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Euendemic: a proposed term for complete endemism in biogeographical classification

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Abstract
Endemism is a core concept in biogeography, yet terminology describing its different forms remains inconsistent. In particular, no formally defined term exists for taxa whose entire natural distribution is confined to a single geographical or biogeographical unit. This perspective proposes euendemic as a clear and standardized descriptor for complete endemism. The proposed term is strictly spatial and does not imply ecological specialization, evolutionary age, or conservation status. By distinguishing complete endemism from partial forms such as near or subendemism, this contribution aims to improve conceptual clarity and comparability across floristic, biogeographical and conservation studies. Examples from recent regional and global assessments illustrate that complete endemism is already widely applied as an analytical category, despite the lack of an explicit term. Formalizing this condition as euendemic provides a concise vocabulary for a commonly used but previously unnamed concept in biogeography. The proposed terminology is intended for consistent use in floristic checklists, biogeographical syntheses, and conservation assessments.

Keywords. Euendemic; endemism; narrow endemic; strictly endemic; subendemic

Introduction

Endemism is a central concept in biogeography, yet the terminology used to describe its different forms remains inconsistent. Expressions such as strict, pure or narrow endemic appear widely in the literature, but their meanings vary among studies and regions. Although the term “strict endemic” is widely used in the literature, it lacks a stable, community-wide definition and is applied inconsistently across studies and spatial scales. Consequently, taxa labelled as strictly endemic in one study may be treated as near or subendemic in another. By introducing a single, explicitly defined label for complete spatial confinement, euendemic reduces reliance on loosely defined qualifiers (e.g., strict or pure endemic) and improves comparability among studies that use different spatial units and scales. Semi- and hemi-endemic categories are clearer because they explicitly denote partial restriction to a focal area. What remains lacking is a concise and consistently defined term for complete endemism, understood here as the condition in which a taxon is confined entirely to a single geographical or biogeographical unit without any confirmed extralimital records. To address this gap, the term euendemic is proposed as the primary descriptor for this spatial condition. This paper does not introduce a new analytical method, but aims to standardize terminology for a spatial condition already widely recognized in biogeographical research. The prefix eu, meaning “true” or “genuine”, is widely used in biology, appearing in terms such as eukaryote and eudicot, where it conveys the idea of a characteristic or fully realized state. In this sense, euendemic denotes taxa that are truly and wholly restricted to a defined unit. This usage aligns with established biological conventions and provides a concise and intuitive label for complete endemism.

Definition

Euendemic: a taxon whose entire natural distribution is restricted to a single geographical or biogeographical unit, with no verified peripheral or extralimital occurrences. As with any distribution-based classification, euendemism is assessed relative to the current state of distributional knowledge and may be revised if credible extralimital records emerge. This definition is strictly spatial and does

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not imply ecological specialization, evolutionary age or conservation status. The geographical or biogeographical unit is study-defined rather than intrinsic, and may be political, floristic, biogeographical, or analytical, provided it is explicitly delimited in the study.

Rationale

Distinguishing complete from partial endemism is important in floristic work, comparative biogeography and assessments of regional distinctiveness. Strict endemism is widely invoked, yet its definition is inconsistent, and taxa may be labelled strictly endemic in one study but near endemic in another. The absence of a precise term for complete endemism can introduce ambiguity when interpreting taxa whose distributions are indeed fully restricted. Euendemism refers to complete confinement to the defined unit, whereas narrow endemism refers to small range size and may include taxa that extend beyond the focal unit. Operationally, euendemic is an all-or-nothing category: a taxon is euendemic if no credible records occur outside the defined unit. Near-endemic and subendemic describe partial restriction, in which most occurrences fall within the focal unit but some verified records extend beyond it. Accordingly, the distinction among these terms hinges on the presence and credibility of extralimital occurrences, rather than on range size alone. A clear descriptor such as euendemic standardizes this often-used but terminologically unspecified category. The conceptual need for distinguishing different forms of endemism has been recognized for nearly a century. In his classic synthesis of crop plant diversity, Vavilov (1926/1951) showed that regions of exceptionally high morphological and genetic variation often coincide with areas containing numerous endemic species or endemic forms of wild relatives. His work implicitly differentiated several modes of endemism, including geographic restriction, ecological specialization, genetically distinctive local forms and relic lineages. Although developed in a pre-molecular context, the central insight remains relevant: understanding how taxa are confined to particular regions requires conceptual clarity about different types of endemism. The terminology proposed here addresses one of these types explicitly, namely complete endemism. A broad conceptual framework for diverse forms of endemism was later synthesized by Morrone (2008), who outlined evolutionary and biogeographical categories such as autochthonous and allochthonous endemics, neo- and paleoendemics, and various forms of relic taxa. This typology demonstrates the long-standing need for terminological precision, yet none of these established categories refers specifically to the purely spatial condition of complete endemism addressed here. As emphasized by Fattorini (2017), endemism in its strict sense refers to taxa confined to a defined area, irrespective of that area's absolute size, and must be distinguished from "areas of endemism", which concern overlapping ranges of multiple taxa. This distinction supports treating complete endemism as a purely spatial property of individual taxa, for which a dedicated term such as euendemic is proposed. Euendemism is intentionally defined as a purely spatial descriptor and is therefore orthogonal to evolutionary categories such as neoendemism and paleoendemism. Both neoendemic and paleoendemic taxa may be euendemic if their entire natural distribution is confined to a single defined unit; if they extend beyond it, they are not euendemic. Recent empirical studies demonstrate how complete endemism already functions as an important analytical class. In the Hyrcanian forests, Ghorbanalizadeh & Akhani (2022) separated strictly endemic species from near endemics extending into neighboring transition zones such as the Caucasus and the Euxinian region. In Iran, Ghahremaninejad et al. (2025) excluded all species with any credible extralimital record, producing a conservative list of 2,503 angiosperms wholly confined to the country. In Turkey, Noroozi et al. (2019) removed all subendemic taxa from their dataset of 1,102 endemic plants belonging to three major families, ensuring that analyses of Centers of Endemism (CEs) and Areas of Endemism (AEs) were based exclusively on fully restricted taxa; among these, 798 species occurred in no more than three grid cells and contributed disproportionately to endemism-weighted metrics. A further example highlighting the need for greater terminological precision comes from the Atlantic Forest. Lima et al. (2020) showed that distinguishing pure endemics from near endemics is often inconsistent and highly sensitive to subjective decisions, even when based on large, curated herbarium datasets. Their data-driven approach revealed that classifications of pure and near endemism can shift with changing knowledge and boundary definitions, and they concluded that ambiguity surrounding complete endemism limits the interpretive power of conservation assessments. This directly reinforces the need for explicit terminology for fully restricted taxa, such as the proposed term euendemic. Large-scale comparative work has also revealed that endemism metrics are highly sensitive to methodological choices. Daru et al. (2020) showed that patterns of weighted and phylogenetic endemism shift markedly with changes in taxonomic treatment, spatial grain and spatial extent, underscoring the importance of clear and consistent terminology when describing fully restricted taxa as part of broader biodiversity analyses. Additional large-scale assessments emphasize the prominence of complete endemism in global biodiversity patterns. Goodman (2023), revisiting estimates of biotic diversity in Madagascar, showed that many major plant and animal groups on the island now have revised diversity estimates with endemism levels approaching complete confinement, underscoring how widespread and biogeographically significant fully restricted lineages can be when documentation is improved. Comparable needs for terminological clarity arise in non-floristic systems. Samayoa et al. (2025), analyzing marine ray-finned fishes of Aotearoa New Zealand, showed that differentiating neoendemism and paleoendemism reveals spatial patterns invisible to species richness alone. Although their study focuses on marine fauna, the conceptual issue is similar: without consistent vocabulary, distinct forms of endemism may be conflated, reducing analytical resolution. Taken together, these studies illustrate both the widespread use of complete endemism as a practical analytical category and the absence of a formally named term to describe it.

Applications

The term euendemic can be incorporated naturally into floristic treatments. Although the examples discussed here are largely floristic, the term is intended as a general biogeographical descriptor applicable to any taxonomic group, provided that the focal spatial unit is explicitly defined. In the Iranian checklist, separating completely restricted species from near endemics was essential to interpreting floristic structure; applying euendemic to the former group provides terminological precision without altering biological interpretation. The study of Noroozi et al. (2019) demonstrates the analytical consequences of restricting datasets to fully confined taxa. Their identification of CEs and AEs aligned closely with mountain systems and global biodiversity hotspots, illustrating how focusing solely on complete endemism produces conservative and geographically meaningful patterns. Under the proposed terminology, all taxa in their dataset qualify as euendemic. A recent Red List assessment of Iran's endemic vascular plants (Khalvati et al., 2025) applied IUCN Criterion B to 2,753 endemic species, explicitly excluding subendemics, and showed that nearly 78% of these fully confined taxa are threatened, with major conservation gaps in mountain systems previously identified as centres of endemism. This illustrates how a clearly defined set of completely restricted taxa, equivalent to euendemics in the sense proposed here, can provide a rigorous basis for national-scale conservation planning. Macroecological and diversification studies may also benefit from explicit recognition of euendemic taxa. Whether a restricted lineage represents a long-standing relic or a recently derived species confined to an isolated region is an important interpretive distinction, and having terminology that clearly identifies fully restricted taxa enhances the resolution of such analyses. Examples of euendemic taxa include species confined to isolated mountain ranges, a single floristic province or remote oceanic islands separated by strong dispersal barriers.

Concluding remarks

The term euendemic is proposed as a clear descriptor for complete endemism. Distinguishing complete from partial endemism improves clarity and comparability across floristic and biogeographical research. Because fully restricted taxa constitute a substantial component of many regional floras and faunas, naming this condition precisely strengthens communication and analytical rigour. A key limitation of any strict endemism category is its dependence on data completeness and boundary definitions; accordingly, euendemism should be interpreted as a transparent and updateable classification rather than an immutable property of taxa. Adoption of euendemic may therefore contribute to a more coherent and effective vocabulary for future biogeographical studies.

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