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For a multidisciplinary
Biogeography: perspectives
and approaches in a climate
change scenario

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For a multidisciplinary Biogeography: perspectives and approaches in a climate change scenario

ABSTRACT

In 2024, we organized the following events at the Department of Geography (FFLCH-USP): the III Ibero-American Congress of Biogeography, the I Brazilian Conference on Biogeography and Climate Change, and the XIII Spanish Congress of Biogeography. In this dossier, we selected articles that represent themes and scientific approaches reflecting the importance of this field in facing the challenges of biodiversity and sociodiversity protection. In *“Exploring the spatiotemporal dynamics of landscapes in Brazil (2002-2020): a conservation perspective,”* the authors identify and quantify landscape patterns at multiple scales in Brazil. Based on the spatiotemporal dynamics of vegetation cover, the analysis highlighted the role of protected areas and agriculture in spatial and temporal transformations. In the study *“Exclusive species of the dunes and their role in habitat restoration on the Catalan coast: The case of *Ammophila arenaria*,”* we learn about the dynamics of the dune flora on the Catalan coast, a region that is highly urbanized and has intense tourist activity. The text *“Filiación corológica y estatus del Valle de Ricote”* presented the landscape of the Ricote Valley in Murcia, Spain, rich in history and marked by the influence of various cultures, resulting in a profound transformation of the original vegetation. In the theme *“Analysis of environmental changes in Brazil in the 21st century based on bioclimatic regimes: the case of the Amazon, the Cerrado, and the Caatinga,”* a climate projection is presented based on maps of the current bioclimatic regimes of Brazil, and their situation in a scenario for the year 2070 according to the IPCC. The article *“Adaptation of the Bioclimatic Regimes Types (BRT) method for the island of El Hierro (Canary Islands)”* produced an updated and detailed bioclimatic map, essential for facing the climate emergency. Through academic production, we were able to understand and confirm the great methodological plurality and the effort of many researchers contributing to Brazilian and Ibero-American Biogeography.

Keywords: Biogeography. Climate change. Biodiversity. Sociodiversity.

Por uma Biogeografia multidisciplinar: perspectivas e abordagens em um cenário de mudanças climáticas

RESUMO

Em 2024, realizamos no Departamento de Geografia (FFLCH-USP) os seguintes eventos: III Congresso Iberoamericano de Biogeografia, I Conferência Brasileira de Biogeografia e Mudanças Climáticas e XIII Congresso Espanhol de Biogeografia. Selecionamos, neste dossiê, artigos que representam temas e abordagens científicas que refletem a importância desse campo diante dos desafios da proteção da biodiversidade e da sociodiversidade. Em *“Explorando a dinâmica espaço-temporal das paisagens no Brasil (2002-2020): uma perspectiva para a conservação,”* os autores identificam e quantificam padrões de paisagem em múltiplas escalas. Com base na dinâmica espaço-temporal da cobertura vegetal, a análise evidenciou o papel das áreas protegidas e da agricultura nas transformações espaciais e temporais. No estudo sobre *“Espécies exclusivas das dunas e sua função na restauração dos habitats na costa catalã: O caso de *Ammophila arenaria*,”* conhecemos a dinâmica da flora das dunas da costa catalã, uma região altamente urbanizada e com intensa atividade turística. O texto *“Filiación corológica e estatus del Valle de Ricote”* apresentou a paisagem do Vale de Ricote, em Múrcia, Espanha, rica em história e marcada pela influência de diversas culturas, resultando em uma profunda transformação da vegetação original. No tema *“Análisis de los cambios ambientales en Brasil en el siglo XXI a partir de regímenes bioclimáticos: el caso de la Amazonía, el Cerrado y la Caatinga,”* é apresentada uma projeção climática com base em mapas dos tipos de regimes bioclimáticos atuais do Brasil, e sua situação

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em um cenário para o ano de 2070 do IPCC. O artigo “*Adaptação do método de Tipos de Regimes Bioclimáticos (TRB) para a ilha de El Hierro (Canárias)*” produziu um mapa bioclimático atualizado e detalhado, essencial para enfrentar a emergência climática. A partir da produção acadêmica, pudemos conhecer e confirmar a grande pluralidade metodológica e o esforço de diversos pesquisadores que produzem a Biogeografia brasileira e ibero-americana.

Palavras-chave: Biogeografia. Mudanças climáticas. Biodiversidade. Sociodiversidade.

Por una Biogeografía multidisciplinaria: perspectivas y enfoques en un escenario de cambio climático

RESUMEN

En 2024, organizamos los siguientes eventos en el Departamento de Geografía (FFLCH-USP): el III Congreso Iberoamericano de Biogeografía, el I Congreso Brasileño de Biogeografía y Cambio Climático y el XIII Congreso Español de Biogeografía. En este dossier, seleccionamos artículos que representan temas y enfoques científicos que reflejan la importancia de este campo para enfrentar los desafíos de la protección de la biodiversidad y la sociodiversidad. En “*Explorando la dinámica espaciotemporal de los paisajes en Brasil (2002-2020): una perspectiva de conservación*”, los autores identifican y cuantifican patrones de paisaje en múltiples escalas en Brasil. Con base en la dinámica espaciotemporal de la cobertura vegetal, el análisis destacó el papel de las áreas protegidas y la agricultura en las transformaciones espaciales y temporales. En el estudio “*Especies exclusivas de las dunas y su papel en la restauración del hábitat en la costa catalana: el caso de *Ammophila arenaria**”, conocemos la dinámica de la flora dunar en la costa catalana, una región altamente urbanizada y con intensa actividad turística. El texto “*Filiación corológica y estatus del Valle de Ricote*” presentó el paisaje del Valle de Ricote en Murcia, España, rico en historia y marcado por la influencia de varias culturas, resultando en una profunda transformación de la vegetación original. En el tema “*Análisis de los cambios ambientales en Brasil en el siglo XXI con base en regímenes bioclimáticos: el caso de la Amazonia, el Cerrado y la Caatinga*”, se presenta una proyección climática basada en mapas de los regímenes bioclimáticos actuales de Brasil, y su situación en un escenario para el año 2070 según el IPCC. El artículo “*Adaptación del método de Tipos de Regímenes Bioclimáticos (BRT) para la isla de El Hierro (Islas Canarias)*” produjo un mapa bioclimático actualizado y detallado, esencial para enfrentar la emergencia climática. A través de la producción académica, pudimos comprender y confirmar la gran pluralidad metodológica y el esfuerzo de muchos investigadores que contribuyen a la Biogeografía brasileña e iberoamericana.

Palabras clave: Biogeografía. Cambio climático. Biodiversidad. Sociodiversidad.

The year 2024 will be a milestone for Brazilian Biogeography. The largest academic event focused on the subject was conducted from November 25 to 29, with the University of São Paulo hosting three simultaneous events: III Iberoamerican Congress of Biogeography, I Brazilian Conference on Biogeography and Climate Change, and the XIII Spanish Congress of Biogeography. The articles presented in this dossier include scientific topics aimed at contributing to the challenges of biodiversity protection and social diversity in a context of major changes in habitats. The events brought together researchers from Brazil and other Iberoamerican countries.

From the explored academic production, we found a great opportunity for a necessary articulation, along with the effort of several researchers who have led Biogeography to achieve its current open form in Brazil and other countries. Our paths have been built upon the diversity of various previous activities that brought us here. The Spanish Congress of Biogeography, for example, began in 2000 in Girona, Spain, and has been held regularly,

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presenting its XIII Edition in Brazil. In 2020, in Santander, Spain, the I Iberoamerican Congress of Biogeography was born, which brought together researchers from Latin America. In Brazil, several efforts and initiatives have been put into practice, such as the I Brazilian Conference on Biogeography in 1998, the Workshop on Applied Biogeography (WORKBIO), with three editions so far, and even the I International Symposium on Field Biogeography, with a single edition in 2015 in João Pessoa, Paraíba. All events paved the way for us to reach this moment, of a first Brazilian National Conference, which is already a success.

The main subject of the events that took place at the University of São Paulo, “**Biogeography: scientific perspectives, conservation, and climate change**,” is an important articulating axis of environmental, biological, and earth sciences. By facilitating international scientific exchange on multiple topics, Brazilian researchers position themselves as key participants in the search for sustainable solutions, thus expanding the global impact of research in Biogeography.

The events addressed, over five days, the main biogeographic contents developed in Iberoamerica, including: landscape studies and biocultural approaches; the challenges of conservation in a climate change scenario; different approaches to historical and chorological biogeography; the conservation of socio-biodiversity; the challenges for the necessary restoration of ecosystems; the Brazilian morphoclimatic domains; discussions on delimitating and classifying biomes, and the challenges for the conservation of the *Pantanal* and *Caatinga* biomes. It was possible to gather researchers from all Brazilian biomes, accounting for approximately 500 researchers, professionals, and students from different countries.

As a way of valuing Biogeography and understanding that its approach can collaborate with other discussions in the field of Geography and related environmental sciences, we encouraged our speakers to submit articles, also with the aim of contributing to the memory of the events. We understand that an open Biogeography is necessary, bringing together constant exchanges, learning, and encouragement for the development of research networks in this field of knowledge. Thus, we would like to thank the opportunity offered by the GEOUSP journal, as well as the researchers who submitted their articles and the peer reviewers who carefully checked the five articles that will be presented here.

The article “*Explorando a dinâmica espaço-temporal das paisagens no Brasil (2002-2020): uma perspectiva para conservação*” [Exploring the spatio-temporal dynamics of landscapes in Brazil (2002-2020): a perspective for conservation] by researchers Dr. Ricardo Sartorello from the Federal University of São Paulo, Dr. Edson Alves Filho from the University of São Paulo, and Dr. Christopher Small from the Lamont-Doherty Earth Observatory - Columbia University, aims to identify and quantify landscape patterns at multiple scales in Brazil, based on the spatio-temporal dynamics of vegetation cover, considering the period from 2002 to 2020. The analysis focused on the phenological characteristics of natural and modified landscapes, highlighting the role of protected areas and agriculture in the Brazilian territory.

The spatiotemporal analysis of the Moderate Resolution Imaging Spectroradiometer (MODIS) enhanced vegetation index (EVI) series enabled the identification of distinct phenological patterns in the Brazilian landscape, with the first three dimensions representing most of the temporal variability, distinguishing perennial vegetation, annual and semiannual cycles, and non-vegetated areas. The mapping of phenological fractions, adjusted to climate

zones and biomes, provided greater spatial detail compared to continental maps and, despite the noise caused by clouds, the model faithfully captured the phenological diversity of the landscape, including double cycles that reveal regional variations. This article presents us very well with the old maxim that landscape is an inheritance, as discussed by Ab'Sáber (2003).

The article “**Especies exclusivas de las dunas y su función en la restauración de los hábitats en la costa catalana: El caso de *Ammophila arenaria***” [Exclusive species of dunes and their function in the restoration of habitats on the Catalan coast: the *Ammophila arenaria* case] by researchers Josep Pintó Fusalba and Carla Garcia-Lozano from the University of Girona in Spain, provides an update on the flora of the dunes on the Catalan coast, a highly urbanized region with intense tourist activity, classifying typical dune species and identifying those suitable for environmental restoration. The research focused on the presence of the species *Ammophila arenaria*, widely mentioned in the literature as a feature of moving dunes and employed in restoration projects. The study has found that their impact is limited in many areas, as the lack of constant winds hinders their competitiveness.

The results show that dune areas in non-urban environments have a greater diversity of species, whereas urban dunes, if sufficiently wide, also preserve good diversity. The Dex index has proven to be a useful and practical tool for environmental managers to assess the conservation status and naturalness of these threatened systems.

The article “**Filiación corológica y estatus del valle de ricote**” [Chorological affiliation and status of the Ricote Valley] by researchers María Cristina Días-Sanz from the Autonomous University of Madrid, and Pedro José Lozano Valencia from the University of the Basque Country, seek to present the landscape of the Ricote Valley, in Murcia, Spain, which is rich in history, marked by the impact of various cultures, such as Iberians, Romans, Carthaginians, and Arabs, resulting in a profound transformation of the original vegetation. The researchers present an inventory of representative plots of each plant landscape, evaluating their conservation and chorological affiliation.

The results revealed a predominance of species that are common or face few threats, highlighting the trivialization of plant landscape. Although the Mediterranean component predominates, the significant presence of the Euro-Siberian element is surprisingly greater than expected. It is in this context that we perceive the contributions of Biogeography, which precisely discusses the relationship between the species of a locality and the different biotic and abiotic factors, as well discussed by Rizzini (1976).

The article “**Análisis de los cambios ambientales en Brasil en el siglo XXI a partir de regímenes bioclimáticos: el caso de la Amazonía, el Cerrado y la Caatinga**” [Analysis of environmental changes in Brazil in the 21st century from bioclimatic regimes: the case of Brazilian Amazon, *Cerrado*, and *Caatinga*] by researcher Rafael Câmara Artigas of the University of Seville, aimed to evaluate the environmental issues that are currently occurring in Brazil and their projection for 2070, with an emissions scenario that estimates increases throughout the 21st century. The assessment was based on maps of the types of current bioclimatic regimes in Brazil, and their situation in an RCP 8.5 scenario for the year 2070, according to the CCSM4 climate change model of the IPCC Fifth Assessment Report in 2014.

Correlations were established between the bioclimatic regimes of the main ecoregions in Brazil: Brazilian Amazon, *Cerrado*, and *Caatinga*. The work presented, along with the Global Forest Watch platform, the deforestation processes, their causes, and the period

of high-intensity fires in September 2024. Then, based on bioclimatic data, the changes estimated to occur in each ecoregion were provided.

Finally, the article “*Adaptação do método de Tipos de Regimes Bioclimáticos (TRB) para a ilha de el hierro (canárias)*” [Adaptation of the Types of Bioclimatic Regimes (TBR) method for the El Hierro Island] by researchers Damián Caballero Fernández and Montserrat Salvà-Catarineu from the University of Barcelona, aimed to assess the applicability of the TBR methodology, testing it on the volcanic island of El Hierro, known for its complex geography and biodiversity. The BIOCLIM package in RStudio was employed for spatial interpolation using the universal kriging (UK) model and a linear regression model for the TBR method, adjusted by ordinary least squares and residual correction with ordinary kriging. Despite showing limitations in higher altitudes and more remote areas, the resulting maps show high accuracy, generating updated and detailed bioclimatic maps that are essential to address climate emergencies.

Thus, this work includes a set of articles presenting a biogeographical overview of different regions, each applying various techniques and methods to their respective areas. The results presented here corroborate the main subject of the event and certainly point to important trends for biodiversity in a climate change scenario. We wish you all a great read and invite you to delve deeper into this cosmos that is Biogeography.

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Sueli Angelo Furlan: General coordination; Text curation; Final review

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