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STRUCTURE AND COMPOSITION OF AQUATIC VASCULAR VEGETATION IN THE CIÉNAGA DE SIERRA CHIQUITA, MONTERÍA–CÓRDOBA

ESTRUTURA E COMPOSIÇÃO DA VEGETAÇÃO VASCULAR AQUÁTICA NA CIÉNAGA DE SIERRA CHIQUITA, MONTERÍA–CÓRDOBA

ESTRUCTURA Y COMPOSICIÓN DE LA VEGETACIÓN VASCULAR ACUÁTICA EN LA CIÉNAGA DE SIERRA CHIQUITA, MONTERÍA-CÓRDOBA

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ABSTRACT

The Ciénaga de Sierra Chiquita, located in the municipality of Montería (Córdoba), is an aquatic ecosystem of high ecological importance that is currently facing various environmental pressures resulting from waste discharge, uncontrolled agricultural expansion, and the introduction of exotic species. These activities have led to significant alterations in its biodiversity and the provision of ecosystem services. This study evaluated the structure and composition of vascular aquatic vegetation in two zones with differing levels of anthropogenic disturbance. A total of 57 species were recorded, distributed across 24 families and grouped into 39 genera, and classified as palustrine, emergent, or floating. The most representative species included *Thalia geniculata, Ludwigia octovalvis*, and *Nymphaea alba*, due to their ecological relevance. Invasive species such as *Lemna minor, Eichhornia crassipes*, and *Pistia stratiotes*. were also identified. The observed differences in floristic composition between the studied zones suggest a direct impact of human activities on the ecosystem's dynamics. The results highlight the urgent need to implement ecological restoration strategies to mitigate these effects, promote the regeneration of native species, and encourage active participation of local communities and authorities in the conservation of the wetland and the ecosystem services it provides.

Keywords: Biodiversity. Hydrophytes. Invasive. Palustrine. Restoration.

RESUMO

A Ciénaga de Sierra Chiquita, localizada no município de Montería (Córdoba), é um ecossistema aquático de grande relevância ecológica que atualmente enfrenta diversas pressões ambientais decorrentes do despejo de resíduos, da expansão agrícola sem controle e da introdução de espécies exóticas. Essas atividades têm ocasionado alterações substanciais em sua biodiversidade e na provisão de serviços ecossistêmicos. Neste estudo, avaliou-se a estrutura e a composição da vegetação vascular aquática em duas áreas com diferentes graus de intervenção antrópica. Foram registradas 57 espécies distribuídas em 24 famílias e agrupadas em 39 gêneros, classificadas como palustres, emergentes e flutuantes. Entre as espécies mais representativas destacam-se *Thalia geniculata, Ludwigia*

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octovalvis e *Nymphaea alba*, devido à sua relevância ecológica. Além disso, foram identificadas espécies invasoras como *Lemna minor, Eichhornia crassipes* e *Pistia stratiotes*. As diferenças observadas na composição florística entre as áreas estudadas sugerem um impacto direto das atividades humanas sobre a dinâmica do ecossistema. Os resultados ressaltam a urgência da implementação de estratégias de restauração ecológica que mitiguem esses efeitos, favoreçam a regeneração de espécies nativas e promovam a participação ativa das comunidades e das autoridades locais na conservação da ciénaga e dos serviços ecossistêmicos que ela fornece.

Palavras-chave: Biodiversidade. Hidrófitas. Invasoras. Palustres. Restauração.

RESUMEN
La Ciénaga de Sierra Chiquita, ubicada en el municipio de Montería (Córdoba), es un ecosistema acuático de gran relevancia ecológica que actualmente enfrenta diversas presiones ambientales derivadas del vertimiento de residuos, la expansión agrícola sin control y la introducción de especies exóticas. Estas actividades han ocasionado alteraciones sustanciales en su biodiversidad y en la provisión de servicios ecosistémicos. En este estudio se evaluó la estructura y composición de la vegetación vascular acuática en dos zonas con distinto grado de intervención antrópica. Se registraron 57 especies distribuidas en 24 familias y agrupadas en 39 géneros, clasificadas como palustres, emergentes y flotantes. Entre las especies más representativas se destacan *Thalia geniculata, Ludwigia octovalvis* y *Nymphaea alba*, por su relevancia ecológica. Asimismo, se identificaron especies invasoras como *Lemna minor*, *Eichhornia crassipes* y *Pistia stratiotes*. Las diferencias observadas en la composición florística entre las zonas estudiadas sugieren un impacto directo de las actividades humanas sobre la dinámica del ecosistema. Los resultados resaltan la urgencia de implementar estrategias de restauración ecológica que mitiguen estos efectos, favorezcan la regeneración de especies nativas y fomenten la participación activa de las comunidades y autoridades locales en la conservación de la ciénaga y de los servicios ecosistémicos que esta provee.

Palabras clave: Biodiversidad. Hidrófitas. Invasoras. Palustres. Restauración.

1 INTRODUCTION

Wetlands are essential ecosystems for maintaining the planet's ecological balance, yet they are currently under increasing threat from human activities. The continuous reduction of their surface area worldwide reflects the impact of urbanization, inefficient water use, and landscape transformation. Factors such as urban and rural expansion, alterations in hydrogeomorphology, infrastructure development, deforestation, and agricultural exploitation have modified their natural structure and dynamics, compromising their ability to sustain life and regulate ecological cycles (Universidad Nacional de La Plata, 2020).

Within this context, ciénagas stand out for their ecological importance, functioning as water regulators and habitats for a wide variety of plant and animal species, many of which rely exclusively on these environments for their survival. In addition, they act as natural buffers against flooding and provide essential ecosystem services to local communities (Ministerio de Transporte, 2019).

The Ciénaga de Sierra Chiquita, located in the municipality of Montería (Córdoba), has been designated a protected area within the urban perimeter and is recognized for its key role in water regulation and the support of high biodiversity. Nevertheless, it faces significant threats such as urban expansion, waste discharge, and the effects of climate change, all of which jeopardize its ecological and functional integrity (Ministerio de Ambiente y Desarrollo Sostenible, 2020). Despite its importance, there is limited available information on the vascular aquatic vegetation in this region. Studies such as those by Cortés Castillo *et al*. (2022), which document the diversity of macrophytes across different regions of Colombia, have significantly contributed to national floristic knowledge; however, studies specifically addressing the aquatic vascular vegetation in the Ciénaga de Sierra Chiquita remain scarce, highlighting the need for research that helps understand its ecological processes and functional role.

In response to this knowledge gap, the objective of this study was to determine the structure and composition of the vascular aquatic vegetation present in this ciénaga. This initiative aims to provide evidence on the diversity and organization of these species within an environment increasingly affected by anthropogenic pressure, recognizing their importance for regional biodiversity and the well-being of the communities that depend on its resources. Furthermore, the study seeks to offer useful information for more effective environmental management and to promote a shift in local perceptions regarding the need to conserve these strategic ecosystems.

2 MATERIALS AND METHODS

2.1 STUDY AREA

The research was conducted in the Ciénaga de Sierra Chiquita, located in the municipality of Montería, Córdoba Department, southwest of the urban center and on the right bank of the Sinú River. This wetland covers approximately 763 hectares and lies under the jurisdiction of the Corporación Autónoma Regional de los Valles del Sinú y del San Jorge (CVS). Geographically, it forms part of the Sinú River alluvial plain, situated between the Abibe and San Jerónimo mountain ranges (Fig. 1).

The protected area includes low-lying zones comprising the wetlands of Sierra Chiquita, Los Araujo, and El Batallón, with an average elevation of 14 m a.s.l., rising to a maximum of 187 m a.s.l. at the highest crest. The geographical location of the wetland is 8.7106° N, 75.9092° W (CVS).

2.2 FIELD PHASE

The study followed a comparative non-experimental cross-sectional design, aimed at analyzing differences in the structure and composition of aquatic vascular vegetation between two zones with different levels of anthropogenic disturbance within the Ciénaga de Sierra Chiquita:

1. a highly disturbed zone, influenced by agricultural activities and pollution; and
2. a low-disturbance zone, characterized by more conserved natural conditions.

In each zone, three 50-m linear transects were established as sampling units (n = 3 per zone, n = 6 total). Along each transect, five 1-m² quadrats were placed at regular intervals, resulting in a total of 30 quadrats. Within each quadrat, all vascular plant species were recorded, both inside and along the edges of the water body.

For each species, species richness, abundance, height, and spatial arrangement were documented to characterize the vertical and horizontal structure of the plant assemblage. These data were used to construct vegetation profiles that graphically represented the structure of the ecosystem.

Additionally, semi-structured interviews were conducted with local residents to complement the ecological characterization with ethnobotanical and land-use information.

Fieldwork was carried out between August 2024 and February 2025, in accordance with the recommendations of the Accreditation and Curriculum Committee of the Biology Program at Universidad de Córdoba. The research protocol was approved during the session held on August 12, 2024 (Minutes No. 27), and the biological collection permit was granted on August 26, 2024. No invasive procedures or fauna handling were conducted; plant collection followed ethical and technical principles to minimize environmental impact.

2.3 LABORATORY PHASE

Samples were transferred to the Herbarium of Universidad de Córdoba (HUC), where they were cleaned, pressed between absorbent sheets, oven-dried, and preserved. Taxonomic identification was conducted using specialized literature (Gentry's Field Guide to the Families and Genera of Woody Plants of Northwest South America; Schmidt's Manual de plantas acuáticas de Colombia) and with the support of botanical experts from Universidad de Córdoba.

2.4 DATA ANALYSIS

Field data were organized into site × species matrices and analyzed using Excel and PAST version 4.11. Mean values and standard deviations of recorded variables were calculated for each zone.

Alpha diversity indices were estimated, including Shannon–Wiener (H'), Simpson (1–D), and Margalef (Dmg), as well as species richness and relative abundance. Differences in community composition and structure between zones were evaluated through comparative analyses of diversity and floristic similarity, using both presence–absence and abundance matrices.

The vertical and horizontal vegetation profiles were created based on species recorded in at least four of the six transects, prioritizing those with greater structural dominance or visual prominence within the community. This criterion provided a concise synthesis of the vegetation, following the methodological approach proposed by Acar and Osman (2022).

Data interpretation considered the internal validity of the design, ensured by spatial replication (transects placed at least 20 m apart), and the external validity, supported by the representativeness of sampling across both contrasting zones.

3 RESULTS

3.1 STRUCTURE

This study reports 57 species of vascular aquatic plants, grouped into 24 families and 39 genera (Appendix). Three growth forms were observed: herbs, shrubs, and lianas. Of these, 22 species (38.60%) belong to the class Liliopsida, 33 species (57.89%) to Magnoliopsida, and 2 species (3.51%) to Pteridophyta (Polypodiopsida). The most representative life form was palustrine, with 41 species (71.93%), followed by emergent with 10 species (17.54%), and floating with 6 species (10.53%).

In the disturbed zone (Fig. 2), a heterogeneous vertical structure was recorded, with species of varying heights. The shortest species correspond mainly to floating forms, such as *Lemna minor* L (10) and *Salvinia auriculata* Aubl (14), which do not exceed 10 cm. Emergent species such as *Thalia geniculata* L (11) and *Typha angustifolia* L (13) reached heights greater than 150 cm. Intermediate-sized species were also observed, including *Senna obtusifolia* (L.) H.S.Irwin & Barneby (7) and *Cnidoscolus urens* (L.) Janti (8), with approximate heights ranging from 80 to 120 cm. The composition includes herbs, subshrubs, and floating forms, with a dispersed distribution along the profile.

In the less disturbed zone (Fig. 3), the vegetation exhibited greater structural diversity, including floating, emergent, and erect species. Low-stature species, such as *S. auriculata* (16), *Pistia stratiotes* L (19), and *Limnocharis flava* (L.) Buchenau (17), were distributed across the water surface. Intermediate-height species were identified, including *Cyperus rotundus* L (4), *Cyperus odoratus* L (7), and *Astraea lobata* (L.) Klotzsch (8), while *T. angustifolia* (18) and *T. geniculata* (14) dominated the upper stratum, exceeding 150 cm in height. The profile shows a continuous distribution of individuals along the horizontal axis, with overlapping strata and variation in growth forms.

3.2 COMPOSITION

During the five sampling sessions conducted in the anthropogenic zone, 31 species of vascular aquatic plants were recorded, grouped into 18 families (Fig. 4). The genus with the highest number of species was *Mimosa*, with 2 species. The families with the greatest species richness were Poaceae, Fabaceae, and Cyperaceae, each with 4 species, representing 38.70% of the total flora found. In the less disturbed zone (Fig. 4), 42 species were recorded, grouped into 21 families. The most representative genera were *Mimosa* (3 species), followed by *Malachra*, *Cyperus*, and *Euphorbia*, each with 2 species. The richest families were Fabaceae (7), Cyperaceae (5), and Poaceae and Euphorbiaceae (4 each), accounting for 47.61% of the total.

The most abundant species in the anthropogenic zone (Fig. 5) were *T. geniculata* with 432 individuals (22.05%) and *L. minor* with 224 (11.43%). The least abundant species were *Commelina erecta* L with 10 individuals (0.51%), *Passiflora misera* Kunth and *Momordica charantia* L, each with 11 individuals (0.56%). The most abundant families were Poaceae, Fabaceae, and Cyperaceae, which together accounted for 47.47% of the total number of individuals recorded, while the least abundant families were Commelinaceae and Passifloraceae, comprising 1.07% of the total.

In the less disturbed zone, the most abundant species (Fig. 5) were *T. geniculata* with 356 individuals (13.83%) and *S. auriculata* with 147 (5.71%). The least abundant species were *S. obtusifolia* with 5 individuals (0.19%), and *Evolvulus nummularius* (L.) L and *Euphorbia hyssopifolia* L, each with 7 individuals (0.27%). The most abundant families were Fabaceae, Cyperaceae, and Poaceae, representing 37.52% of the total individuals recorded. The least abundant families were Cucurbitaceae and Pontederiaceae, comprising 0.82% of the total.

3.3 DIVERSITY

Species richness (Taxa_S) was higher in the less disturbed zone (42) compared to the anthropogenic zone (31). Diversity indices were also higher in the former: Simpson (1-D) was 0.9557 versus 0.9179; and Shannon-Weaver (H') was 3.428 compared to 2.975.

Evenness indices reflected a more uniform distribution in the less disturbed zone: Evenness (e^H/S) was 0.7336 and Equitability_J was 0.9171, whereas in the anthropogenic zone they were 0.6317 and 0.8662, respectively.

Finally, the Margalef (5.221) and Menhinick (0.8277) indices were also higher in the less disturbed zone compared to those in the anthropogenic zone (3.958 and 0.7004, respectively).

3 DISCUSSION

The aquatic vascular vegetation of the Ciénaga de Sierra Chiquita exhibits a pronounced ecological differentiation between the two surveyed zones, which can be directly associated with contrasting levels of anthropogenic disturbance. The documentation of 57 species belonging to 24 families and 39 genera indicates that, despite increasing human pressure, the wetland still retains considerable floristic richness. Comparable levels of taxonomic diversity have been reported for tropical wetlands characterized by complex hydrological regimes, where seasonal flooding, water-level fluctuations, and land-use intensity jointly regulate macrophyte assemblages (Pozo-García et al., 2022). In this context, the higher richness and diversity recorded in the less disturbed zone suggest that hydrological stability and reduced direct human intervention play a fundamental role in maintaining community complexity in Sierra Chiquita.

The dominance of palustrine species (71.93%), followed by emergent and floating life forms, reflects the prevalence of shallow environments with periodically fluctuating water levels and a broad transition zone between aquatic and terrestrial habitats. Similar structural configurations have been described in semi-lentic wetlands of the Colombian Andes, where palustrine macrophytes predominate under conditions of sediment accumulation and variable inundation frequency (Salazar Suaza & Quijano-Abril, 2020). The recurrent presence of genera such as *Cyperus*, *Ludwigia*, *Thalia*, and *Typha* is consistent with floristic patterns reported for wetlands throughout northern South America and the Caribbean. These taxa are widely recognized for their tolerance to hydrological instability and nutrient enrichment, as well as for their role as habitat-forming species that strongly influence ecosystem structure.

One of the most relevant outcomes of this study is the clear floristic and structural contrast between the two zones. The disturbed area exhibited lower species richness, reduced evenness, and a marked dominance of a limited number of opportunistic taxa, particularly *Thalia geniculata* and *Lemna minor*. This pattern is consistent with observations from altered wetlands in other regions of Colombia, where anthropogenic disturbance promotes the expansion of fast-growing helophytes and floating species through nutrient enrichment, vegetation removal, and habitat simplification (Botero-Álvarez et al., 2021). The high abundance of T. geniculata in both zones, but especially in the disturbed sector, highlights its ecological plasticity and capacity to persist under environmental stress, a trait commonly associated with species adapted to modified wetlands.

The presence of invasive or highly opportunistic macrophytes, including *Eichhornia crassipes*, *Pistia stratiotes*, and *Lemna minor*, across both sectors of the ciénaga constitutes an early warning signal of ecological pressure. Similar trends have been documented in wetlands of Venezuela (Gordon et al., 2021) and in urban and peri-urban lagoons of Chile (Cisterna-Osorio & Pérez-Bustamante, 2019), where eutrophication and hydrological alteration favor the rapid proliferation of floating plants that can displace native assemblages. In Sierra Chiquita, the occurrence of these species likely reflects increased nutrient inputs associated with agricultural activities and domestic waste discharges, mirroring processes observed in other South American wetlands undergoing early stages of degradation.

Marked differences were also detected in the vertical and horizontal structure of the vegetation. The less disturbed zone displayed greater stratification and spatial continuity among floating, emergent, and erect forms, resulting in a more heterogeneous vegetation mosaic. This level of structural complexity is characteristic of relatively conserved wetlands, where hydrological connectivity and habitat diversity promote the coexistence of multiple life strategies (Pozo-García et al., 2022; Costa et al., 2025). In contrast, the disturbed zone was characterized by a simplified structure dominated by few species, indicating a reduction in spatial heterogeneity. Such simplification has been associated with diminished ecosystem resilience, reduced availability of microhabitats, and impaired ecological functioning.

Diversity indices further support these interpretations. Higher values of Shannon, Simpson, Margalef, and Menhinick indices, together with greater evenness, were consistently recorded in the less altered zone. Previous studies have demonstrated that wetlands subject to lower anthropogenic pressure tend to maintain more balanced and functionally diverse plant assemblages, whereas disturbed systems often experience dominance by a few competitive species and a decline in functional redundancy (Urbina et al., 2022; Vilenica et al., 2022). In Sierra Chiquita, the observed patterns indicate that human activities are already reshaping community structure, even though the system still preserves part of its ecological integrity.

From a methodological standpoint, the comparative non-experimental design employed in this study is suitable for assessing spatial variation in vegetation structure and composition across disturbance gradients. Internal validity is strengthened by spatial replication, well-defined transects, and representative coverage of the study area. Similar approaches have been successfully applied in wetland assessments in Ecuador, Chile, and Ethiopia, supporting the use of aquatic vegetation as a reliable indicator of ecological condition when sampling is systematic and spatially explicit (Cun Jaramillo et al., 2020; Aránguiz-Acuña et al., 2020; Fentaw et al., 2024). External validity is reinforced by the consistency between the patterns observed in Sierra Chiquita and those reported for other tropical and subtropical wetlands worldwide.

Overall, the results suggest that the Ciénaga de Sierra Chiquita is undergoing an incipient but measurable process of ecological degradation, manifested by reduced richness in disturbed areas, increasing dominance of opportunistic species, and the widespread presence of invasive macrophytes. These findings are consistent with broader assessments of wetland degradation in Colombia and South America, which emphasize the impacts of habitat fragmentation, nutrient loading, and hydrological alteration on aquatic ecosystems (Murillo-Pacheco et al., 2016; Lozano & Brundu, 2018). Consequently, the implementation of ecological restoration strategies, nutrient management, and hydrological connectivity recovery is urgently required. The less disturbed zone should be considered a reference condition, providing a baseline for restoration efforts aimed at preserving the floristic diversity and functional integrity of the ciénaga.

4 CONCLUSIONS

The study allowed for the determination of the structure and composition of vascular aquatic vegetation in the Ciénaga de Sierra Chiquita, where 57 species were identified, grouped into 24 families and 39 genera. The presence of 16 species shared between both sampling zones indicates partial overlap in floristic composition, although influenced by the degree of environmental disturbance. This information serves as a baseline for understanding floristic patterns in urban wetlands subjected to varying levels of anthropogenic pressure.

Regarding vegetation structure, notable differences were observed between the zones. The less disturbed zone exhibited a more complex vertical and horizontal organization, with more defined stratification and greater spatial heterogeneity, whereas the anthropogenic zone showed a simplified structure dominated by a few low-stature species. This pattern highlights how human intervention modifies the architecture of aquatic ecosystems, altering their ecological functionality.

When estimating richness and abundance, 42 species were recorded in the less disturbed zone and 31 in the anthropogenic zone, highlighting the impact of human activities on floristic diversity. The data show a greater abundance of palustrine species, with *T. geniculata* being dominant in both environments. The presence of invasive species such as *L. minor*, *P. stratiotes*, and *Eichhornia crassipes* (Mart.) Solms in both zones reinforces the need for continuous monitoring of these water bodies.

Finally, the diversity analysis revealed a more uniform and equitable distribution of species in the conserved zone, supported by higher values of the Shannon-Weaver (H′), Simpson (1-D), Margalef, and Menhinick indices, as well as the evenness metrics Evenness and Equitability_J. These results confirm that wetlands with lower levels of disturbance preserve greater floristic diversity and better structural organization, which is essential for guiding ecological restoration efforts and the conservation of these strategic ecosystems.

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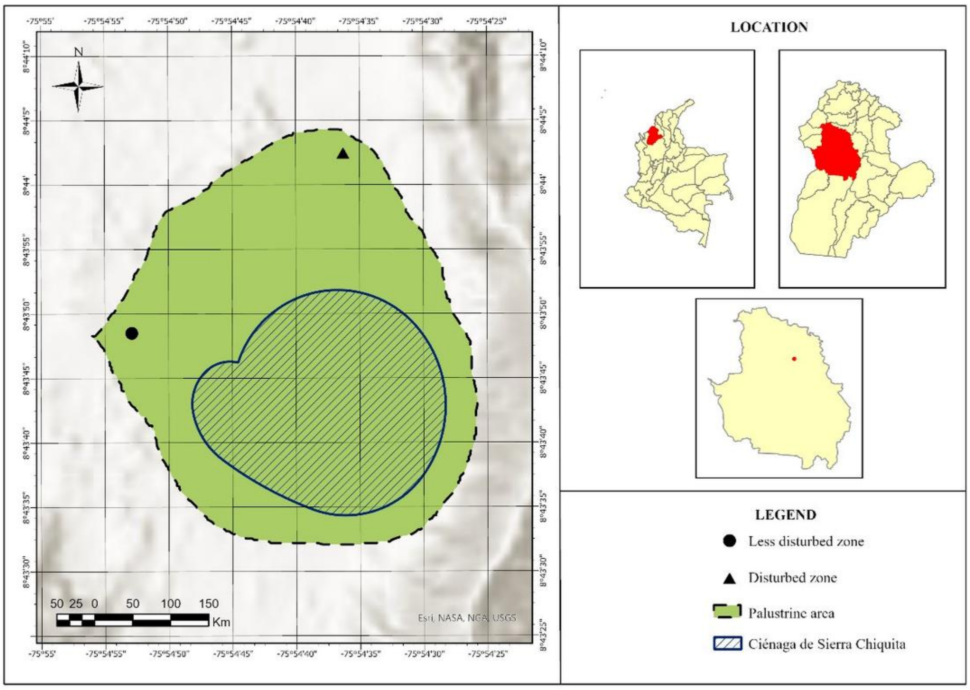
APPENDIX

Figure 1

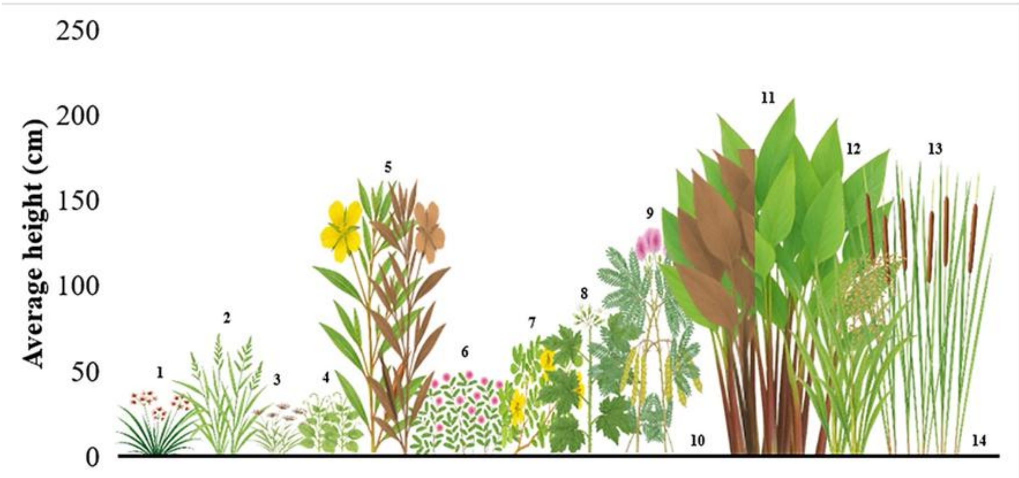
Geographical location of the Ciénaga de Sierra Chiquita in the municipality of Montería, department of Córdoba (Colombia)



The blue hatched area represents the main water body of the wetland, while the green area corresponds to the surrounding palustrine zone. Sampling sites are indicated by symbols: ● less disturbed zone and ▲ disturbed zone.

Figure 2

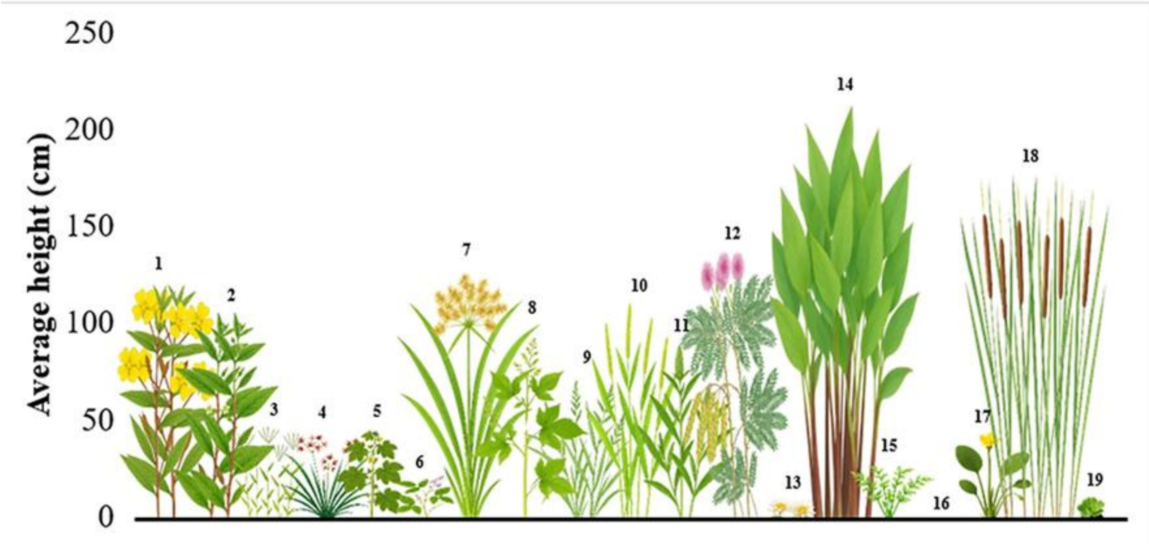
Vegetation profile of the Ciénaga de Sierra Chiquita, disturbed zone



Species codes: 1 = *Cyperus rotundus*; 2 = *Echinochloa colona*; 3 = *Chloris barbata*; 4 = *Heliotropium indicum*; 5 = *Ludwigia erecta*; 6 = *Mimosa pudica*; 7 = *Senna obtusifolia*; 8 = *Cnidoscolus urens*; 9 = *Mimosa pigra*; 10 = *Lemna minor*; 11 = *Thalia geniculata*; 12 = *Oryza sativa*; 13 = *Typha angustifolia*; 14 = *Salvinia auriculata*.

Figure 3

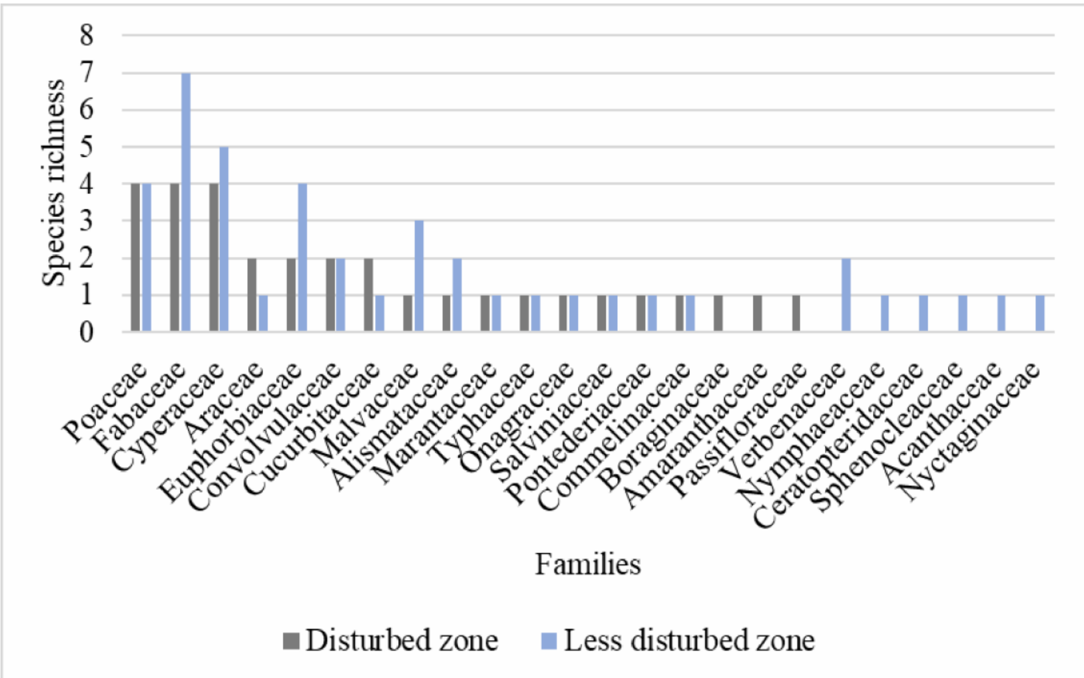
Vegetation profile of the Ciénaga de Sierra Chiquita, less disturbed zone



Species codes: 1 = *Ludwigia octovalvis*; 2 = *Caperonia palustris*; 3 = *Digitaria sanguinalis*; 4 = *Cyperus rotundus*; 5 = *Malachra alceifolia*; 6 = *Desmodium incanum*; 7 = *Cyperus odoratus*; 8 = *Astraea lobata*; 9 = *Echinochloa colona*; 10 = *Hymenachne amplexicaulis*; 11 = *Sphenoclea zeylanica*; 12 = *Mimosa pigra*; 13 = *Nymphaea alba*; 14 = *Thalia geniculata*; 15 = *Ceratopteris thalictroides*; 16 = *Salvinia auriculata*; 17 = *Limnocharis flava*; 18 = *Typha angustifolia*; 19 = *Pistia stratiotes*.

Figure 4

Species richness by family of aquatic vascular plants in two zones of the Ciénaga de Sierra Chiquita



The figure compares the number of species per family between the disturbed and less disturbed zones.

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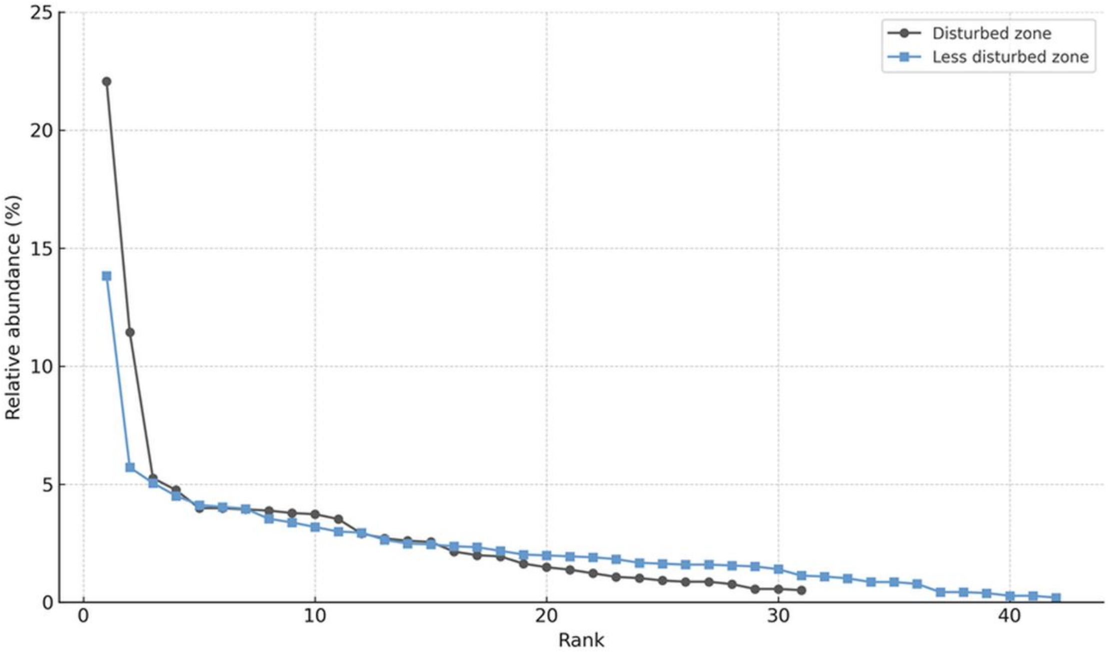
Figure 5

Rank-abundance curves of aquatic vascular plant species in two zones of the Ciénaga de Sierra Chiquita



The x-axis represents species rank and the y-axis shows relative abundance (%). The three most abundant species in each zone are highlighted. The steeper slope in the disturbed zone indicates dominance by a few species, while the less disturbed zone exhibits a more even distribution of species.

Table 1

List of aquatic vascular plant species recorded in the Ciénaga de Sierra Chiquita, Montería, Córdoba

Family	Species
Acanthaceae	*Ruellia tuberosa* L.
Alismataceae	*Limnocharis flava* (L.) Buchenau
	Echinodorus cordifolius (L.) Griseb.
Amaranthaceae	*Amaranthus spinosus* L.
Araceae	*Pistia stratiotes* L.
	Lemna minor L.
Boraginaceae	*Heliotropium indicum* L.
Ceratopteridaceae	*Ceratopteris thalictroides* (L.) Brongn
Commelinaceae	*Commelina erecta* L.
Convolvulaceae	*Evolvulus nummularius* (L.) L.
	Ipomoea aquatica Forssk.
	Aniseia martinicensis (Jacq.) Choisy
Cucurbitaceae	*Luffa acutangula* (L.) Roxb.
	Momordica charantia L.
	Cucumis melo L.

Cyperaceae	*Cyperus odoratus* L, *Fimbristylis littoralis* Gaudich *Schoenoplectus lacustris* (L.) Palla *Rhynchospora nervosa* (Vahl) Boeckeler *Cyperus rotundus* L. *Scleria levis* Retz
Euphorbiaceae	*Caperonia palustris* (L.) A.St.-Hil *Euphorbia hyssopifolia* L. *Euphorbia nutans* Lag. *Astraea lobata* (L.) Klotzsch *Cnidoscolus urens* (L.) Janti
Fabaceae	*Mimosa pigra* L. *Centrosema plumieri* (Turpin ex Pers.) Benth. *Mimosa pudica* L. *Senna obtusifolia* (L.) H.S.Irwin & Barneby *Desmodium incanum* (Sw.) DC. *Alysicarpus vaginalis* (L.) DC. *Vigna longifolia* (Benth.) Verdc. *Mimosa quadrivalvis* L.
Malvaceae	*Malachra radiata* (L.) L. *Malachra alceifolia* Jacq *Melochia pyramidata* L. *Melochia corchorifolia* L.
Marantaceae	*Thalia geniculata* L.
Nyctaginaceae	*Boerhavia erecta* L.
Nymphaeaceae	*Nymphaea alba* L.
Onagraceae	*Ludwigia octovalvis* (Jacq.) P.H.Raven. *Ludwigia erecta* (L.) H.Hara
Passifloraceae	*Passiflora misera* Kunth
Poaceae	*Echinochloa colona* (L.) Link *Hymenachne amplexicaulis* (Rudge) Nees *Digitaria sanguinalis* (L.) Scop, *Imperata cylindrica* (L.) Raeusch. *Oryza sativa* L. *Phragmites australis* (Cav.) Trin. ex Steud. *Chloris barbata* Sw.
Pontederiaceae	*Eichhornia crassipes* (Mart.) Solms
Salviniaceae	*Salvinia auriculata* Aubl.
Sphenocleaceae	*Sphenoclea zeylanica* Gaertn
Typhaceae	*Typha angustifolia* L.

Verbenaceae	*Phyla nodiflora* (L.) Greene
	Priva lappulacea (L.) Pers.