CLIMATE CHANGE IMPACT ON MODELING THE DISTRIBUTION OF ORNAMENTAL SPECIES IN BRAZILIAN TERRITORY

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SUMMARY

Catharanthus roseus *(L.) G. Don and* Euphorbia milii *Des Moul. are ornamental species that occur spontaneously, are adapted to challenging environments, and exhibit phenotypic plasticity and resilience. Understanding the current and future distribution of these species can reveal potential losses in areas suitable for climate adaptation. The objective was to model the geographic distribution of* C. roseus *and* E. milii *under climate change scenarios to assess their suitability across Brazilian biomes. Nineteen bioclimatic and fourteen edaphic variables were utilized to model the ecological niche. The current distribution was analyzed based on data from the reference period (2009–2019), and future projections were assessed under two climate scenarios: SSP245 (less pessimistic) and SSP585 (more pessimistic) for the time intervals 2041–2060, 2061–2080, and 2081–2100. Losses in areas of environmental suitability for* C. roseus *and* E. milii *across the biomes were observed in all three time intervals, with* C. roseus *demonstrating greater resilience. These species, valued for ornamental and medicinal purposes, are expected to be significantly impacted by climate change from 2041 onward and should be conserved in backyards and gardens in regions with higher climate adaptability to prevent loss of genetic diversity.*

Introduction

The species *Catharanthus roseus* (L.) G. Don and *Euphorbia milii* Des Moul are widely distributed in Brazilian regions, in backyards, gardens, in natural populations, and in several tropical and subtropical regions of the world (Chaturvedi *et al.*, 2022). They are species with ornamental and medicinal potential, present rusticity, and phenotypic plasticity. The species *C. roseus* is a perennial herb belonging to the Apocynaceae family (Cacique *et al.*, 2020). Its pink, purple, and white flowers are used for decorative purposes (Paarakh *et al.*, 2022). *E. milii* is a thorny shrub belonging to the family Euphorbiaceae, known as the “crown of thorns” or "crown of Christ" and is used for the construction of live fences. The species are listed as plants that arise

KEYWORDS / Modeling of Ecological Niche / Plant Conservation / Vulnerability of Plant Species /

Received: 07/12/2024. Modified: 09/06/2024. Accepted: 09/10/2024.

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from spontaneous nature and cultivation in gardens (Kinupp *et al.*, 2021).

Catharanthus roseus is widely cultivated for medicinal and ornamental purposes, often cultivated near temples, gardens, parks, and farms, and used for landscape beautification. Its leaves, roots, and flowers are used in the treatment of cancer, diseases of the genitourinary system, kidneys, liver, and cardiovascular. Its flower is valued for its fragrance and its aroma that stimulates the brain. Extracts of various parts of the plant and isolated compounds were identified with several pharmacological properties, such as antimicrobial, antioxidant, anthelmintic, anti-alimentary, anti-sterility, antidiarrheal, and antidiabetic (Kumar *et al.*, 2022)

The species have attracted attention due to their versatility, resilience, and capability to withstand habitat disturbance. They can provide valuable insights into how different biomes respond to global climate change, as evidenced by studies on the reduction of suitable plant areas in varying climates (Chaturvedi *et al.*, 2022). Climate change is one of the main elements responsible for ecosystem change (Inouye, 2022).

Greenhouse gas emissions from anthropogenic activities have increased progressively, and according to the Intergovernmental Panel on Climate Change (IPCC, 2021) report, a temperature rise of 1.5°C is projected for the next 30 years. In this context, future climate scenarios (Shared Socioeconomic Pathways - SSP) intermediate SSP 245 and more pessimistic SSP 585 (representing moderate and high emissions, respectively) are used. These scenarios are correlated with greenhouse gas emissions, economic factors, and population growth. Some studies show the impact of environmental changes on the distribution of PANC over different periods (Borges *et al.*, 2023). Others address the effect on the phenology and flowering time of many species, which can impact genetic viability and flowering time. However, these impacts still need to be better understood for species considered rustic, ornamental, and medicinal (Inouye, 2022).

Studies of environmental changes in the development and perpetuation of *C. roseus* and *E. milii* that have wide distribution in the Brazilian territory can be considered a good indicator of risk for vegetation maintenance in certain environments since these have plasticity and ease of survival in more hostile environments. The Brazilian environmental diversity, considering soil and climate variations, is ideal for modeling and conservation analysis of plant species in different environments. The impact of climate change on plant species can be demonstrated through ecological niche modeling. It is currently a methodology used for ecology, adaptation, and conservation studies aimed at reducing the loss of genetic variability (Borges *et al.*, 2023).

The study aimed to evaluate the potential distribution of *C. roseus* and *E. milii* in the current period and future climatic scenarios through ecological niches modeling of using bioclimatic and edaphic variables.

Material and Methods

The species' geographic coordinates were gathered from the Environmental In-formation Reference Center database, the Species Link platform (CRIA, 2024) and the *Global Biodiversity Information Facility* (GBIF, 2024). Additional information was obtained from virtual herbariums and a review of scientific articles in the literature. This data was collected in 2024 at the Plant Breeding Laboratory of the Federal University of Amazonas and was used to model and create layers related to the distribution of species in the Brazilian phytogeographic domains.

The occurrence points were subjected to an inconsistency analysis and were processed the "*tidyverse*" package (Wickham and Wickham, 2017), to remove duplicate points, "outliers," and those outside Brazilian territory. This process ensured the reliability and accuracy of the consensus model generated. To reduce data autocorrelation and potential sampling bias, occurrences within a radius of less than 5 km were removed using the "spThin" package in RStudio, as recommended by Aiello-Lammens *et al.* (2015).

To predict the current climate patterns, historical data from 1970 to 2000 was utilized, available from the *WorldClim-Global Climate Data* database. This data includes bioclimatic variables with a spatial resolution of 2.5 minutes (Fick and Hijmans, 2017). Soil variables were added to improve the modeling process since soil characteristics can directly influence the development of plant species (Alvarez *et al.*, 2022). These data are available in *SoilGrids* (ISRIC, 2024) and *EarthEnv* (Amatulli *et al.*, 2018) databases.

To analyze the 33 variables chosen for modeling and correct the multicollinearity, the Principal Component Analysis (PCA) was performed from the R Environment (R Development Core Team, 2024) to identify the contribution of each variable and reduce the number of variables used in the model (Velazco *et al.*, 2017). Among the Principal Components (PCs) generated in the PCA, the most representative were the first six, which represented the highest sample variability, accounting for at least 95%.

For future projections, the atmospheric circulation model CNRM-CM6-1, from CNRM-CERFACS (National Center for Meteorological Research and European Center for Advanced Research and Training in Scientific Calculation) was used, considering the periods of 2041–2060, 2061–2080 and 2081–2100. Additionally, two distinct scenarios of greenhouse gas (CO_2) emissions were considered: SSP245 and SSP585 (SSP – Shared Socioeconomic Pathways). In this context, SSP245 represents a "less pessimistic" scenario, where actions will be taken to reduce greenhouse gas emissions, while SSP585 depicts a "more pessimistic" scenario, where no mitigation measures will be implemented. For the ecological niche modeling process and species distribution, the ENMTML package (Andrade *et al.*, 2020) was used in the R Environment (R Development Core Team, 2024).

To predict the geographic distribution of these species, a consensus model was developed from six different modeling algorithms: Support Vector Machine - SVM (Prasad *et al.*, 2006), Maximum Entropy Default - MXD (Anderson and Gonzalez Júnior, 2011), Bioclim – BIO (Xu *et al.*, 2013), Random Forest – RDF (Prasad *et al.*, 2006), Generalized Linear Models – GLM (Nelder and Wedderburn, 1972) and Bayesian Gaussian Process – GAU (Williams and Barber, 1998). To identify the model with the best predictive quality, the models were evaluated using three distinct metrics: Area Under the Curve (AUC) (Fielding and Bell, 1997), True Skill Statistic (TSS) (Allouche *et al.*, 2006), and Sorensen (Leroy *et al.*, 2018). The value of 1.0 indicates perfect discrimination, while values below 0.5 indicate unsatisfactory modeling performance (Leroy *et al.*, 2018).

Results

The most important climatic variables (with higher eigenvector values) were identified in the main components PC3, PC4 and PC5 and were related to the monthly average of the daily temperature variation (°C): Bio2 (PC5: −0,40), rainfall seasonality: Bio15 (PC3: 0.35) and rainfall accumulated in the hottest quarter (mm): Bio18 (PC5: −0.48). The soil variables of higher importance value related to soil characteristics were identified for clay (PC4: 0.35), sand (PC4: 0.54) and silt (PC4: 0.48) (Table I). The climatic and edaphic variables of lower importance were present in the main components PC3 and PC6, related to the monthly average of the daily temperature variation (maximum and minimum temperature) (°C) Bio 2 and clay, respectively.

The six algorithms (BIO, GAU, GLM, MXD, RDF and SVM) analyzed provided satisfactory performance accross all evaluation indices for both ornamental species. For C. roseus, the highest metrics were observed in the algorithms GAU (0.99 ±0.00), RDF (0.99 ±0.00), and SVM (0.99 ±0.00) for the AUC evaluation index. For *E. milii*, the RDF algorithm (0.95 ±0.02) presented the best metrics in the AUC evaluation index, corroborated by the low standard deviation values identified (Table I).

An occurrence matrix was obtained with 692 occurrence points for *C. roseus* (Figure 1a) and 111 for *E. milii* (Figure 1b), restricted to the Brazilian territory. In the present period (2009−2019), *C. roseus*, and *E. milii* showed wide distribution accross the Brazilian territory phytogeographic domains of the Amazon, Pantanal, Cerrado, Caatinga, and Atlantic Forest (Figure 1c, d). For *C. roseus*, a wide distribution was observed in the Amazon domain, except for the north, in which a low probability of occurrence of the species was detected, as in the Pampa domain, according to the area highlighted in red (Figure 1c). A similar pattern was observed for *E. milii*, with a low probability of occurrence also detected in the south of the Amazon domain and at the boundary with the Cerrado (Figure 1d).

The projections for *C. roseus* for the less pessimistic scenario SSP245 in the reference period 2041–2060 indicate losses of climatic adaptation areas in areas of the phytogeographic domains Amazon, Caatinga, Pantanal, part of the Atlantic Forest, and Pampa (Figure 2a). It is also observed an intensification in losses of areas in these domains in the periods 2061–2080 (Figure 2b) and 2081–2100 (Figure 2c), whose losses are in the northern and central portion of the Amazon domain and coastal areas of the Caatinga and Atlantic Forest domain.

In the most pessimistic scenario SSP585, the Amazon, Caatinga, and Atlantic Forest domains remain the most affected regarding the loss of areas with environmental suitability for *C. roseus* (Figure 2d, e, f). Despite this, the species maintains a high probability of occurrence in the southern part of the Amazon domain, the central region of the Atlantic Forest, and the central-southern region of the Cerrado domain.

For *E. milii*, there were significant losses of areas with environmental suitability in the Amazon, Pantanal, Cerrado, Caatinga, and Pampa domains under the SSP245 climate scenario (Figure 2g, h, i). The Caatinga domain showed a low probability of occurrence in all three time intervals studied (2041–2060, 2061–2080, and 2081–2100) (Figure 2g, h, i). In the most pessimistic scenario (SSP585), the Amazon, Cerrado, Caatinga, and Pantanal domains are severely affected by climate change (Figure 2j, k, l).

For *C. roseus*, in the SSP245 scenario, the greatest loss of area with climatic suitability, in percentage terms, occurred in the Caatinga (−21.45%), Atlantic Forest (−11%), and Amazon (−7.08%) domains in the time interval 2081−2100 compared to the current period (Table II). In the same scenario, there was an increase in the area with climatic suitability for the Pantanal (26.01%) and Cerrado (1.60%) domains. Conversely, in the more pessimistic scenario SSP585 fot the interval 2081−2100, losses are intensified in the Caatinga (−36.80%), Amazon (−31.65%), and Atlantic Forest (−14.96%). The Pampa domain showed a gain of 12.86% in area when compared to the current area (Table II).

For *E. milii*, there was a loss of area with climatic suitability under both scenarios analyzed (SSP245 and SSP585) (Table II). In the SSP 245 scenario, significant losses were observed in all phytogeographic domains, with the Pantanal (−99.28%), Caatinga (−88.94%) and Pampa (−54%) being the most affected in the 2081−2100 period. More pronounced losses are observed in scenario SSP585, in the time interval 2081−2100. Among the domains with the highest percentage of losses, Pantanal (−99.95%), Caatinga (−95.49%), Amazon (−94.85%), and Cerrado (−79.28%) stand out (Table II).

The Brazilian phytogeographic domains are widely distributed across forest areas, consistent with Bihani (2021), which notes their occurrence in tropical, subtropical, and temperate areas. *Urena lobata* L. a rustic and introduced plant, has a wide distribution in the Brazilian phytogeographic domains and behaves similarly *C. roseus*. Projections for both the less pessimistic and more pessimistic scenarios indicate losses of climatic suitability mainly in the Amazon, Pantanal, Atlantic Forest, and Caatinga (Gomes *et al.*, 2022). *C. roseus* has high

TABLE I
INDICATOR VARIABLES AND STANDARD DEVIATION (SD) FOR VALIDATING SIX MODELS FOR PREDICTING THE POTENTIAL AREA OF OCCURRENCE OF *C. roseus* AND *E. milii*

Metrics	Algorithms					
	BIO³	GAU4	GLM5	MXD6	RDF7	SVM8
C. roseus						
AUC¹	0.97 ±0.01	0.99 ±0.00	0.98 ±0.01	0.96 ±0.00	0.99 ±0.00	0.99 ±0.00
TSS²	0.93 ±0.03	0.90 ±0.02	0.89 ±0.01	0.84 ±0.01	0.93 ±0.01	0.89 ±0.01
Sorensen	0.96 ±0.02	0.95 ±0.01	0.95 ±0.01	0.92 ±0.00	0.96 ±0.01	0.94 ±0.01
E. milii						
AUC¹	0.89 ±0.05	0.94 ±0.02	0.94 ±0.02	0.91 ±0.03	0.95 ±0.02	0.94 ±0.02
TSS²	0.78 ±0.09	0.77 ±0.05	0.77 ±0.04	0.72 ±0.05	0.79 ±0.08	0.75 ±0.07
Sorensen	0.87 ±0.06	0.88 ±0.03	0.89 ±0.02	0.87 ±0.02	0.90 ±0.04	0.88 ±0.03

¹AUC (*Area under the Curve*); ²TSS (*True Skill Statistics*); ³BIO (*Bioclim*); 4GAU (*Bayesian Gaussian Process*); 5GLM (*Generalized Linear Models*); 6MXD (*Maximum Entropy Default*); 7RDF (*Random Forest*); 8SVM (*Support Vector Machine*).

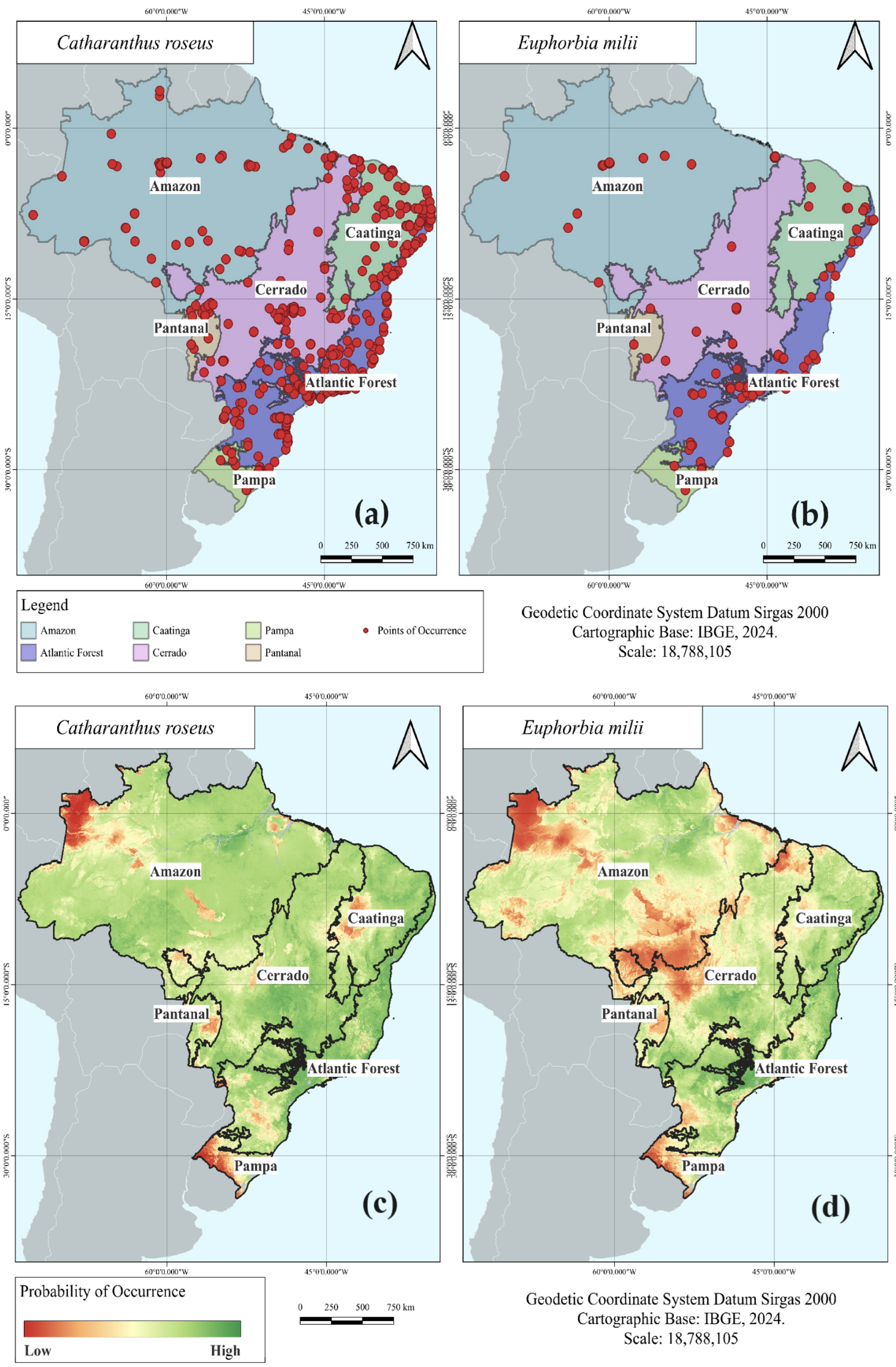

Figure 1. Points of occurrence restricted to Brazilian phytogeographic domains after collinearity analysis and spatial reduction, and projection for the present period (2009–2019) of the species: (a, c) *Catharanthus roseus* and (b, d) *Euporbia milii*.

ornamental value due to its year-round flowering and wide adaptability, allowing it to survive extreme abiotic events (Das *et al.*, 2020), which justifies its permanence in some of the domains mentioned in the most pessimistic scenario. *E. milii* is considered a succulent plant with slow growth and limited branching, making it more sensitive to climate change. Consequently, with ongoing increases in temperature and environmental changes, suitable areas for *E. milii* are expected to decrease.

Global climate change is a major factor driving changes in the geographic distributions of plant species and their extinction risks, either in the short or long term (Zhang *et al.*, 2020). Ecosystems are impacted by changes in precipitation, average temperature, and the frequency of extreme climatic events, which can lead to abrupt shifts in plant community composition according to species' climatic needs (Pérez-Navarro *et al.*, 2024). Additionally, climate can directly affect flowering phenology, which is crucial for ornamental species (Zhang *et al.*, 2020). Understanding the effects of climate changes on habitats considered environmentally suitable for these species is vital for assessing ecosystem and species susceptibility to climate change and the processes leading to vulnerability or adaptation (Pérez-Navarro *et al.*, 2024).

Given the importance of these species for the national and international markets and their responses to global climate change, studying future predictions for ornamental species is a strategy to ensure their conservation in Brazilian territory. For the species studied, it is recommended that areas of suitability for future occurrence, particularly for the most pessimistic SSP585 period, be incorporated as natural propagation areas to aid in conservation. For *C. roseus*, this should focus on the central and southeastern regions of Brazil, and for *E. milii*, on fragments of the Atlantic Forest, primarily in southeastern Brazil. Genetic variability from risk areas should be sampled and incorporated into areas that support future species occurrence starting from 2040, as losses in climatic suitability have already been observed. Similar studies for other rustic species should be conducted since their adaptive responses and sensitivities to environmental changes differ.

Ornamental plants, such as those studied here, may tolerate extreme climatic conditions, including high temperatures, prolonged droughts, or intense rainfall. Conserving these plants can diversify the vegetation in areas most affected by climate change, aid in recovery, and enhance the resilience due to their rusticity. Characterization and monitoring of different genotypes of resilient species should be carried out to support global ecosystem restoration goals (Simonson *et al.*, 2021). Urban gardens and home yards, often undervalued, can play a crucial role in preserving ornamental plants and maintaining Brazilian biodiversity, particularly in urban areas where habitat loss is significant. They provide refuge for these species, contribute to genetic conservation, and offer microhabitats that can mitigate some negative effects of climate change. Incorporating these plants into urban landscaping and community garden projects can also raise public awareness of

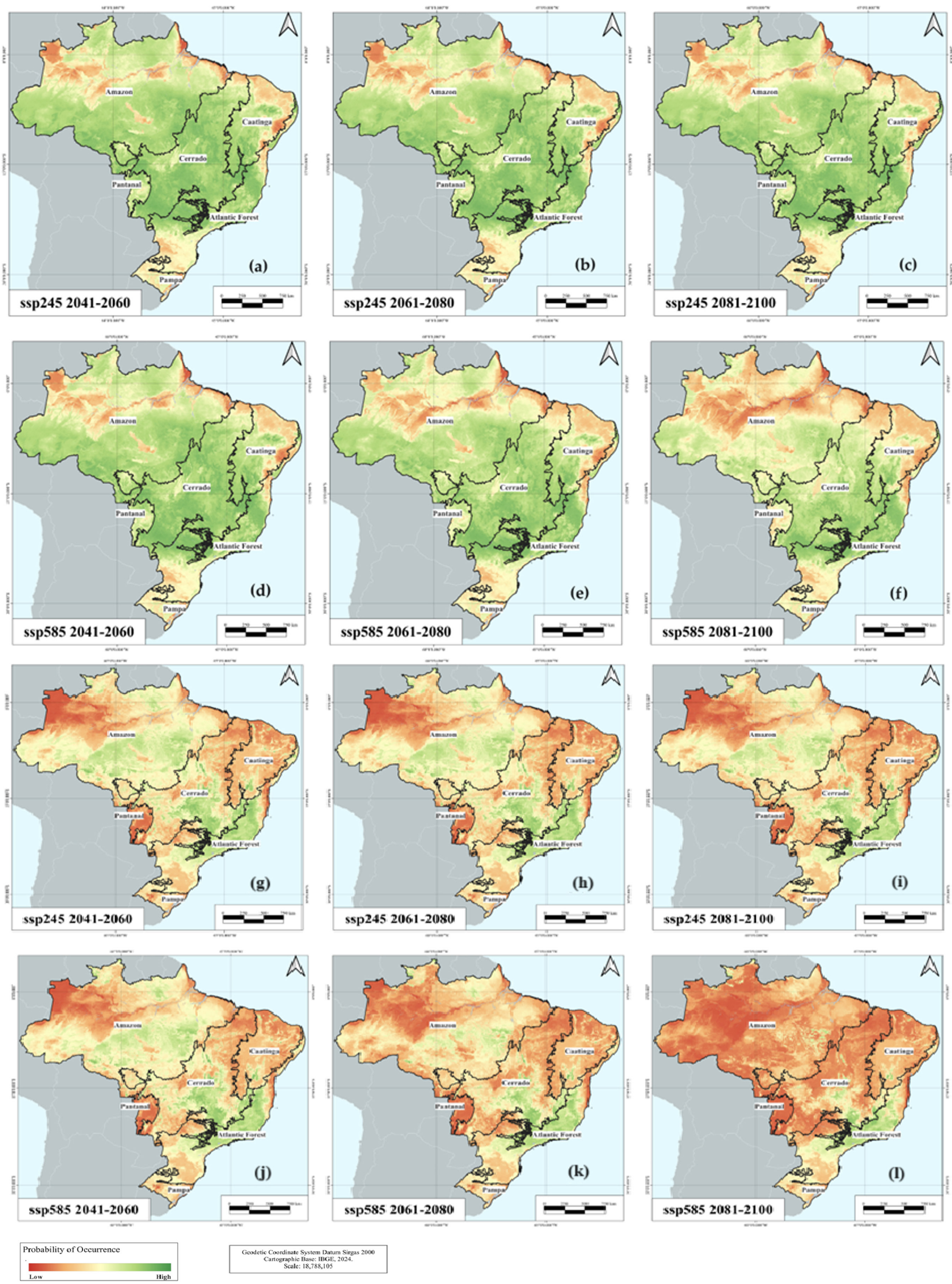

Figure 2. Projection of the environmental suitability of *Catharanthus roseus* and *Euphorbia milii*: (a, b, c, g, h, i) less pessimistic climate scenario SSP245; (d, e, f, j, k, l,) more pessimistic scenario SSP585 in the time intervals (a, d, g, j) 2041–2060; (b, e, h, k) 2061 –2080; and (c, f, i, l) 2081–2100.

TABLE II
PROJECTIONS OF AREA OF ENVIRONMENTAL SUITABILITY (%) FOR *C. roseuS* AND *E. milii* IN SCENARIOS SSP245 AND SSP585 IN THE TIME INTERVALS 2041–2060, 2061–2080, AND 2081–2100, COMPARED TO THE CURRENT PERIOD, IN THE BRAZILIAN TERRITORY

Coverage	SSP[1]245[2]			SSP[1]585[3]		
	2041–2060	2061–2080	2081–2100	2041–2060	2061–2080	2081–2100
			C. roseus			
Amazon	−5.24	−6.93	−7.08	−5.89	−11.23	−31.65
Caatinga	−17.66	−19.76	−21.45	−19.92	−25.03	−36.80
Cerrado	2.39	2.01	1.60	2.17	0.19	−5.47
Atlantic Forest	−10.79	−10.30	−11.00	−11.26	−13.05	−14.96
Pampa	2.15	1.51	−0.04	0.52	5.45	12.86
Pantanal	26.54	26.38	26.01	26.44	22.80	−7.90
Total	−4.73	−5.77	−6.24	−5.41	−9.19	−22.11
			E. milii			
Amazon	−17.67	−26.46	−35.11	−26.36	−63.22	−94.85
Caatinga	−85.50	−87.18	−88.94	−87.28	−91.26	−95.49
Cerrado	−36.05	−40.04	−46.42	−39.79	−58.81	−79.28
Atlantic Forest	−31.62	−32.12	−32.75	−33.24	−35.84	−39.34
Pampa	−62.75	−56.67	−54.00	−54.84	−56.52	−35.78
Pantanal	−98.58	−98.79	−99.28	−98.34	−99.62	−99.95
Total	−34.73	−39.70	−45.28	−39.76	−61.34	−80.79

[1]SSP: *Shared Socioeconomic Pathways*; [2]245: less pessimistic; and [3]585: more pessimistic.

local flora conservation and inspire sustainable practices (Kumar *et al.*, 2022). Studies on a variety of ornamental plants may help understand adaptability mechanisms to new environmental conditions and their ability to reproduce and survive. Leveraging interdisciplinary tools (e.g., omics toolkits, new ecological strategies, genome editing technologies) can improve predictions of species persistence during rapid environmental changes, aiding in climate resilience and biodiversity conservation (Anderson *et al.*, 2020).

Species such as *C. roseus* and *E. milii* are distributed worldwide due to their exuberance, beauty, and adaptation potential. They can be used in sustainable landscaping projects to reduce water consumption, use natural resources efficiently, and create environments more resilient to climate change. Green spaces in large urban areas should be plentiful, sustainable, adapted to local edaphoclimatic conditions, and have reduced maintenance costs (Xarepe *et al.*, 2024).

It is important to conduct studies and ongoing monitoring to evaluate the impact of ornamental plants on local ecosystems. It is essential to ensure that their conservation is carried out responsibly, minimizing the risks of invasion and negative impacts on native biodiversity. These species can be utilized primarily for landscaping projects in cities and in areas where there has been vegetation loss, particularly to re-store areas without native vegetation, such as those undergoing erosion. The extensive restoration of various ecosystems is increasingly recognized as essential for biodiversity conservation and for stabilizing the Earth's climate (Strassburg *et al.*, 2020).

Species with large geographical ranges, such as *C. roseus* and *E. milii*, are expected to be less vulnerable to climate change as they can find suitable climatic variations within parts of their range (Lucas *et al.*, 2019). However, endemic species' distributions may contract due to climate change, increasing their extinction risk due to local impacts like habitat loss and interactions with more resilient introduced species (IPCC, 2021). Global warming will disproportionately increase extinction risks for both endemic and non-endemic native species. Reducing extinction risks will require adaptation responses in biodiversity-rich areas and greater climate change mitigation (Manes *et al.*, 2021).

Despite numerous studies on climate change impacts on plant species, synthesizing clear patterns of risk for conservation remains challenging. This synthesis should compare different levels of ecological organization (e.g., species and community levels) based on ecological uniqueness (i.e., level of endemism) and policy-relevant climate scenarios (projected rates of climate change) (Manes *et al.*, 2021). Conservation decisions for each species should consider its importance, distribution area, climatic suitability loss, and extinction risk aggravation.

There is substantial global concern about plant invasions' potential impacts on native biodiversity in protected areas. Studies show that there will be increased risks of multiple invasive alien plants inside and outside protected areas in the future (Kariyawasam *et al.*, 2020). The severity of threats should force policymakers and resource managers to consider new species protection strategies to complement existing conservation approaches (Gregory *et al.*, 2021). On the other hand, it should be considered that the species introduced, when used rationally, are viable alternatives for plantations not only in their centers of diversity but also to participate in the reconstitution of ecosystems that need species with greater rusticity. Thus, these should also be subject to conservation in climate scenarios and periods of increased risk of loss of variability. It is recommended for conservation to use areas that do not have native species, native forests, or riparian forests that can facilitate dispersion by water and that can contaminate natural populations of other species.

The species in the present study can be utilized in urban green spaces to reduce factors contributing to climate change, such as atmospheric carbon dioxide, improve soil cover, enhance the local microclimate, and contribute to sensory gardens. Enhancing carbon sequestration efficiency in urban green spaces is essential for urban sustainability (Fan *et al*., 2023). The rustic plants introduced can be an alternative for planting in areas and/or cities most affected by rising temperatures.

Conclusions

The ornamental species *C. roseus* and *E. milii*, with wide distribution in Brazil, show a loss of areas with environmental suitability in future scenarios, especially in the Amazon and Cerrado phytogeographic domains.

The loss of areas with environmental suitability for the occurrence of *C. roseus* and *E. milii* increases over the years (2041 to 2100) in all Brazilian phytogeographic domains under the SSP585 scenario (more pessimistic) due to global climate change.

To mitigate losses of *C. roseus* and *E. milii* due to the reduction of climatic suitability areas, genetic variability should be sampled before the anticipated critical scenario. Conservation efforts should be focused on backyards and gardens in regions with higher adaptability.

ACKNOWLEDGMENT

The authors express their gratitude to FAPEAM- Amazonas State Research Support Foundation for awarding Danielle Portela de Almeida a scholarship.

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IMPACTO DEL CAMBIO CLIMÁTICO EN LA MODELIZACIÓN DE LA DISTRIBUCIÓN DE ESPECIES ORNAMENTALES EN EL TERRITORIO BRASILEÑO

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RESUMEN

Catharanthus roseus *(L.) G. Don. y Euphorbia milii Des Moul. son especies ornamentales de ocurrencia espontánea, adaptadas a ambientes desafiantes, exhiben plasticidad fenotípica y resiliencia. El conocimiento de la distribución actual y futura de estas especies puede destacar pérdidas en áreas de adaptación climática. El objetivo de este trabajo consistió em presentar el modelado de la distribución geográfica en escenarios de cambios climáticos de* C. roseus *y* E. milii *para verificar las áreas de adecuación para la ocurrencia de especies en los biomas brasileños. Se utilizaron diecinueve variables bioclimáticas y catorce edáficas para modelar el nicho ecológico. La distribución actual se analizó con base en datos del período de referencia (2009–2019), y las proyecciones futuras se evaluaron bajo dos escenarios climáticos: SSP245 (menos pesimista) y SSP585 (más pesimista) para los intervalos de tiempo 2041–2060, 2061–2080 y 2081–2100. Se observaron pérdidas en áreas de adecuación ambiental para* C. roseus *y* E. milii *en los biomas durante los tres intervalos de tiempo, con* C. roseus *demostrando mayor resiliencia. Estas especies, valoradas por sus usos ornamentales y medicinales, se espera que sean significativamente impactadas por el cambio climático a partir de 2041 y deberían ser conservadas en patios y jardines en regiones con mayor adaptabilidad climática para prevenir la pérdida de diversidad genética.*

IMPACTO DAS MUDANÇAS CLIMÁTICAS NA MODELAGEM DA DISTRIBUIÇÃO DE ESPÉCIES ORNAMENTAIS EM TERRITÓRIO BRASILEIRO

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RESUMO

Catharanthus roseus *(L.) G. Don. e Euphorbia milii Des Moul. são espécies ornamentais de ocorrência espontânea, adaptadas a ambientes desafiadores, apresentam plasticidade fenotípica e resiliência. Conhecimento da distribuição atual e futura dessas espécies pode destacar perdas em áreas de adaptação climática. O objetivo foi apresentar a modelagem da distribuição geográfica em cenários de mudanças climáticas de* C. roseus *e* E. milii *para verificar as áreas de adequação para a ocorrência de espécies nos biomas brasileiros. Dezenove variáveis bioclimáticas e quatorze edáficas foram utilizadas para modelar o nicho ecológico. A distribuição atual foi realizada com base no período de referência (2009-2019) e as projeções futuras foram avaliadas em dois cenários climáticos, SSP245 (menos pessimista) e SSP585 (mais pessimista) nos intervalos de tempo (2041-2060, 2061-2080 e 2081-2100). Foi possível verificar perdas de áreas com adequação ambiental para* C. roseus *e* E. milii *nos biomas brasileiros nos intervalos de três tempos, sendo* C. roseus *considerada mais resiliente. Estas espécies para fins ornamentais e medicinais serão significativamente afetadas pelas mudanças climáticas a partir de 2041 e devem ser conservadas em quintais e jardins em regiões com maior adaptação climática para evitar a perda da diversidade genética.*