THE GREEN CARPET CONTRIBUTION

Moss-covered areas capture 6.43 billion tons of carbon a year and have a coverage area nearly that of China

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Annually, moss-covered areas absorb 6.43 billion tons more carbon from the atmosphere than land environments that are not covered by this type of vegetation. This amount, reported in an international study published in the scientific journal *Nature Geoscience* in May, is equivalent to more than six years of global carbon emissions associated with land-use changes, such as those from the transformation of forest swaths into agricultural or pasture areas. Like all plant matter, mosses capture carbon dioxide (CO_2) through photosynthesis, reducing the atmospheric levels of the gas that is

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the main contributor to the greenhouse effect and causes global warming.

In the study, which was conducted by researchers based in Brazil, estimates of the area of the planet occupied by moss were also reported: 9.4 million square kilometers (km_2), almost equivalent to that of China. This figure was generated after moss sampling was conducted in 123 ecosystems across all continents.

Unlike vascular plants (trees, bushes, herbs, and ferns), mosses are a type of plant in the Bryophyta group that do not synthesize lignin in their cell walls; for this reason, mosses do not have woody, rigid parts. Moss was one of the first plants to exist in the land environment almost 500 million years ago and is particularly important in places where vascular plants do not survive, carpeting forest floors and fields and growing on tree trunks and rocks. There are currently at least 12,000 species of moss that are spread across all the world's continents.

This study involved 50 scientists from around the globe who submitted moss samples from tropical climates such as the Australian outback zone and from icy zones such as Antarctica. Analyses were conducted on specimens from forested areas, meadows, and pastures in natural and urban environments. In Brazil, moss samples were only collected from the Cerrado (wooded savannah) region.

The results of this study reinforce the importance of preserving moss-covered areas, which has yet to be investigated in depth. "Within the global climate change scenario, there is a need to incentivize studies into this group of plants, which are very sensitive to changes in their habitat," said botanist Alberto Teixido of the Complutense University of Madrid, one of the article's authors. Spanish by birth, Teixido lived in Brazil for eight years until July last year, during which time he undertook postdoctoral work at the Federal University of Minas Gerais (UFMG), subsequently becoming a visiting professor at the Federal University of Mato Grosso (UFMT). Another author of the study with links to Brazil is Colombian biologist Gabriel Peñaloza-Bojacá, who performed his PhD at the UFMG.

The aim of this study was to analyze moss-covered regions and compare them with regions without this type of vegetative cover. In total, the researchers identified 24 different ways in which mosses contribute to the soil environment and to other plants. This type of vegetation, for example, influences the microclimate of ecosystems and helps to control humidity and temperature. In addition to reducing global warming contributions, carbon absorbed by moss aids in the growth of nearby plants. Mossy soils have relatively high concentrations of nutrients such as nitrogen, phosphorus, and magnesium and relatively high levels of enzyme activity.

These benefits come about because mosses, particularly those of the *Sphagnum* genus, are able to create a humid ecosystem with organic material harboring a wide range of microbes, fungi, and invertebrates. All of these factors give rise to effective and rapid nutrient cycling and organic material decomposition processes. Moss-covered ground, when compared to surfaces without moss, exhibits less erosion and contains fewer pathogens responsible for causing disease in plants.

According to Teixido, there is a lack of consolidated data on the importance of mosses in Brazilian ecosystems. "We need more experts to describe and identify the physiology and ecology of mosses across different ecosystems, such as Amazonia," he commented. According to the *Flora e Funga do Brasil* project, which is coordinated by the Rio de Janeiro Botanical Gardens, there are 896 moss species in the country, many of which occur in Atlantic Forest areas.

The botanist Denilson Fernandes Peralta of the São Paulo State Institute for Environmental Studies (IPA) acknowledged that the estimates of moss-covered areas around the globe were impressive, but he pointed out certain limitations of the new study. "Moss specimens from important Brazilian biomes such as the Atlantic Forest, Amazonia, and Caatinga (semiarid scrublands), South American Patagonia, and northern hemisphere tundra were not included in the research," said Peralta, a specialist in seedless plants, flowers, and fruits that reproduce using spores, such as bryophytes. "This means that the data may result in underestimates, and further revisions may be needed." Even so, according to Peralta, the survey presented in the article is significant for understanding the environmental significance and services provided by mosses. ■

The scientific article consulted for this report is referenced in the online version.