

PROLOGUE TO CUEVAS, NÚÑEZ, AND SÁNCHEZ'S TREE FLORA OF LAS JOYAS FIELD STATION, MEXICO: THE ROLE AND IMPORTANCE OF TREE FLORAS

TOM WENDT

Billie L. Turner Plant Resources Center
The University of Texas at Austin
Austin, Texas 78712
twendt@austin.utexas.edu

A splendid tree flora of the Las Joyas biological field station in the Sierra de Manantlán of Jalisco, Mexico, written by Ramón Cuevas Guzmán, Nora M. Núñez López, and Enrique V. Sánchez Rodríguez, was published in 2021 in Spanish by the University of Guadalajara (Cuevas G. et al. 2021). The current author wrote a prologue for that book in Spanish. With the idea that said prologue may be of interest to a wider audience and also to draw attention to this very fine tree flora, the prologue is here reprinted (with permission) in English.

A pdf of the book is available without charge at: <https://www.researchgate.net/publication/355104833_Flora_arborea_de_la_Estacion_Cientifica_Las_Joyas_y_areas_adyacentes_Sierra_de_Manantlan_Mexico>.

Prologue

“Una percepción errónea de muchas personas es que la flora arbórea, al tratarse de organismos generalmente grandes y conspicuos es bien conocida y que la exploración es suficiente, por lo que solamente es necesario su catalogación.”

Villaseñor et al. 2013, La Flora Arbórea de México

How slender are the bodies of the young black oaks! With one stroke of the brush you could make them beautiful, on paper, but that would never be what they are.

Thomas Merton, 17 July 1956, A Search for Solitude

There remains much to learn about the trees of Mexico. Téllez et al. (2020) present a summary of the background of and needs for a modern tree flora* for Mexico, as well as general trends in tree species richness, distribution and endemism in the country. Complete or in-progress recent attempts at lists and databases of all Mexican tree species (Ricker & Hernández 2010; Ricker et al. 2013, 2016; Steinmann & Ricker 2020; Villaseñor et al. 2013; Téllez et al. 2020) are fundamental to the effort but are only one step toward an in-depth tree flora. Completed or ongoing vascular plant floras of parts of Mexico, of which there are several very fine examples (many mentioned in Téllez 2020), are obviously extremely useful for tree identification, but they differ somewhat in focus from tree floras, as discussed below.

Trees are the visual dominants of the vegetation of huge swaths of the world and are of great and undisputed importance to humanity, but for all of that, the knowledge of their taxonomy, especially in tropical areas where their diversity is by far the highest, remains incomplete. There are many and very diverse reasons for this, some of which apply to all plants, but two factors particularly apply to trees:

a) Trees, due to their size, present logistical difficulties to botanists. It is harder to study the completeness of their morphology and variation in the field, and it is harder and more time-consuming to make herbarium specimens that adequately represent that morphology and variation. It is also harder

* Throughout this prologue the word “flora” will mean the written or digital and usually published work, not the sum of all species of an area.

to fully describe their morphology adequately due to their size and complexity, and full descriptions require extensive field study. In addition, populations are more spread out than those of many smaller plants, making populational study or sampling more difficult.

b) Even more importantly, at least in Mexico, trees on the average evolve and speciate more slowly through normal mutation and selection processes than do smaller plants, probably due mostly to longer generation time (reduced meiosis) and lower long-term rate of cell division at apical meristems (reduced mitosis), both of which can contribute to a lower rate of mutations incorporated into germ cells (Lanfear et al. 2013). At the same time, effective population size tends to be smaller in populations of large plants (Boucher et al. 2017), which also tends to decrease populational variability. Genetic variation can thus be a limiting factor for trees (Boucher et al. 2017). At the same time, trees living in an area in which climates have changed rapidly and will continue to do so, such as Mexico, need to be able to adapt relatively quickly despite these limitations. In general, one might expect Mexican tree species to have relatively open genetic systems that allow both greater phenotypic plasticity and increased gene exchange with other populations or species. It is thus not surprising that trees are much more likely to be outcrossers and more likely to hybridize than smaller herbaceous plants (Boucher et al. 2017; Mitchell et al. 2019). The evolutionary strategies that one would hypothesize as counterbalances to the limitations imposed by large size and long generation time in an area with a history of repeatedly rapidly changing climate can be seen in *Quercus*, the most diverse tree genus at Las Joyas and in Mexico (Ricker et al. 2016). Valencia-A. (2020), in a work that should be required reading for all taxonomists working with Mexican trees, outlines the increased plasticity, convergence, hybridization, introgression, and incomplete divergence that characterize Mexican oaks and complicate their taxonomy. Oaks may represent an extreme example, but similar processes are probably characteristic of most Mexican tree species, making species boundaries at times difficult to understand.

Thus, in trees we have organisms that are both harder to study and to describe, and that are more prone to plasticity, variation and hybridization, making tree systematics more challenging. The writer of a tree flora (and any systematist studying arboreal groups) must be acutely aware of this, and focusing just on trees allows more attention to be paid to these challenges.

A modern up-to-date tree flora of Mexico is the goal, but comprehensive local tree floras and in-depth systematic studies of individual tree groups are the building blocks, each of them depending greatly on the other. Local trees floras, which can cover areas from a few hectares to an entire state, vary greatly according to the purposes for which they are written, which range from the strictly utilitarian to the strongly taxonomic-ecological. There are various possible purposes, but two apply especially to tree floras:

1) *Identification of the local trees.* There are almost always many local researchers, foresters, naturalists and others who want or need to identify the local trees. Tree floras are particularly useful in this case because identification keys to just the local trees are much easier to use than keys that cover either all types of plants or broader geographies that include many more species of trees. When dealing just with trees, vegetative keys become possible and are much more appropriate than for the general flora. Local tree floras that have only this purpose may be as simple as a key to identification and a brief introduction (e.g., Cuevas G. et al. 1991, the forerunner of the current work), although they often include more detail. They may include all tree species, in which case extensive field work and the production of a complete list of species are involved, or they may cover only the more common species.

2) *Presentation of in-depth taxonomic and ecological portraits of local trees.* As noted above, trees species tend to present more variation, whether it be morphological or ecological, as well as to require more effort to study and describe their morphology, when compared to herbaceous species. Research work for a local flora that focuses just on trees allows sufficient time and attention to be paid to adequately study and describe the tree morphology and its variation. The known taxonomy and variation of each species is reviewed throughout its range, and then extensive field experience and

observation of the local population and its variation inform its taxonomic treatment for the flora, where variation and taxonomic problems are discussed when relevant. Details of tree morphology (including not just the usual botanical details but also information on bark, tree architecture, detailed leaf venation, etc.), habitat, and variation at the individual and populational level not only provide better portrait the tree species locally, but also provide basic data for understanding the species at wider levels of distribution.

A comprehensive local tree flora incorporates both purposes listed above and includes all tree species in the area of study. In addition, it will include field-based assessments of the habitat and conservation status of each species, as well as local names and uses. The research for a comprehensive local tree flora thus provides not only critical information with which other botanists can better understand and identify the tree species covered by that flora, but also a wealth of field data and taxonomic work that help in the understanding of the variation and taxonomy of the species throughout their ranges. Systematic monographs of specific tree groups are always greatly helped by data and specimens from good local tree floras, and I would argue that an adequate tree flora for Mexico will never be done without a series of very good local tree floras.

 The Sierra de Manantlán is known to botanists and naturalists nationally and internationally for its species-rich montane forests and as the native habitat of *Zea diploperennis*, the diploid perennial wild corn or teosinte (Vázquez-García et al., 1995). Téllez et al. (2020) show that the state with the highest tree diversity and endemism in western Mexico is Jalisco, and the Sa. de Manantlán shares in that diversity. Good floristic lists of both the entire sierra (Vázquez-García et al. 1995) and of the biological station Las Joyas (Cuevas G. et al. 2004) have been done, and the area falls within the geographical limits of the monumental but still incomplete *Flora Novo-Galiciana* and the on-going *Flora de Jalisco*.

In 1991, the three authors of this tree flora, joined by the late Francisco Javier Santana Michel (one of the botanists to whom the present flora is dedicated), published a 32-page guide for the identification of the trees of Las Joyas (Cuevas G. et al. 1991). The current work presents almost three decades of constant work by all three authors, plus Santana Michel and others, to produce a full accounting of these trees and their identification. All three, and especially the first two, have been involved in intensive field work; the second and especially third authors have done extremely nice and useful black-and-white drawings of most of the species; and all three have been involved in the needed taxonomic work and descriptions. The authors are ideal for this kind of work, with strong and lengthy backgrounds in systematics, floristics, forest ecology, forestry, conservation, scientific illustration, and field biology, and all have worked in the area of Las Joyas for over 30 years.

The very useful 1991 work included a key to 101 species and a very nice illustrated glossary, without descriptions or discussion of the species. The present work represents a much expanded study with keys to 143 species, complete treatments of all species with illustrations, and substantive relevant introductory materials and the glossary.

Following on Thomas Merton's quote above, no visual or written account of a tree can fully portray the real organism; despite their size and ubiquity, there is so much that remains hidden and mysterious about trees, and this is part of why we are fascinated by these silent giants. Nevertheless, the descriptions in a good local tree flora should allow the user to form a mental image of each tree before ever seeing it in the field, imperfect though that image may be. They should be detailed enough to fill out the picture but not so detailed as to numb the mind. The species treatments in this book accomplish this by combining solid but succinct descriptions with outstanding illustrations (all 143 species are illustrated: 123 with outstanding line drawings only, 16 with photographs only, and 4 with both). The user must use both text and illustration to form a mental picture, because some details are only in one or the other. The original illustrated glossary is a wonderful help.

A comprehensive tree flora aims at a wider range of users than a standard flora and at the same time seeks to provide more diverse detail about the organisms included. It aims at both simplifying identification while providing insight into the variation and morphology of difficult-to-study and taxonomically difficult group of organisms. This is a difficult balance, a balance that the present work accomplishes admirably. It meets the definition above of a “comprehensive” local tree flora, covering all tree species of an area in a comprehensive and illustrated manner. The careful taxonomy, fine descriptions, outstanding illustrations, and extensive field experience make it exemplary.

In my first plant taxonomy class over 50 years ago, early in the course the professor, John L. Morrison, quoted Confucius: “The beginning of wisdom is to call things by their proper name.” Note that the quote does not say “knowledge,” it says “wisdom,” which I interpret as perceiving how to apply knowledge in an ethical, compassionate, insightful, and disinterested way for the good of all.

Hugh Iltis, in *Flora de Manantlán* (Vázquez-García et al. 1995), said that “los taxónomos, les gusta o no, cargan consigo una responsabilidad social enorme.” He was talking about the responsibility of taxonomists in the face of the global biodiversity conservation crisis. Wisdom requires taxonomists to work diligently and effectively in the effort to conserve the global biota, and this requires both solid taxonomy and vocal advocacy. Trees need our wisdom and effort, and local tree floras have an important part to play in conservation efforts. No good local tree flora can ignore this responsibility.

Villaseñor et al. (2013) estimate 4331 species of trees for Mexico. Their definition of “tree” is much more inclusive than that of the current authors, and so this number is not comparable to the 143 species treated here. However, Villaseñor et al. report that 57.4% of Mexican trees (or about 2486 species) reach 10 m in height. By my count, about 105 of the species in the current work reach that height, meaning that Las Joyas station holds 4.2% of all Mexican tree species that reach 10 m in height. This is not an insignificant percentage for a tiny, upland biological station that occupies, along with nearby areas include in this work, less than 0.002% of the country’s total area. This fact is useful in understanding the relative biodiversity of different parts of the country, but even more important from the point of view of conservation. It indicates the importance that Las Joyas can play in a national conservation scheme, but it also underlines the importance that the data in a good tree flora can play in conservation.

A good local tree flora should contribute significantly to conservation efforts not only locally but at broader geographical levels. Conservation assessments given for each species at the local level are obviously very useful locally and more broadly, and the ability to identify tree species correctly is basic to conservations efforts. But in addition, the taxonomic insights into the species—which in this case include 4.2% of all species of larger trees in Mexico — are also critical. Taxonomy plays a basic role in conservation, where much work is done at the species level (e.g., “Red Lists” of endangered species, such as González-Espinosa et al. 2011). These efforts are only as good as the taxonomy that underlies them, and it is to this point that Iltis directs himself. Good taxonomy is by itself does not conserve species, but incorrect or incomplete taxonomy can profoundly handicap conservation efforts (e.g., Vogel Ely et al. 2017). As discussed above, the research and data of local tree floras on local variation and species delimitation of trees can be enormously helpful in better taxonomic understanding of those groups. This local tree flora is exemplary in this regard. It provides both local conservation assessments through an “estado de riesgo” section for each species, as well as useful data for understanding the species taxonomically.

We need all the wisdom possible to keep our natural world, and us with it, from disappearing. And one of the elemental places to start is with understanding the species we live with. Well done local tree floras, such as this one, play an important part of understanding and conserving one of the most magnificent and inspiring (and economically and ecologically important) lifeforms on earth, the trees.

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