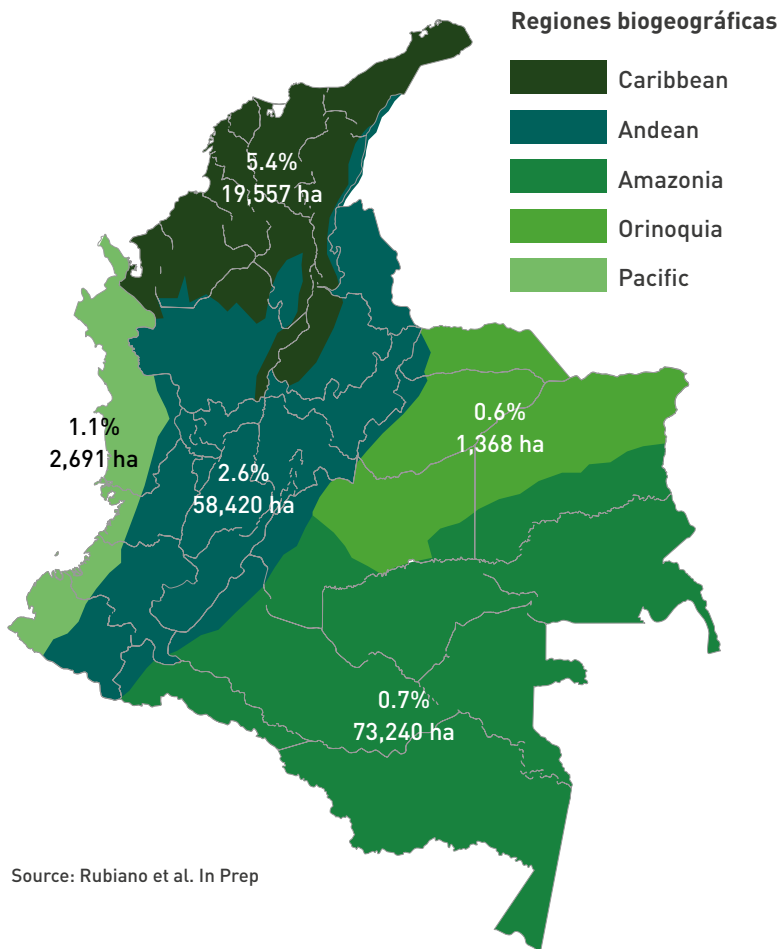
Let’s think about Colombia. In terms of percentage of land surface, it is small, not having more than 0.22% of land surface. In contrast, it is a mega diverse country because it [concentrates 10% of the worldwide biodiversity](#). This gives us great power.

But, as Benjamin Parker told his nephew Peter, “Spiderman,” referring to an old Greek saying, “a great power comes with great responsibilities.” If our responsibility is to maintain such biodiversity, reality tells us that we are clearly losing the battle.

In a report from Instituto de Investigación de Recursos Bio-lógicos. Alexander von Humboldt reveals that until 2017, [“Colombian biodiversity has shown an average decrease of 18%.”](#) The biggest threat is associated with the loss of natural habitat of species due to the development of activities such as extensive agriculture and farming.

Proportionally, the Caribbean region is the most affected regarding natural vegetation loss

Mapping data in 51 protected areas in Colombia between 2000 and 2019 show that, proportionally, the Caribbean region is the most affected regarding natural vegetation loss within the protected areas, followed by the Andean region. The country's dry forests, decimated to critical levels, are concentrated in the Caribbean region, which reflects a severe loss of natural vegetation.



Source: Rubiano et al. In Prep

If this happens in our small country, it is hard to imagine the impact this may have at regional level in a particular ecosystem, such as the tropical rainforest, that covers approximately 37% of the land area. According to an international study published in 2021 in *Science Advances*, 17% of the tropical rainforest has disappeared, at a global level, between 1990 and 2019, which is estimated at slightly more than 7,000,000 ha.



Kristian Rubiano, Doctorate student, Faculty of Natural Sciences of Universidad del Rosario, states that “although deforestation figures in Amazonia are alarming, the rest of the national territory is affected by the loss of ecosystems. And, as these ecosystems have less coverage than Amazon’s rainforests, they are at risk of disappearing.”

Although it may seem that the battle for ecosystem conservation is lost, we can still hope for the victory. For example, across the world, the number of protected areas has increased as an effective strategy of conservation. According to [Parques Nacionales Naturales de Colombia \(PNNC\)](#), over 15% of the country is currently composed by 1,391 protected areas, although only 60 of them are included in Sistema de Parques Nacionales Naturales ([SPNN](#)).

Professor Posada suggests that “to have an effective conservation process, we must start from all socio-economical aspects related to human communities.”

Rubiano also adds that “the creation of protected areas must not be disconnected from people, since, in one way or the other, human beings interact with these reservoirs.”

This is why, within these protected areas, we can see significant changes in land use, especially in buffer zones, the border between protected areas and unprotected land.

Within 39 Natural National Parks in Colombia, the deforestation rate has increased by 177% in the three years after signing the Peace Agreement. If this trend continued, the connection area between the Amazon and the Andean regions may disappear.

Advised by [Nicola Clerici](#), head professor, Faculty of Natural Sciences, Universidad del Rosario, in collaboration with researchers [Marius Bottin](#) and [Luigi Boschetti](#), Rubiano also mapped the 10-km buffer zone of 51 protected areas to compare levels of affectation. The research showed that buffer zones have had a greater natural vegetation loss than protected areas. “This allows us to conclude that at least in part, PNNCs are fulfilling their purpose,” said Clerici, who added that “The results from the first chapter of Kristian’s thesis show that around 97% (13,315,567 ha) of vegetal ecosystems within PNNs has remained stable in the period analyzed. However, this does not mean that they are working perfectly.”

The concern regarding some PNNs, such as Cordillera de Los Picachos, Sierra de La Macarena, and Tinigua, is that their forest ecosystems are being decimated, especially now in the post-conflict period. “In an analysis we carried out in 2018, in which we compared the deforestation rate of 39 PNNs and their buffer zones three years before and after signing the peace agreements with the Fuerzas Armadas Revolucionarias (*Revolutionary Armed Forces*, FARC), we estimate an increase in deforestation of around [177% within the PNNs studied and of around 158% in their buffer zones](#). If the current trends continue, there would likely be a total disconnection between the Amazon and Andean regions in Colombia, which would be devastating for the ecologic connectivity of these regions,” poses Professor Clerici.



Professor Posada adds that “there is much concern that other ecosystems in the country, such as the [high Andean forest](#) and the [tropical dry forest](#), may also disappear.”

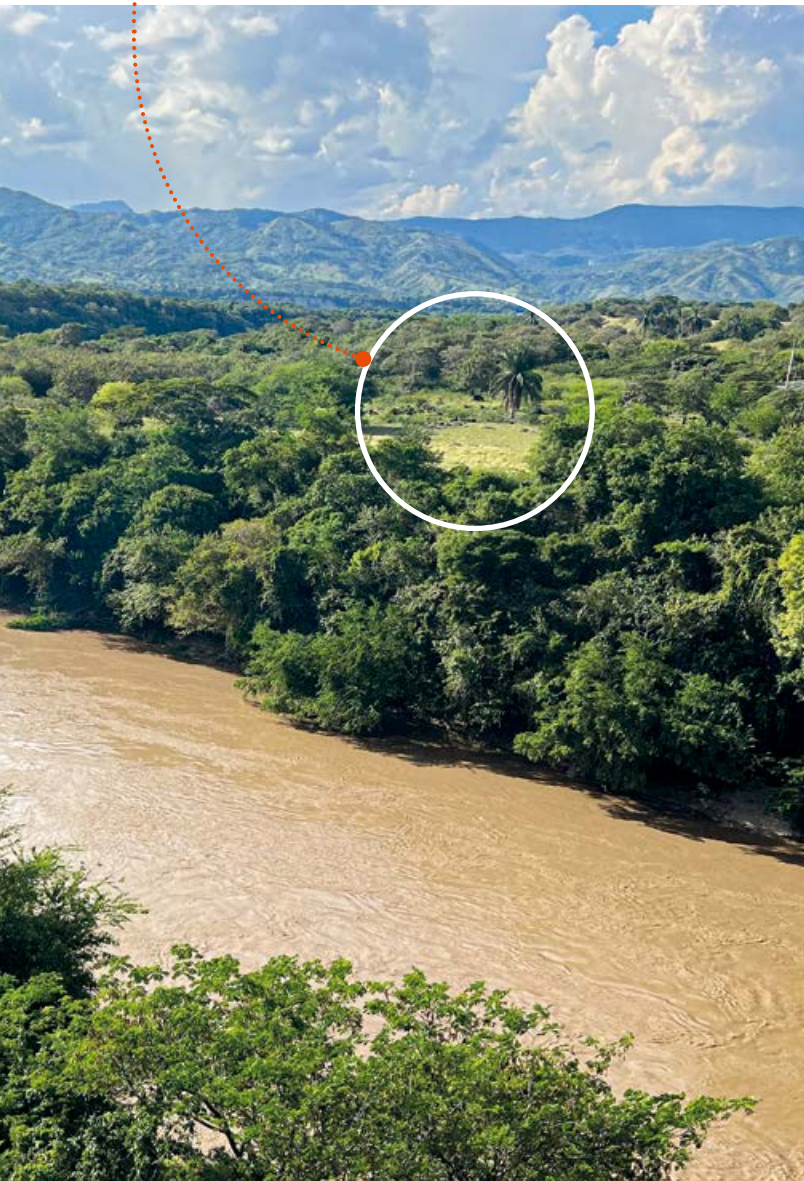
The tropical dry forest, a king in critical state

According to the results of Rubiano and his advisory team, the main trajectory of natural vegetation loss in Colombia has been the shift from forest to productive land and artificial areas, with around 105,372 ha of land transformed within the 51 protected areas analyzed and 202,564 ha in the buffer zones.

These changes occur in greater proportions in the Caribbean and Andean regions, where the biggest population centers of the country are located. “People like living in these areas mainly because they are drier, which provides two well-regarded characteristics: one is that areas with less rain tend to retain more nutrients in the soil; the other is that, in drier or higher-altitude climates, there is a lower probability of being exposed to tropical diseases related to humid environments. Hence, these regions of drier ecosystems are more decimated,” says Professor Posada.



"Forests in Colombia are being threatened by fragmentation and degradation resulting from diverse anthropogenic pressures such as farming, human infrastructure, and agriculture, among others."



Aware of this growing threat in our ecosystems, the Instituto Humboldt, collaborating with [Conservation International](#), the Instituto de Investigaciones Marinas y Costeras ([Invemar](#)), the Ministerio de Ambiente y Desarrollo Sostenible, and the Pontificia Universidad Javeriana, made a conservation diagnosis for the country's ecosystems following the categories of the International Union for Conservation of Nature ([IUCN](#)). Thus, in 2017, they consolidated a *Red List for Ecosystems in Colombia*.

In this list, 81 systems were listed, of which 53 (65%) are within a certain threat category (20 ecosystems in critical danger, CR; 18 endangered, EN; and 15 in vulnerable state, VU), while 28 (35%) represent a lower concern (LC).

In particular, dry ecosystems, such as the tropical dry forest, the tropical desert, the wetlands in Cundinamarca and Boyacá, and the tropical rainforest areas in Piedemonte Llanero are the ones in critical danger.

The tropical dry forest is the ecosystem with the greatest risk of extinction in the country, as it currently has around 1,022,632 ha, which equals less than 8% of its original coverage. The most worrying part is that only 6.4% of these forests are located within protected areas.

In the book [Bosque seco Colombia: biodiversidad y gestión](#), Instituto Humboldt states that "the tropical dry forest is in a critical state of fragmentation and degradation, since most of its areas are exposed to anthropogenic pressures such as farming, human infrastructure, and agriculture."

It is crucial to preserve what remains of this type of ecosystems within protected areas since, when there is no or little human exploitation, these biodiverse natural structures are resilient. Rubiano's data showed that 171,844 ha of land within protected areas, as well as 274,815 ha in buffer zones, resulted in forest gains once human economic activities ceased.

Rubiano's thesis shows that within protected areas, we can win the battle of conservation of our ecosystems if we handle them appropriately. Ecosystems can, therefore, recover their territory.

Thus, it is important to create spaces to talk and debate about ecologic resilience and restoration, as happened at the ATBC congress this year. The discussions that took place there show that change in land use trajectories towards more sustainable systems may save the dry forest in particular, which, against all odds, still refuses to disappear. ■