We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

4,800
Open access books available

122,000
International authors and editors

135M
Downloads

Our authors are among the

154
Countries delivered to

TOP 1%
most cited scientists

12.2%
Contributors from top 500 universities

CLARIVATE ANALYTICS BOOK CITATION INDEX INDEXED

WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com

Chapter

Introductory Chapter: Endemism as a Basic Element for the Conservation of Species and Habitats

Eusebio Cano Carmona, Ana Cano Ortiz and Carmelo Maria Musarella

1. Introduction

A number of chapters have been submitted to the book *Endemic Species* by different authors. Many of them are of interest for conservation, as they deal with species located in special situations, which are in most cases under threat from human activity. Other authors have promoted conservation and exploitation simultaneously, which is an idea of key importance, as these two practices are not mutually exclusive. In fact the reverse is true: using certain species in a reasonable or sustainable way may even enhance the state of conservation.

The chapter entitled *Instrumental Methods for Detection of Lipophilic Marine Toxins in Endemic Species from Pacific Austral Fjords*, containing a detailed description on procuring toxins for certain species of dinoflagellates, is important from the social sanitary point of view. The work on endemisms in Bolivia examines the distribution and megadiversity in the country, with particular emphasis on the Bromeliaceae and Orchidaceae families. The works on endemic flora in Mexico are very important, as is the case of *The Endemism of the Vascular Flora of Mexico Present in Comarca Lagunera, an Agricultural Region in the Chihuahuan Desert*, which studies over 300 species for very special territories such as deserts. These are precisely the areas that will be most seriously affected by climate change. Climate change could be mitigated by means of cultivation techniques and the creation of bioclimatic optimisation models; this is why the work on *Mexican Indigenous Species with Agroecological Uses* is particularly interesting, as it examines certain species that were cultivated in the past and are currently being recovered. The excellent study on *Salvia ceratophylloides* Ard. (Lamiaceae), an exclusive endemic species of southern Italy, alerts to the endangered situation of this species and points to the need for special conservation measures while noting that its threatened status is due to unregulated urban development. In the conclusions, the authors propose the establishment of micro-reserves and the possibility of creating a seed bank and local botanical gardens to favour conservation. These botanical gardens should have a phytosociological character, with a prior study of the plant association or associations in which this taxon is included.

Other territories such as Madagascar have over 10,000 endemic species. Australia has its own species, genera and botanical families, as this continent has three major climate types, tropical, desertic and Mediterranean, along with Central America and many other areas on earth. In areas in Central America, the

endemic flora is of particular importance for conservation. The origin of this flora varies in different areas of the planet and may consist of taxa with ancient origins (paleoendemics) or young taxa formed by the evolutionary process after becoming isolated (neoendemics). Plate tectonics and the Alpine orogeny that gave rise to seas, oceans and mountain chains are among the causes of the isolation of populations, which has allowed the genesis of new species. However, the greatest impact on the emergence of endemic species occurred with the glaciations in the Quaternary era, as they took refuge in more southerly environments and subsequently become isolated.

The highest rate of endemism can be found in major mountain chains and on islands in the tropical-subtropical belt. The following are areas of particular interest: Spain, Madagascar, Malaysia, South Africa, Australia, Central America, and particularly Mexico and the Caribbean. Of all the Mediterranean countries in the EU, Spain has the highest rate of endemic plants due to its orography and geological and climatic diversity, as it is situated between the Atlantic Ocean and the Mediterranean Sea and favoured by migratory routes from the northern territories in Europe and Africa. However, Spain is among the countries that suffered the greatest extinction of species during the Quaternary glaciations as a result of the configuration of its mountain systems, which should alert us to the fact that the climate change that is already underway could trigger a similar phenomenon.

2. Methodology

The study of endemism is analysed in several areas and related with the habitat, and fieldwork is conducted in several American and European territories (Mexico, Hispaniola, Spain, Portugal, Italy, Palestine etc.), consisting of compiling phytosociological relevés. The results are various works on vegetation that describes a number of plant associations [1–9], all of great interest due to their endemic character. Other results include works on endemism [10] and a series of studies on the flora of the island published in the journal Moscosoa, together with the Flora of Hispaniola by [11]. This present research is a continuation of the aforementioned works, and we corroborate the bioclimatic and biogeographical studies [1, 7, 12, 13].

3. Results and discussion

Species become isolated through different causes, including geological, geographic, climatic and biological barriers, and throughout history many authors have taken this phenomenon as the basis for understanding the situation of Mexico, Panama, Honduras, Guatemala and the Caribbean Islands—all of which can be considered hotspots and are of great interest for conservation. This is essentially due to the fact that the extinction of species during the Quaternary era was less widespread than in the old European continent due to the configuration of the mountain chains, which acted as corridors for plants and animals. A similar phenomenon occurred with the geological barriers in Hispaniola, part of the Greater Antilles in the Antillean arc. Large mountain chains were formed in the Cretaceous era that was subsequently linked by Tertiary and Quaternary sediments. The Cordillera Central range is siliceous in character and has the highest altitude in the whole of the Caribbean region (Pico Duarte: 3175 m); other mountain chains also originated during the Cretaceous era but have a lower altitude and a calcareous character, with patches of serpentines, which contain a high rate of serpenticolous edaphisms [5, 10].

Examples of this are the islands of Cuba and Hispaniola, which despite their limited territorial extension each have over 6000 plant species of which over 33% are endemic. Five sectors and 19 biogeographical districts have been described for the specific case of Hispaniola, and a series of works have been published on its flora and vegetation [6, 14], highlighting the interest of this island due to its high diversity of flora and vegetation. Of the 6000 species described on the island, a little over 33% are endemic, with a predominance of tree, shrub, vine and epiphyte biotypes; endemic plant species number more than 2000. This high diversity of endemic flora includes their own species and even genera. This is the case of Tortuga Island with *Tortuella abietifolia* and *Salvia montecristina*, which is exclusive to the Morro de Montecristi, *Eugenia samanensis* on the Samaná peninsula and *Pereskia quisqueyana* and *Melicoccus jimenezii* on the eastern plain (eastern Caribbean sector). The geological origins of the Caribbean led to the creation of the Antillean arc, which enabled the migratory route from Florida and the Lesser Antilles and favoured the arrival of species to the large mountain ranges. Their subsequent isolation due to the lack of genetic flow between individuals resulted in speciation and the emergence of endemism.

Climate change is causing territorial climate irregularities and an increase in extreme climate statistics. Certain territories in which species have been adapted to the climate for thousands of years are unable to withstand such sweeping changes in this new rapidly changing climate scenario. It is precisely the endemic species with less plasticity that are most at risk.

However, in spite of the influence of climate change on endemic animals and plants, the greatest threat may come from humans, as human pressure on habitats is increasing by the day in spite of the various protection policies, which are more declarations of intent than actual facts. Agricultural and livestock farming areas are maintained almost all over the planet, and there are very few sustainable farming operations. This is for several reasons: first, the need in some countries today and in the past to obtain food and energy, which throughout history has led to mass deforestation, and, second, the current proliferation of forest fires, which are responsible for the loss of biological diversity. It is evident that endemic species form part of some kind of habitat, which points to the need to protect that habitat, as this will also protect the species. It can therefore be said that endemic species are key to the establishment of conservation policies. In places on the planet that are considered hotspots due to their high rate of endemics, we need to know the plant associations in which these species occur. If this information is not available, we believe it is crucial to conduct research to increase the knowledge of these plant communities. Some authors have studied the vegetation in Cuba, as is the case of [15–18], and numerous diverse endemic syntaxa have been included in the phytosociological classes of *Byrsonimo-Pinetea caribaeae*, *Caseario-Pinetea cubensis* and *Phyllantho-Neobracetea valenzuelanae.* In the case of the island of Hispaniola, where we only know of our own recent studies, there is a wide diversity of endemic syntaxa as a result of the high rate of endemic species [19]. In previous years we studied the high-mountain forests of *Pinus occidentalis* and formulated several endemic associations for the island, *Dendropemon phycnophylli-Pinetum occidentalis*, *Coccotrino scopari-Pinetum occidentalis* and *Leptogono buchii-Pinetum occidentalis*, which are included in the class *Byrsonimo-Pinetea caribaeae*. A detailed vegetation study was carried out in arid/semiarid and dry environments [20], and the syntaxa *Harrisia nashii-Prosopidetum juliflorae* and *Neoabbottio paniculatae-Guaiacetum officinalis* were described—among others—and included in the class *Cercidi-Cereetea.* A similar situation occurs elsewhere on Earth such as in the Mediterranean region, whose characteristic climate is dry with cold winters and hot summers, and whose orography and geology allowed the arrival of Arctic species (Sierra Nevada)

and African species (southern Iberian Peninsula) during the Quaternary era. The isolation of species occurred as a result of climate change during the Quaternary era and due to the numerous soil niches that have acted as centres of origin (dolomites in the Sierra de las Almijaras, serpentines in the Sierra Bermeja, etc.). All these Iberian territories that are considered of interest due to their flora have endemic plant associations, which have been prioritised by the EU in its Directive 92/43/EC. This excellent regulation enables these places to be conserved, so it is important to extrapolate it to other places on the planet and particularly to hotspots.

It is evident that the immense majority of endemisms are located within a particular habitat and that this habitat contains one or several plant associations. Paleoendemisms are adapted to very specific environments that occupied greater extensions in the past but have since been restricted as a consequence of climate change, whereas due to their plasticity, neoendemisms may occupy less strict ecological niches and, as noted by [21], be prepared to increase their area of distribution. This implies that the habitat in which these species are located can be catalogued as either paleohabitats or neohabitats. Paleohabitats should be considered as a restricted area, which formerly covered a greater territory and in theory date from the Eocene and Oligocene eras. If the current climate trend was evolving towards the climate of those periods, the paleohabitat would expand, and if the reverse was true, it would disappear and so would the endemic species in consequence. Neohabitats have been generated more recently, appearing between the Miocene, Pliocene and Pleistocene eras, and include endemic species with a greater distribution area. The current climate trend could increase or reduce their area of distribution.

4. Conclusions

Habitat conservation measures must be established to safeguard the flora, and particularly the flora threatened by anthropic actions and climate change. Although human actions cannot be eliminated completely, it is possible to implement a system of sustainable management that mitigates habitat deterioration caused by anthropic action and climate change. This management must have two aspects: the first is local management, which integrates humans in the natural environment by raising educational standards and encouraging the public to value and respect the landscape for which it is essential for people to be familiar with these habitats. It is therefore crucial to have knowledge of plant associations, as certain non-endangered syntaxa can be used and exploited by humans, while others must be strictly monitored for their conservation, as is the case of those we have mentioned previously in this work. In second place, it is important to implement the appropriate national and international policies against fire and climate change.

Author details

Eusebio Cano Carmona[1*], Ana Cano Ortiz[1] and Carmelo Maria Musarella[1,2]

1 Departamento Biología Animal, Vegetal y Ecología, Botánica, Universidad de Jaén, Jaén, Spain

2 Dipartimento di AGRARIA, Università "Mediterranea" di Reggio Calabria, Reggio Calabria, Italy

*Address all correspondence to: ecano@ujaen.es

References

[1] Cano E, Veloz A, Cano Ortiz A. Contribution to the biogeography of the Hispaniola (Dominican Republic, Haiti). Acta Botanica Gallica. 2010a;**157**(4):581-598

[2] Cano E, Veloz A, Cano Ortiz A. The habitats of *Leptochloopsis virgata* in the Dominican Republic. Acta Botanica Gallica. 2010b;**157**(4):645-658

[3] Cano E, Cano Ortiz A, del Río S, Alatorre J, Veloz A. Bioclimatic map of the Dominican Republic. Plant Sociology. 2012a;**49**(1):81-90. DOI: 10.7338/pls2012491/04

[4] Cano E, Veloz A, Cano Ortiz A, Alatorre J, Otero R. Comparative analysis of the mangrove swamps of the Dominican Republic and those of the state of de Guerrero. Mexico. Plant Biosystems–An International Journal Dealing with all Aspects of Plant Biology. 2012b;**146**(1):112-130. DOI: 10.1080/11263504.2012.704885

[5] Cano E, Cano Ortiz A, del Río S, Veloz A, Esteban Ruiz FJ. A phytosociological survey of some serpentine plant communities in the Dominican Republic. Plant Biosystems–An International Journal Dealing with all Aspects of Plant Biology. 2014;**148**(2):200-212. DOI: 10.1080/11263504.2012.760498

[6] Cano E, Cano Ortiz A, Veloz A. Contribution to the knowledge of the edaphoxerophilous communities of the Samaná peninsula (Dominican Republic). Plant Sociology. 2015;**52**(1):3-8. DOI: 10.7338/PLS2012491/04

[7] Cano Ortiz A, Musarella CM, Cano E. Biogeographical areas of Hispaniola (Dominican Republic, Republic of Haiti). In: Plant Ecology. University Campus, Croatia: Intech Publisher; 2017a. pp. 165-189. DOI: 10.5772/intechopen.69081

[8] Cano Ortiz A, Musarella CM, Piñar Fuentes JC, Bartolomé Esteban C, Quinto Canas R, Pinto Gomes CJ, et al. Advances in knowledge of vegetation of the Spanish Island (Caribe-Cento America). In: Vegetation. University Campus, Croatia: Intech Publisher; 2017b. -83, 99. (ISBN 978-953-51-5790-8). https://www.intechopen.com/booksprocess/action/chapter/125184

[9] Cano Ortiz A, Musarella CM, Piñar Fuentes JC, Pinto Gomes CJ, Cano E. Analysis of the conservation of Central American mangroves using the phytosociological method. In: Mangrove–Fauna and Flora. University Campus, Croatia: Intech Publisher; 2018. pp. 189-206. Available from: https://www.intechopen.com/booksprocess/action/chapter/128266

[10] Cano Ortiz A, Musarella CM, Piñar Fuentes JC, Pinto Gomes CJ, Cano E. Distribution patterns of endemic flora to define hotspots on Hispaniola. Systematics and Biodiversity. 2016;**14**(3):261-271. DOI: 10.1080/14772000.2015.1135195

[11] Liogier AH. *La Flora de la Española*. Vol. I–IX. Jardín Botánico Nacional Dr. Rafael Ma, Moscoso, Santo Domingo. Dominican Republic: Eastern Central University; 1996-2000. ISBN: 84-8400-217-9

[12] Cano E, Cano OA. Establishment of biogeographic areas by distributing endemic flora and habitats (Dominican Republic, Haiti, R.). In: Biogeography. University Campus, Croatia: Intech Open Access Publisher; 2012. pp. 99-118. ISBN: 978-953-51-0454-4. Available from: https://www.intechopen.com/

[13] Rivas Martínez S, Sánchez Mata D, Costa M. North American Boreal and Western Temperate Forest Vegetation. Itinera Geobotanica. 1999;**12**:5-316

[14] Cano Ortiz A, Musarella CM, Piñar Fuentes JC, Pinto Gomes CJ, del Río S, Cano E. Diversity and conservation status of mangrove communities in two large areas in Central America. Current Science. 2018;**115**(3):534-540

[15] Borhidi A. Phytogeography and Vegetation Ecology of Cuba. Budapest: Akadémiai Kiadó; 1991. 858 pp

[16] Borhidi A. Phytogeography and Vegetation Ecology of Cuba. 2nd ed. Budapest: Akadémiai Kiadó; 1996. 926 pp

[17] Reyes OJ, Acosta CF. Sintáxones de los pinares de *Pinus cubensis* de la zona nororiental de Cuba. Lazaroa. 2012, 2012;**33**:111-169

[18] López Almirall A. Contribución al catálogo de flora cubana: Eendemismos de suelos derivados de ofiolitas. Botánica Complutensis. 2013;**37**:135-152. DOI: 10.5209/rev_BOCM.2013.v37.42276

[19] Cano E, Veloz A, Cano Ortiz A. Phytosociological study of the *Pinus occidentalis* woods in the Dominican Republic. Plant Biosystems–An International Journal Dealing with all Aspects of Plant Biology. 2011;**145**(2):286-297. DOI: 10.1080/11263504.2010.547685

[20] Cano Ortiz A, Musarella CM, Piñar Fuentes JC, Veloz A, Cano E. The dry forest in the Dominican Republic. Plant Biosystems. 2015;**149**(3):451-472. DOI: 10.1080/11263504.2015.1040484

[21] Noguera-Urbano EA. Endemism: differentiation of the concept, methods and applications. Acta Zoológica Mexicana (N S). 2017;**33**(1):89-107