Epilogue

The tendency toward environmental deterioration, currently seen as the most severe in the history of humanity, coupled with climate-change processes is illustrated through high rates of loss in terms of natural capital (Mayr 2000). In their turn, increased migration and disparities in energy consumption among different nations result in high rates of cultural capital loss (Ehrlich and Ehrlich 2005). The depletion of natural and cultural capital leads inexorably to reflection on new ways of understanding the cultural–natural dynamic and, eventually, to the search for alternatives to reverse the trend of anthropogenic degradation.

Environmental deterioration is a global issue with enormous local repercussions. On the one hand, the most industrially developed nations are identified as the causative agents behind the most major changes, while, on the other, developing nations are defined as industrial-impact buffer zones (Velázquez and Picón 2010b). Mexico, a country transitioning to industrialization, is undergoing a process of accelerated environmental deterioration, as seen through the loss of native natural capital and hence the loss of buffering capacity (Velázquez et al. 2010a). The challenge of being able to discern precision what is being lost is not trivial, given that there is no consensus on how to define organizational levels for natural capital. The framework underlying the theme developed in this book, ―SECLAVEMEX‖, is an attempt to remedy this lack of definition. A rigorous academic implementation would affect various issues laid out below.

Vegetation types, as much in Mexico as in a large part of the world, are considered as the best indicators of ecosystem diversity within a given territory. Even so, there exists no global classification system sustained by rigorous definitions and typologies for ecosystems. For countries with low alpha and beta diversity, despite their size (e.g. Canada, Russia, Argentina, Australia, and among many others), the lack of a classification system is irrelevant, given the limited range of vegetation types discernible through remote sensing and the relatively few species distributed across enormous spaces. The task of discerning vegetation types in countries with high alpha and beta diversity (e.g. Madagascar, Colombia, Mexico, and among many others) is highly complex. There are many reasons, but three are irrefutable, namely the wide-ranging diversity of endemic species, the high rate of species replacement between contiguous sites, and the gradual substitution of vegetation

A. Velázquez et al., *Standardized Hierarchical Vegetation Classification*,
Geobotany Studies, DOI 10.1007/978-3-319-41222-1

types along gradients (vegetation series), which impedes accurate discernment by remote sensing devices.

The aim of developing a single, accurate inventory of the natural capital in a given territory necessitates a rigorous systematization of vegetation-related information. In this contribution, the case of Mexico is presented, given that the previously proposed systems could not rely on the quantity of information now readily available. The necessity of cartographical expression was irrelevant, and the nomenclature was limited in terms of global context (Jardel et al. 2002; González-Elizondo et al. 2007).

—SECLAVEMEX‖ contributes to the definition of levels of vegetation organization from two overall viewpoints. The first is the geographic vision beginning with the definition of major biomes based on physiognomic criteria discernible with a high degree of certainty via remote sensing images; the second is the botanical vision stemming from profound knowledge of species groupings in given territories denoting various levels of groupings along catenae. This —geobotanical‖ approach was lacking in the education of biological diversity experts in Mexico and is a key to permitting the development of rigorous inventories of ecosystems.

A second implication refers to the necessity of there being a baseline when understanding processes of vegetation dynamics, whether they tend toward irreversible deterioration or toward processes of salvageable recovery. The precise description of the condition of the vegetation types and their tendencies are now fundamental to the ability to reverse undesirable processes or at least to document systematically those vegetation types vulnerable in the long and short terms.

It should be highlighted that, within the previous framework, the range of deterioration experienced by each vegetation type across its organizational levels varies drastically—generally known as the resilience mechanism. It is, for example, known that dry tropical deciduous forests are relatively more susceptible to certain deterioration processes than humid temperate perennial forests (Rzedowski 1978; Durán 2004). For this reason, it is fundamental to know each type of vegetation within an organized framework and hence to denote the resilience capacity of each. In Mexico, there is still a preponderance of dictating natural resource management and conservation policies regarding all vegetation type as functionally equal. As a result, an innovative and eventually fruitful policy such as sustainable forestry or payment for the provision of environmental water services is adequate for one type of vegetation but not for others as each has its own nature in terms of resilience capacity; all of which underscore the urgent need to develop uses and policies responsive to the particularities of each vegetation type. For such an aim, a single and rigorous system is crucial (Peterson 2002; Walker et al. 2002).

An additional advantage included in SECLAVEMEX is the possibility to bridge the gap between the various levels of biological organization and their eventual cartographical expression. This aspect is doubtless fundamental and far from exhausted. The analysis it provides is, moreover, sophisticated, given the complex nature of the vegetation patterns prevalent in Mexico.

Even so, it is from an organized outline that legends expressing vegetation distribution patterns are developed. Based on the various grouping levels, congruent

work scales can be derived, permitting the analysis of said patterns whether for purely academic ends or for management, conservation, and restoration purposes. Among the academic aspects, there stands out the lack of any reference framework for, among others, biogeographical, palaeoecological, synecological, and ecological niche studies. In terms of applied aspects, there is an increasingly urgent need for a single inventory of Mexican vegetation types in their diverse organizational levels with a corresponding cartographical expression so as to corroborate unequivocally the baseline for territorial planning or, as it is better known in Mexico, the land use planning (—Ordenamiento Ecológico Territorial‖). Thematic mapping of some 60 distinct themes is currently necessary in order to substantiate the tasks of the —Ordenamientos Ecológicos Territoriales‖. No less than half of these themes in their diagnostic, characterization, integration, analytical, prognostic, or projection phases rely on vegetation-type maps to determine the condition, the tendency, and the potential uses for a territory, hence rendering crucial the availability of a SECLAVEMEX replete with a congruent territorial expression. Without such a system, inter-regionally incompatible OETs will continue to be developed and will be impossible to nest in macroregional outlines.

One of the applications worthy of deep reflection is the theme of conservation. To date, conservation schemes in Mexico have followed three lines: the establishment of various categories of Áreas Naturales Protegidas (ANP—protected natural areas), the declaration of Unidades de Manejo de Vida Silvestre (UMAS—wildlife management units) and the environmental services payment schemes (PSA—pago por servicios ambientales). These three approaches have been successful in some aspects, all the while being questionable and even contradictory in certain regions for various reasons: ANPs are, by their very nature, predominantly exclusive of cultural capital and tend toward a low level of operative efficiency in some highly populated regions. UMAS seem destined to address proposals which, in the main, never move beyond adding to an increasingly large number of demands for infinity on infinitely small spaces. Finally, the PSA programme exists within an erroneous conceptual framework, which, on the one hand, gives relative importance to a vegetation type from which goods or services are derived, ignoring that said product prevails through the functional connection of a group of vegetation types, and, which, on the other hand, incentivizes assigning a purely economic value to nature, largely ignoring the fact that what it aims to preserve has had its functional integrity excellently maintained locally by those who hold to principles beyond commercialization, namely cultural and historical values. In the light of previous framework, it is hoped that SECLAVEMEX will be able to contribute to the development of *ad hoc* conservation policies for all vegetation types, policies designed with the specific characteristics of each region of widely diverse countries such as Mexico in mind. Analyses of gaps or —ecological niches‖ need to be addressed in the short term such that policies strengthening existent conservation efforts can be derived—policies which can assist in correcting or reorienting conservation projects no longer deemed successful (Boege 2008).

New initiatives such as REED+ for the mitigation of climate change are also important given that the conceptualization and classification of as well as coherent

nomenclature for ―forests‖, for example, remain unresolved issues, not only in Mexico, but also in a large part of the world, thus providing another opportunity to test the relevance of SECLAVEMEX as much in the ecological definition of ―forests‖ as in their territorial delimitation.

Mexico, with one of the world's most important emerging economies, with education centres ranking among the best in the work and with its extraordinary cultural and natural heritage, deserves a vegetation classification system rigorous in its conceptualization and simple in its application partly in order to maximize existent knowledge and partly to minimize costs. This goal was, without a doubt, an additional cost-benefit strength afforded by SECLAVEMEX. There are multiple benefits stemming from the use of an inclusive system, congruent with local reality, which draws on the recapitulation of findings from preceding works as way of reorienting for future experiences. In Europe, for example, thanks to the fact that the phytosociological approach to the study of vegetation was taken over a century ago there exists today a congruent strategy for prioritising management and conservation strategies for natural resources (http://www.rednatura2000.ue). A decade ago, Canada and the USA took the same path and, although they are still a long way from achieving what exists in Europe, they do have a very similar and compatible scheme (FGDC 2006). Mexico can start with SECLAVEMEX, improving it and developing it into a solid territorial expression of vegetation types, or it can remain on the verge of being able to deepen nationwide knowledge and thus of being able to generate information which would, in real time, contribute to natural- and cultural-resource management and conservation strategies and policies. This task is not the responsibility of a single academic discipline, institution, or social group. On the contrary, it is a collective effort based on agreement and consensus, concepts which are the axis of development in Mexico, a country crying out for new ways to reconcile growing social demands on all that an natural world, ample though under increasing pressure, has to offer.

This book represents the first in a series of eight additional currently underway, the aim of which is to compile a mesoscale inventory of Mexican vegetation types with corresponding cartographical representation. This goal could be achieved within fifteen years and would be possible with massive participation on the part of institutions, researchers, and students. The conceptual framework, however, was the fundamental challenge, and it is SECLAVEMEX, as presented in this contribution, which defines it.

Appendices

See Appendices A.1, A.2, A.3, A.4, A.5, A.6, A.7 and A.8.

Appendix A.1 Common levels and criteria of four classification systems in Mexico

Author(s)	Criteria used in their categories	Level (nomenclature)	Application of the criteria and levels
Miranda and Hernández X. (1963)	1. Floristic	Level I (Vegetation types)	The selection criteria are not applied uniformly in defining each vegetation type
	2. Growth form		The nomenclature is clear, but with a prevalent use of traditional terms
	3. Function		
	4. Height		
	5. Spines		
	6. Habitat		
	7. Succulence		
Rzedowski (1978)	1. Growth form	Level I: (Vegetation types)	The selection criteria are not applied uniformly in defining each vegetation type
	2. Climate	Level II: (Other vegetation types)	It is a hierarchical proposal with two levels, but the nomenclature is not standardized
	3. Function		
	4. Floristic		
	5. Spines		
	6. Xeromorphy		
	7. Habitat		
	8. Substratum		

(continued)

A. Velázquez et al., *Standardized Hierarchical Vegetation Classification*,
Geobotany Studies, DOI 10.1007/978-3-319-41222-1

Appendix A.1 (continued)

Author(s)	Criteria used in their categories	Level (nomenclature)	Application of the criteria and levels
COTECOCA (1994)	1. Growth form	Level I: (Vegetation types)	The first criterion is applied consistently in defining the large groups (e.g. forests, jungles, shrubland, and grassland)
	2. Height		The following criteria are applied inconsistently, thus making the nomenclature confusing
	3. Function		
	4. Leaf morphology		
	5. Spines		
	6. Succulence		
	7. Density		
	8. Development		
	9. Substratum		
	10. Management		
González-Medrano (2003)	a. Climate zone	Level I: (Climate zone)	Hierarchy and standardized use of criteria exist
	b. Zonality or azonality	Level II: (Vegetation zonal azonal)	Includes a zonality criterion which brings into consideration which renders system confusing to the point of incomprehensibility
	1. Growth form	Level III: (Bioma)	The nomenclature also relies on different bases and criteria
	2. Function	Level IV: (Series of formation)	
	3. Height	Level V: (Formations)	
	4. Texture and consistency of leaves and stems	Level VI: (Associations)	
	5. Land cover	Level VII: (Consociations)	

Appendix A.2 Criteria of selection SECLAVEMEX and their description

Criteria	Dominant attributes	Qualifier's definition and description of the dominant elements or attributes
Physiognomy	Forest	Dominated by woody stem plants above 5 m tall
Growth form	Shrubland	Dominated by plants with one of more woody or succulent stems. Usually of less than 5 m in height or arborescent or arbofrutescent plants over 5 m high
	Grassland	Dominated by plants with no woody base
	Non-vascular	Plants with limited or no vascular system
Climate	Humid temperate	Climates with a mean annual temperature between 5° and 18 °C and precipitation from 1,000 to >4,000 mm
	Dry temperate	Climates with a mean annual temperature between 5° and 18 °C and precipitation from 0 to 1,000 mm
	Humid tropical	Climates with a mean annual temperature above 18 °C and precipitation from 1,000 to >4,000 mm
	Dry tropical	Climates with a mean annual temperature above 18 °C and precipitation from 0 to 1,000 mm
	Cold	Type E (T) C (cold and temperate. Climates with mean annual temperatures between −2° and 5 °C and precipitation from 0 to 2,000 mm
	Euriclimatic	Cold, temperate, or tropical. Optional qualifier Euriclimatic
Phenology of the foliage	Deciduous	Plant communities where 75 to 100 % of the top stratum individuals lose their leaves during the dry season
	Subdeciduous	Plant communities where 50–75 % of the top stratum individuals lose their leaves
	Evergreen	Plant communities where 75–100 % of the superior-canopy individuals remain green year round
	Subevergreen	Plant communities where 25–50 % of the top stratum individuals lose their foliage during the dry season
Presence of spines or vertical spikes	Spiny	Plant community dominated by individuals with spines
	Spineless	Plant community dominated by individuals without spines
	Subspineless	Plant communities with a density superior to 30 % of individuals with spines but inferior to 70 %
Leaf characteristics	Needle-leaved	Needle-shaped leaf
	Clustered	A clustering of flexible sprouts over a small area
	Angustifolia	Flat, narrow leaf
	Caespitose	Turf like (developed through creeping stems)
	Scales-leaved	Scale-shaped leaf
	Broadleaved	Broad, flat leaf
	Linearifolia	Narrow leaf with parallel edges
	Megaphyllous	Leaf larger than ±150 cm^2
	Microphyllous	Leaf smaller than ±2.5 cm^2
	Rosetophilous	Leaf cluster, generally helically, forming a rosette
	Others	Various unconsidered leaf types

(continued)

Appendix A.2 (continued)

Criteria	Dominant attributes	Qualifier's definition and description of the dominant elements or attributes
Succulence	Succulent	Communities with a predominance of plants with succulent or fleshy stems, leaves, and roots
	Non-succulent	Community of non-succulent dominant plants, neither in leaves stems
Floristic composition	Family	Family is a mid-level taxon within the system of taxonomic categories containing one or more genera (The taxon "Family" can be dominant is some communities, for example herbs in grassland and Pinaceae in some temperate forests)
	Genus	The taxon "genus" can be dominant in some plant communities, for *Quercus* or *Pinus* in holm or pine forests
	Species	"Species" is the basic taxon with the hierarchical taxonomic system. Numerous plant communities can be discerned by the dominance of 1–3 or more species
Substratum type	*Gypsophile*	Plant community adapted to gypsum-rich soils
	Halophytic	Communities adapted to high-salinity soils
	Aquatic and subaquatic	Plants adapted to water covering the soil
	Others	Substrata which and be relevant, but which do form part of this work

Appendix A.3 Previous studies permitting categories and criteria suggested by SECLAVEMEX to be inferred

Case study	Level I	Level II	Level III	Level IV	Level V	Level VI	Level VII
	Bioma	Major formation	Formation	Subformation	Series of associations	Association	Subassociation
Low deciduous jungle in Kalakmul western Campeche. (Slope centre on light soil hills and NW to 200 and 250 m.s.n.m. M.a. T. 24.6 °C and precipitation 1,076 mm, Canopy 15 m. (Martínez and Galindo-L et al. 2002)	Forest	Humid tropical	Deciduous	Broadleaved	*Pseudobombax–Bursera*	*Pseudobombax ellipticum*-and *Bursera simaruba*	*Lysiloma latisiliqua*
Low deciduous jungle at the UNAM Chamela biology station Jalisco. M.a. T 24.6°C and Precip. 788 mm (Durán 2004)	Forest	Dry tropical	Deciduous	Broadleaved	*Apoplanesia–Lonchocarpus*	*Apoplanesia paniculata, Lonchocarpus constrictus*	
Quercus forest in the La Michilía biosphere reserve SE of Durango, semi-dry temperate climate. M.A.T. 11.6 °C. Precip. 789 mm. (González-Elizondo et al 1993)	Forest	Dry temperate	Deciduous	Broadleaved	*Quercus*	*Quercus obtusata, Q.crassifolia, and Arctostaphylos pungens*	
Holm forest. Cerro Huitepec Reserve, San Cristóbal de las Casas, Chis. E-NE of the hill/slope. Elev. 2,450–2,260 m. M.a.T. 14-15 °C. Precip. 1,300mm (Ramírez-Marcial et al. 1998)	Forest	Humid temperate	Deciduous	Broadleaved	*Quercus*	*Quercus* spp *(95 %) Arbutus xalapensis and Alnus acuminata*	
Mountain mesophyll forest in Sierra San Carlos, Tamps. At 1,300–1,400 MSNM. Precip. 734.8 mm (Luna et al. 2001)	Forest	Dry tropical	Evergreen	Linear and broadleaved	*Abies–Carya*	*Abies guatemalensis, Carya ovata, Quercus* spp. *Carpinus caroliniana*	

(continued)

Appendix A.3 (continued)

Case study	Level I	Level II	Level III	Level IV	Level V	Level VI	Level VII
	Bioma	Major formation	Formation	Subformation	Series of associations	Association	Subassociation
Mountain mesophyll forest in Chinantla, Oax. At 1,600–1,800 MSNM. M.a. T. 14–17 °C. Precip. 5,797.8 mm (Luna et al. 2001)	Forest	Humid temperate	Evergreen	Broadleaved	*Engelhardtia*		*Engelhardtia mexicana*
Spiny shrubland. Tepejí del Río. Altitude 2,250 m. M.a. T. 15–16 °C. Precip. 605–790 mm (Romero and Rojas 1991)	Shrubland	Dry temperate	Evergreen	Spiny	*Opuntia–Acacia*	*Opuntia lindheimeri, Acacia schaffneri* and *Mimosa aculeaticarpa* var. *biuncifera*	
Xeric shrubland. Nizanda, Itsmo de Tehuantepec, Oax. Altitud 100–700 m. m.a. T. 15 °C. Precip. 1,000 mm (Pérez-García et al 2001)	Shrubland	Humid tropical	Evergreen	Succulent	*Agave–Hechtia*	*Agave ghiesbreghtii, Hechtia caudata, H. rosea*	
Grassland. Lake Zirahúen, Mich. M. a.T. 10 °C. Precip. ±1,149 mm (Pérez-Calix 1996)	Herbaceous	Humid temperate	Perennial	*Angustifolia* —clustered		*Muhlenbergia gigantea*	
Grassland Sierra de San Carlos. Tamps. M.a.T. 23 °C. Precip. 734 mm (Briones 1991)	Herbaceous	Dry tropical	Deciduous	*Angustifolia* —caespitose		*Agrostis semiverticillata, Bothriochloa saccharoides var. torreyana, Danthonia spicata,* etc.	

Appendix A.4 Standardized hierarchical classification system for vegetation in Mexico

Hierarchical level				
Level I	II	III	IV	V
Denomination				
Bioma	Major formation	Formation	Subformation	Series of associations
Definition criteria				
Physiognomy	Climate type	Foliage phenology	Morphology, presence of Spines and succulence	Genus level dominance
		(Stratum height)		
Forest	Temperate, humid, or cold	Evergreen	*Linearifolia*	*Abies*
				Pseudotsuga and Picea
			Needle-leaved	*Pinus*
			Scale leaf	*Cupressus*
			Needle-leaved, scale-*linearifolia*	*Juniperus*
				Pinus and Juniperus
			Broadleaved	*Pinus and Abies*
				Quercus
			Needle-leaved, broadleaved	*Pinus* and *Quercus*
		Subevergreen or subdeciduous	Broadleaved	*Quercus*
		Deciduous	Broadleaved	*Alnus*
				Quercus
	Temperate, humid, or dry	Evergreen	Spineless, broadleaved	*Quercus, Pinus and Juniperus*
				Quercus, Juniperus and Bouteloua
	Temperate or tropical humid	Evergreen and subevergreen	Broadleaved	*Liquidambar, Ostrya and Carpinus*
				Alfaroa, Alnus and Carpinus
				Liquidambar, Quercus and Podocarpus
			Megaphyllous	*Sabal, Brahea, Orbignya and Scheelea*

(continued)

Appendix A.4 (continued)

Hierarchical level				
Level I	II	III	IV	V
				Sabal, Orbignya and Scheelea
				Sabal, Orbignya and Brahea
				Scheelea, Sabal and Pseudophoenix
	Dry temperate	Evergreen	Needle-leaved	*Pinus cembroides and P. pinceana*
			Scale leaf	*Juniperus flaccida and Juniperus* sp.
		Subdeciduous or deciduous	Spiny	*Acacia, Prosopis and Pithecellobium*
	Humid tropical	Evergreen	Broadleaved	
			Sub-spineless	
			Needle-leaved or scale leaf	*Pinus–Juniperus*
			Needle-leaved, broadleaved	*Pinus– Quercus*
			Broadleaved	*Terminalia, Swietenia* and *Brosimum*
				Terminalia, Swietenia and *Brosimum*
				Pachira, Chrysobalanus and *Calophyllum*
				Billia, Clusia, Engelhardtia and *Meliosma*
				Ryzophora, Avicennia, Laguncularia and *Conocarpus*
		Subevergreen	Broadleaved	*Achras, Bucida* and *Brosimum*
				Brosimum, Manilkara and *Bursera*
				Alseis, Pterocarpus, Carpodiptera and *Manilkara*

(continued)

Appendix A.4 (continued)

Hierarchical level				
Level I	II	III	IV	V
				Brosimum
				Haematoxylum, Metopium, Byrsonima and *Cresentia*
				Byrsonima, Curatella and *Cresentia*
		Subdeciduous	Broadleaved	*Enterolobium, Hymenaea* and *Orbignya*
				Hymenaea, Enterolobium and *Cedrela*
			Spiny	
	Dry temperate	Evergreen	Needle-leaved	*Pinus*
		Subevergreen or subdeciduous	Needle, broadleaved	*Pinus* and *Quercus*
			Broadleaved	*Quercus*
			Spiny	*Prosopis (Acacia)*
			Broadleaved	*Pithecellobium and Prosopis*
				Brosimum, Ficus and *Bursera*
		Deciduous	Spiny	*Cercidium, Pithecellobium, Olneya* and *Prosopis*
			Broadleaved	*Cercidium, Pithecellobium, Olneya and Prosopis*
				Ceiba, Lysiloma and *Cochlospermum*

(continued)

Appendix A.4 (continued)

Hierarchical level				
Level I	II	III	IV	V
	Cold, temperate, or tropical (euriclimatic)	Evergreen	Broadleaved	*Plumeria, Bursera, Gyrocarpus and Spondias*
				Piscidia, Lysiloma and *Cordia*
				Taxodium, Platanus and *Populus*
		Evergreen to deciduous	Not applicable	*Platanus, Populus, Salix* and *Taxodium*

Appendix A.5 Standardized hierarchical classification system for vegetation in Mexico

Hierarchical level				
Level I	II	III	IV	V
Denomination				
Bioma	Major formation	Formation	Subformation	Series of associations
Definition criteria				
Physiognomy	Climate type	Foliage phenology (stratum height)	Morphology, presence of spines and succulence	Genus level dominance
Shrubland	Humid temperate or cold	Evergreen to deciduous	Broadleaved, microphyllous	
	Dry temperate	Evergreen	Needle-leaved	*Pinus, Juniperus*
			Squamipholiate-leaf	*Pinus*
				Juniperus
			Broadleaved	*Quercus*
				Adenostoma, Arctostaphylos, Ceanothus, Quercus, etc.
				Quercus, Arctostaphylos, Cotoneaster, Adenostoma, etc.
			Microphyllous	*Larrea, Fouquieria, Cercidium, Ambrosia*, etc.
				Larrea, Flourencia, etc.
				Larrea
			Rosetophilous	*Yucca*
			Succulent, rosetophilous and/or spiny	*Agave, Hechtia, Dasylirion* and *Yucca*
				Agave, Fouquieria, Pachycormus, Machaerocereus, etc.
				Agave, Bergerocactus, Dudleya, etc.
				Agave, Hechtia, etc.
				Agave
				Agave, Hechtia, etc.
				Agave, Hechtia y/o Dasylirion, etc.

(continued)

Appendix A.5 (continued)

Hierarchical level				
Level I	II	III	IV	V
		Deciduous	Spineless	
			Subspineless	*Helietta, Neopringlea, Gochnatia*, etc.
				Helietta, Neopringlea, Cordia, Pithecellobium, etc.
				Helietta, Gochnatia, etc.
				Ipomoea, Bursera, Acacia, etc.
				Acacia, Eysenhardtia, Forestiera, Ipomoea,
			Spiny	*Condalia, Koeberlinia, Lycium, etc.*
				Acacia
				Cercidium, Acacia, Leucophyllum, Condalia, etc.
				Acacia
				Prosopis, Acacia, Mimosa, etc.
		Evergreen to deciduous	Succulent-subspineless	*Bursera, Jatropha, Pachycereus,* etc.
				Bursera, Jatropha, Ambrosia, etc.
			Succulent	*Fouquieria*
				Opuntia
				Cactáceas
				Cereus
				Myrtillocactus, Lemaireocereus, Escontria, etc.
				Pachycereus, Lophocereus, Cephalocereus, Opuntia, etc.

(continued)

Appendix A.5 (continued)

Hierarchical level				
Level I	II	III	IV	V
				Opuntia, Myrtillocactus, Carnegia, Stenocereus
				Cactáceas
				Lemaireocereus, Prosopis, Burseras, Karwinskia, etc.
				Fouquieria, Euphorbia, Lycium, Lophocereus, etc.
				Fouquieria, Yucca, Pachycereus and *Stenocereus*
				Fouquieria, Pachycereus, Opuntia, etc.
				Pachycereus, Machaerocereus, Lophocereus, Opuntia, etc.
			Microphyllous, broadleaved, and succulent	*Opuntia, Coccoloba, Bromelia,* etc.
				Ipomoea, Croton, Opuntia, etc.
				Prosopis, Larrea, Opuntia, Atriplex, etc.
				Hilaria, Opuntia, Ephedra, Eriogonum, etc.
	Cold, temperate, and tropical (euriclimatic)	Evergreen	Broadleaved to microphyllous	
		Deciduous	Broadleaved, microphyllous, succulent	

Appendix A.6 Vegetation study methods (Taken from Amador 2009)

Fixed surfaces or dimensions method
Minimum area. Quantitative approach for characterizing vegetation described by data. The sample size (collection of sampling units) must provide the most useful and accurate information possible. It is customary to define sampling units before carrying out any ecological study, given that these are regarded as the smallest area adequately representing the species composition within the community
In concordance with some authors, the following empirical values have been proposed:
Forest arboreal stratum: 200–500 m^2
Shrubland: 10–25 m^2
Forest herbaceous stratum: 50–200 m^2
Herbaceous: 30–100 m^2
Nested points method
The most usual method for defining the field area. A small area is recommended for initial consideration: 0.5 m^2 and that all species present should be noted. The area is doubled successively, and the additional species found in each duplication are noted
Simultaneously, a graph *i* constructed with the y- axis representing the number of species and the x-axis representing the samples area
The minimum area is the sampling area in which the curve turns almost horizontal
Square methods
Permits precise determination of species density, cover and frequency within the community and using this data to highlight the importance of each. This method does not necessarily imply square areas, and other forms can be used to delimit a constant and known area
Circular plane
Used widely in forest settings. The squared plane is used on flat terrain with abundant vegetation, whereas the rectangular plane is used where there are well-defined environmental gradients
Dimensional techniques (or variable dimensions)
There are various techniques using the distance between the plants or between the plants and a randomly chosen point. These techniques were developed and perfected for the study of the arboreal stratum of plant communities. They offer the advantage of not having delimited zones *a priori*. The two most commonly used techniques are those of points in a quadrant and random points
Points in a quadrant
Random points are located within the area to be sample. In many cases, however, it is appropriate to select points along a line or transect crossing the area to be described
A Cartesian coordinate axis is placed exactly at the sampling point dividing the zone of the site into four equal quadrants (hence the name of the technique). For each quadrant the distance from the centre of the coordinate axis to the nearest plant
Random points
Also require points selected at random. For each point, the plant closest to the centre of the quadrant is located. A line is traced from the point to the plant and then another line perpendicular to the first such that the second line divides the area into half. Then, the plant closest to the sampling point is located in the opposite half (that is the half not containing the first plant selected) with the distance between the two plants now being measured and recorded
Transect method
In some types of vegetation, many species present growth forms which make it difficult to distinguish the limits between individual plants. This characteristic renders inadequate the application of the surface (Fixed or Variable)
Canfield line
In 1941, R. Canield proposed the “line intercept method” to obtain cover estimates of species frequency in low-height communities. A measuring tape covering from 10 to 100 m distance is laid (the distance is based upon plant height). All plants intercepted by the tape are recorded in terms of species, and total cover along the tape. This method is repeated n times until all plant species of the community to be characterized are comprised

Appendix A.7 Relevé sheet with minimum information for a baseline study

Surveyor data and location of sampling unit						
Name				Institution		
Date		Municipality		State		
Latitude		Longitude		Elevation		
Map		Photograph/Image		Polygon Number		
Characterization data Landform						
	Mountain	Low Hills	Plain	Meseta	Valley	Other
Catenal	Crest	Slope	Piedmont	Valley		
Exposure		Slope	Concave slope		Convex slope	
Soil						
Type		Depth		Colour		
Texture		Structure		Drainage		
Substratum	Gypsophile	Halophytic	Hydrophilic	Other		
Level I Physiognomy Stratification						
	Height X	Coverage %	Classes of cover 1 = <1–1 % 2 = 2–5 % 3 = 6–25 % 4 = 26–50 % 5 = >50 %			
Arboreal						
Arbustive						
Herbaceous						
Flush						
Other						
Note Class coverage threshold values may vary according to the aim of the study						
Level II climate			Level III Phenology			
	Humid	Dry		Arboreal	Arbustive	Herbaceous
Tropical			Deciduous			
Temperate			Subdeciduous			
Cold	NA	NA	Evergreen			
Euriclimatic			Subevergreen			

(continued)

Appendix A.7 (continued)

Level IV Leaf Morphology						
		Arboreal	Arbustive	Herbaceous	Other	
Presence of spines	Spiny					
	Spineless					
	Subspineless					
Leaf type						
	Needle-leaved					
	Clustered					
	Angustifoliate					
	Caespitose					
	Scale-leaf					
	Broadleaved					
	Linearifolia					
	Megaphyllous					
	Microphyllous					
	Rosetophilous					
	Others					
Succlence	Succulent					
	No-succulence					
Levels V-VII Floristic composition						
	Collection number	Common name	Scientific name Family, genus, species	Stratum	Coverage	

Appendix A.8 Comparison among vegetation classification systems from Mexico

Hierarchical level						
I	II	III	IV			V
Bioma	Major formation	Formation	Subformation			Series of associations
Physiognomy	Climate-type	Phenology	Morphology presence of spines and succulence	Correspondence with previous proposals (original nomenclature in Spanish)	Author(s)	Level genus or family dominance
Forests	Humid or cold temperate	Evergreen	*Linearifolia*	Bosque de *Abies*	Rzedowski	*Abies*
				Bosque de abetos u oyameles	Miranda and HX	
				Bosque de oyamel (incluye ayarín & cedro)	I GEOGRAFÍA	
				Bosque de oyamel	INEGI	
				Bosque de ayarín	INEGI	*Pseudotsuga y/o Picea*
				Bosque de *Pseudotsuga* & de *Picea*	Rzedowski	
				Bosque templado alto de linearifolios	GLEZ-MED	
				Bosque templado mediano linearifolio ripario	GLEZ-MED	
				Bosque linearifolio	COTECOCA	
			Needle-leaved	Bosque de *Pinus*	Rzedowski	*Pinus*
				Pinares	Miranda and HX	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Bosque de pino	I GEOGRAFÍA	
				Bosque de pino	INEGI	
				Bosque templado mediano aciculifolio gipsófilo	GLEZ-MED	
				Bosque templado mediano de aciculifolios	GLEZ-MED	
				Bosque aciculifolio	COTECOCA	
				Bosque claro aciculifolio sempervirente	UNESCO	
				Bosque de aciculifolios	INEGI	
			Scale leaf	Bosque de *Cupressus*	Rzedowski	*Cupressus*
				Cipresal	INEGI	
				Bosque de cedro	INEGI	
				Bosque de *Juniperus*	Rzedowski	*Juniperus*
				Bosque de enebros	Miranda and HX	
				Bosque de táscate	INEGI	
				Bosque de táscate	I GEOGRAFÍA	
				Bosque escuamifolio	COTECOCA	
				Bosque templado bajo de escuamifolios	GLEZ-MED	
			Needle-leaved, scale-linearifolia	Bosque aciculi-escuamifolio	COTECOCA	*Pinus & Juniperus*

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Bosque templado bajo de escuamiaciculifolios	GLEZ-MED	
				Bosque aciculi-linearifolio	COTECOCA	*Pinus & Abies*
				Bosque templado & subpolar sempervirente de coníferas	UNESCO	
				Bosque de coníferas	INEGI	
				Bosque de coníferas	Rzedowski	
			Broadleaved	Bosque de *Quercus*	Rzedowski	*Quercus*
				Bosque de encino	I GEOGRAFÍA	
				Bosque de encino	INEGI	
				Bosque esclerófilo	INEGI	
				Encinar	Miranda and HX	
				Bosque de roble de Veracruz	DINERSTEIN	
				Bosque de roble del centro de México	DINERSTEIN	
				Bosque mediano perennifolio de durifolios	GLEZ-MED	
				Bosque templado mediano de durifolios	GLEZ-MED	
				Bosque latifoliado sempervirente esclerófilo con lluvias de invierno	UNESCO	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Bosque claro latifoliado sempervirente	UNESCO	
				Bosque esclerófilo perennifolio	COTECOCA	
			Needle-leaved, broadleaved	Bosque aciculi-esclerófilo	COTECOCA	*Pinus* & *Quercus*
				Bosque de pino & roble de la Sierra de Juárez	DINERSTEIN	
				Bosque de pino & roble de la Sierra Madre del Sur	DINERSTEIN	
				Bosque de pino & roble de la Sierra Madre Oriental	DINERSTEIN	
				Bosque de pino & roble de San Lucas	DINERSTEIN	
				Bosque de pino & roble transvolcánica de México	DINERSTEIN	
				Bosque de pino-encino	INEGI	
				Bosque de pino-encino (incluye encino-pino)	I GEOGRAFÍA	
				Bosque esclero-aciculifolio	COTECOCA	
				Bosque templado mediano de aciculidurifolio	GLEZ-MED	
				Bosque templado mediano de duriaciculifolios	GLEZ-MED	
				Bosque de encino-pino	INEGI	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Bosque templado bajo de duriescuamifolios	GLEZ-MED	
				Bosques de coníferas & b. temp. de latifoliadas	DINERSTEIN	
		Subevergreen or subdeciduous	Broadleaved	Bosque de encino	INEGI	*Quercus*
				Bosque de encino	I GEOGRAFÍA	
				Bosque de *Quercus*	Rzedowski	
				Bosque esclerófilo	INEGI	
				Encinares	Miranda and HX	
				Bosque esclerófilo subcaducifolio	COTECOCA	
				Bosque mayormente sempervirente	UNESCO	
				Bosque templado latifoliado sempervirente estacional con lluvias en verano	UNESCO	
		Deciduous	Broadleaved	Bosque de *Alnus*	Rzedowski	*Alnus*
				Bosque templado mediano de durifolios	GLEZ-MED	*Quercus*
				Bosque templado mediano caducifolio	GLEZ-MED	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
	Humid or dry temperate	Evergreen	Spineless, broadleaved	Bosque esclerófilo caducifolio	COTECOCA	
				Bosque bajo abierto	I GEOGRAFÍA	*Quercus, Pinus, Juniperus,*etc.
	Humid temperate or tropical	Evergreen or/and subevergreen	Broadleaved	Bosque bajo abierto	INEGI	*Quercus, Juniperus, Bouteloua*, etc.
				Bosque caducifolio	Miranda and HX	*Liquidambar, Ostrya, Carpinus*, etc.
			Megaphyllous	Bosque caducifolio	COTECOCA	*Alfaroa, Alnus, Carpinus*
				Bosque caducifolio	INEGI	
				Bosque mesófilo de montaña	I GEOGRAFÍA	
				Bosque mesófilo de montaña	INEGI	*Liquidambar, Quercus, Podocarpus*
				Bosque mesófilo de montaña	Rzedowski	
				Bosque bajo hidrófilo pinnado palmatifoliado	GLEZ-MED	*Sabal, Brahea, Orbignya, & Scheelea*
				Palmar	DINERSTEIN	
					I GEOGRAFÍA	
					COTECOCA	
					INEGI	*Sabal, Orbignya, Scheelea*

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
	Dry temperate	Evergreen	Needle-leaved	Palmares	Rzedowski	*Sabal, Orbignya, Brahea*
					Miranda and HX	*Scheelea, Sabal, Pseudophoenix*
				Bosque de *Pinus*	Rzedowski	*Pinus cembroides, P. pinceana*
		Subdeciduous or deciduous	Scale leaf	Bosque de táscate	INEGI	*Juniperus flaccida, Juniperus*
			Spiny	Bosque caducifolio espinoso	COTECOCA	*Acacia, Prosopis, Pithecellobium*
			Broadleaved	Bosque denso espinoso	UNESCO	
				Bosque espinoso	INEGI	
				Bosque espinoso	Rzedowski	
				Bosque claro deciduo por el frío, con árboles sempervirentes	UNESCO	
				Bosque claro extremadamente xeromórfico dominado por esclerófilas	UNESCO	
				Bosque deciduo por el frío con árboles (o arbustos) sempervirentes entremezclados	UNESCO	
				Bosque denso extremadamente xeromórfico dominado por esclerófilas	UNESCO	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
			Subspineless	Bosque claro deciduo por el frío, sin árboles sempervirentes	UNESCO	
				Bosque deciduo por el frío sin árboles sempervirentes	UNESCO	
				Bosque claro deciduo por la sequía	UNESCO	
			Subevergreen or subdeciduous	Bosque claro mayormente deciduo	UNESCO	
				Bosque mayormente deciduo	UNESCO	
				Bosque claro espinoso	UNESCO	
	Humid tropical	Evergreen		Bosque sempervirente tropical & subtropical de coníferas estacional con lluvias en verano	UNESCO	*Pinus -Juniperus*
			Broadleaved	Bosque tropical & subtropical de coníferas	DINERSTEIN	
				Bosque tropical alto perennifolio	GLEZ-MED	*Terminalia, Swietenia, Brosimum, etc.*
				Bosque tropical bajo perennifolio	GLEZ-MED	
				Bosque tropical perennifolio	Rzedowski	
				Selva alta perennifolia	Miranda and HX	
				Selva alta perennifolia	INEGI	*Terminalia, Swietenia, Brosimum, etc.*

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Selva alta perennifolia	COTECOCA	
				Selva alta & mediana perennifolia	I GEOGRAFÍA	
				Selva baja perennifolia	I GEOGRAFÍA	*Pachira, Chrysobalanus, Calophyllum,* etc.
				Selva baja perennifolia	COTECOCA	
				Selva baja perennifolia	INEGI	
				Selva mediana a baja perennifolia	Miranda and HX	*Billia, Clusia, Engelhardtia, Meliosma,* etc.
				Selva mediana perennifolia	COTECOCA	
				Bosque tropical ombrófilo	UNESCO	
				Manglar	Rzedowski	*Ryzophora, Avicennia, Laguncularia & Conocarpus*
				Manglar	Miranda and HX	
				Bosque de manglares	UNESCO	
				Manglar	COTECOCA	
				Manglar	I GEOGRAFÍA	
				Manglares	DINERSTEIN	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Manglar	INEGI	
		Subevergreen	Broadleaved	Bosque tropical alto subperennifolio	GLEZ-MED	*Achras, Bucida, Brosimum*, etc.
				Bosque tropical bajo subperennifolio	GLEZ-MED	
				Bosque tropical mediano subperennifolio	GLEZ-MED	*Brosimum, Manilkara, Bursera,*etc.
				Selva alta o mediana subperennifolia	Miranda and HX	
				Selva alta subperennifolia	COTECOCA	
				Selva alta subperennifolia	INEGI	
				Selva mediana subperennifolia	COTECOCA	
				Selva alta & mediana subperennifolia	I GEOGRAFÍA	*Alseis, Pterocarpus, Carpodiptera, Manilkara, etc.*
				Selva mediana subperennifolia	INEGI	*Brosimum*
				Selva baja subperennifolia	I GEOGRAFÍA	*Haematoxylum, Metopium, Byrsonima & Cresentia*
				Selva baja subperennifolia	COTECOCA	*Byrsonima, Curatella & Cresentia*
				Selva baja subperennifolia	INEGI	
				Selva baja subperennifolia	Miranda and HX	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
		Subdeciduous	Broadleaved	Bosque de *Byrsonima, Curatella* & *Cresentia*	Rzedowski	
				Selva mediana caducifolia & subcaducifolia	I GEOGRAFÍA	*Enterolobium, Hymenaea, Orbignya*, etc.
				Bosque tropical & subtropical sempervirente estacional	UNESCO	
				Bosque húmedo de la Sierra Madre	DINERSTEIN	
				Bosque húmedo de Oaxaca	DINERSTEIN	
				Bosque húmedo de Tehuantepec	DINERSTEIN	
				Bosque húmedo de Yucatán	DINERSTEIN	
				Bosque húmedo tropical de hoja ancha	DINERSTEIN	
				Bosque montano de Veracruz	DINERSTEIN	
				Bosque tropical & subtropical semideciduo	UNESCO	
				Humedal de Quintana Roo	DINERSTEIN	
				Selva alta o mediana subcaducifolia	Miranda and HX	*Hymenaea, Enterolobium, Cedrela*, etc.
				Selva baja subcaducifolia	COTECOCA	
				Selva mediana subcaducifolia	COTECOCA	
			Spiny	Selva baja subperennifolia espinosa	COTECOCA	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
	Dry tropical	Evergreen	Spiny	Selva baja subperennifolia subespinosa	COTECOCA	
				Bosque claro mayormente sempervirente	UNESCO	
		Subevergreen or subdeciduous	Broadleaved	Mezquital central de México	DINERSTEIN	
				Mezquital de San Lucas	DINERSTEIN	
				Mezquital occidental de México	DINERSTEIN	
				Mezquital	INEGI	*Prosopis* (*Acacia*)
				Mezquital (incluye huizachal)	I GEOGRAFÍA	
				Selva baja espinosa perennifolia	Miranda and HX	*Pithecellobium, Prosopis*, etc.
				Bosque tropical bajo subcaducifolio	GLEZ-MED	
				Bosque tropical mediano subcaducifolio	GLEZ-MED	
				Bosque tropical subcaducifolio	Rzedowski	*Brosimum, Ficus, Bursera,* etc.
				Selva baja subcaducifolia	INEGI	
				Selva mediana subcaducifolia	INEGI	
			Spiny	Selva baja subcaducifolia espinosa	COTECOCA	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Selva mediana subcaducifolia espinosa	COTECOCA	
				Selva baja subcaducifolia subespinosa	COTECOCA	
				Selva baja espinosa	I GEOGRAFÍA	*Cercidium, Pithecellobium, Olneya, Prosopis,* etc.
				Selva baja espinosa	INEGI	
				Selva baja caducifolia espinosa	COTECOCA	
				Selva baja espinosa caducifolia	Miranda and HX	*Cercidium, Pithecellobium, Olneya, Prosopis,* etc.
				Selva mediana caducifolia espinosa	COTECOCA	
		Deciduous	Broadleaved	Selva mediana caducifolia	COTECOCA	
				Selva mediana caducifolia	INEGI	
				Selva alta caducifolia	COTECOCA	
				Bosque seco de Baja California	DINERSTEIN	
				Bosque seco de Balsas	DINERSTEIN	
				Bosque seco de Jalisco	DINERSTEIN	
				Bosque seco de Oaxaca	DINERSTEIN	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Bosque seco de Sinaloa	DINERSTEIN	
				Bosque seco de Tamaulipas & Veracruz	DINERSTEIN	
				Bosque seco de Veracruz	DINERSTEIN	
				Bosque seco de Yucatán	DINERSTEIN	
				Bosque seco tropical de hoja ancha	DINERSTEIN	
				Bosques tropicales de latifoliadas	DINERSTEIN	
				Bosque deciduo por la sequía (tropical & subtropical)	UNESCO	
				Bosque tropical bajo caducifolio	GLEZ-MED	*Ceiba, Lysiloma, Cochlospermum,* etc.
				Bosque tropical caducifolio	Rzedowski	
				Bosque tropical mediano caducifolio	GLEZ-MED	*Plumeria, Bursera, Gyrocarpus, Spondias,* etc.
				Bosques tropical secos	GLEZ-MED	
				Selva baja caducifolia & subcaducifolia	I GEOGRAFÍA	
				Selva baja caducifolia	Miranda and HX	*Piscidia, Lysiloma, Cordia,* etc.

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
	Cold, temperate or tropical (euclimatic)	Evergreen	Broadleaved	Selva baja caducifolia	COTECOCA	
				Selva baja caducifolia	INEGI	
				Bosque subtropical ombrófilo	UNESCO	
				Bosque bajo a mediano perennifoliohalófilo	GLEZ-MED	*Taxodium, Platanus, Populus*, etc.
	Humid or cold temperate	Evergreen to deciduous	Not applicable	Bosque de galería	INEGI	
				Otras comunidades leñosas	Rzedowski	
				Bosque bajo perennifolio hidrófilo	GLEZ-MED	
				Bosque mediano a alto perennifolioripario	GLEZ-MED	
				Selva de galería	INEGI	
				Vegetación de galería	I GEOGRAFÍA	*Platanus, Populus, Salix & Taxodium*
				Bosque cultivado	INEGI	
Needle-leaved		Evergreen to deciduous	Broadleaved, microphyllous	Plantación forestal	I GEOGRAFÍA	
				Tundra de arbustos enanos, líquenes & musgos	UNESCO	
				Pantano turboso no elevado	UNESCO	
				Formación de pantano turboso de musgos con arbustos enanos	UNESCO	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Pantano turboso elevado	UNESCO	
				Matorral deciduo por el frío	UNESCO	
				Matorral denso enano deciduos por el frío	UNESCO	
				Matorral claro enano deciduos por el frío	UNESCO	
	Dry temperate	Evergreen	Needle-leaved	Matorral de coníferas	I GEOGRAFÍA	*Pinus, Juniperus*
				Matorral de coníferas	INEGI	*Pinus*
				Matorral de *Pinus*	Rzedowski	
				Matorral claro sempervirente aciculifolio micrófilo	UNESCO	
				Matorral denso sempervirente aciculifolio micrófilo	UNESCO	
			Scale leaf	Matorral de *Juniperus*	Rzedowski	*Juniperus*
			Broadleaved	Matorral mediano esclerófilo	COTECOCA	*Quercus*
				Matorral mediano esclerófilo perennifolio	GLEZ-MED	
				Matorral alto esclerófilo	COTECOCA	
				Matorral bajo esclerófilo	COTECOCA	
				Matorral arborescente	COTECOCA	
				Matorral arbofrutescente	COTECOCA	
				Chaparral	I GEOGRAFÍA	*Adenostoma, Arctostaphylos, Ceanothus, Quercus*, etc.

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Chaparral	INEGI	*Quercus, Arctostaphylos, Cotoneaster, Adenostoma,* etc.
				Matorral enano mayormente sempervirente	UNESCO	
				Matorral denso enano sempervirente	UNESCO	
				Matorral claro enano sempervirente	UNESCO	
				Matorral de arbustos enanos sempervirente herbáceo	UNESCO	
				Matorral mediterráneo	DINERSTEIN	
			Microphyllous	Matorral desértico micrófilo	I GEOGRAFÍA	*Larrea, Fouquieria, Cercidium, Ambrosia*, etc.
				Matorral inerme	INEGI	*Larrea, Flourencia*, etc.
				Matorral inerme parvifolio	Miranda and HX	
				Matorral alto inerme	GLEZ-MED	
				Matorral mediano parvifolio	COTECOCA	*Larrea*
				Matorral mediano parvifolio crasicaulescente	COTECOCA	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
			Rosetophilous	Matorral desértico micrófilo	INEGI	*Yucca*
				Izotal	COTECOCA	
			Succulent, rosetophilous and/or spiny	Izotales	Miranda and HX	
				Izotal	INEGI	
				Matorral desértico rosetófilo	I GEOGRAFÍA	*Agave, Hechtia, Dasyliriony Yucca*
				Matorral rosetófilo costero	I GEOGRAFÍA	*Agave, Fouquieria, Pachycormus, Machaerocereus*, etc.
				Matorral rosetófilo costero	INEGI	*Agave, Bergerocactus, Dudleya*, etc.
				Matorral con rosetófilos acaules	INEGI	*Agave, Hechtia*, etc.
				Matorral desértico rosetófilo	INEGI	*Agave*
				Crasi-rosulifolios espinosos	Miranda and HX	*Agave, Hechtia*, etc.
				Matorral crasirosulifolio espinoso	COTECOCA	
				Crasi rosulifolios	INEGI	*Agave, Hechtia y/o Dasylirion*, etc.

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Matorral alto rosetófilo espinoso	GLEZ-MED	
				Matorral bajo rosetófilo espinoso	GLEZ-MED	
		Deciduous	Spineless	Matorral mayormente deciduo	UNESCO	
				Matorral claro subdesértico deciduo	UNESCO	
				Matorral denso mayormente deciduo	UNESCO	
				Matorral denso enano facultativamente deciduos por la sequía	UNESCO	
				Matorral claro enano facultativamente deciduo por la sequía	UNESCO	
				Matorral denso enano obligatoriamente deciduos por la sequía	UNESCO	
				Matorral claro enano obligatoriamente deciduos por la sequía	UNESCO	
				Matorral claro subdesértico deciduo	UNESCO	
				Matorral denso enano & comunidades relacionadas	UNESCO	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
			Subspineless	Matorral submontano	I GEOGRAFÍA	*Helietta, Neopringlea, Gochnatia*, etc.
				Matorral submontano	INEGI	*Helietta, Neopringlea, Cordia, Pithecellobium,* etc.
				Matorral alto subinerme	COTECOCA	*Helietta, Gochnatia*, etc.
				Matorral alto subinerme	GLEZ-MED	
				Matorral mediano subinerme	COTECOCA	
				Matorral mediano subinerme	INEGI	
				Matorral mediano subespinoso	Miranda and HX	
				Matorral bajo subespinoso	COTECOCA	
				Matorral deciduo por la sequía, con plantas leñosas sempervirentes entremezcladas	UNESCO	
				Matorral deciduo por la sequía, sin plantas leñosas sempervirentes entremezcladas	UNESCO	
				Matorral inerme o subinerme parvifolio	Miranda and HX	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
			Spiny	Matorral subtropical	I GEOGRAFÍA	*Ipomoea, Bursera, Acacia,* etc.
				Matorral subtropical	INEGI	*Acacia, Eysenhardtia, Forestiera, Ipomoea*
				Matorral espinoso con espinas terminales	Miranda and HX	*Condalia, Koeberlinia, Lycium, etc.*
			Succulent-spineless	Matorral espinoso con espinas laterales	Miranda and HX	*Acacia*
				Matorral espinoso tamaulipeco	I GEOGRAFÍA	*Cercidium, Acacia, Leucophyllum, Condalia*, etc.
				Matorral alto espinoso	GLEZ-MED	*Acacia*
				Matorral alto espinoso	COTECOCA	*Prosopis, Acacia, Mimosa*, etc.
				Matorral mediano espinoso	COTECOCA	
				Matorral bajo espinoso	COTECOCA	
				Huizachal	INEGI	
				Matorral espinoso	INEGI	
				Matorral espinoso tamaulipeco	INEGI	
		Evergreen to deciduous		Matorral sarcocaule	I GEOGRAFÍA	*Bursera, Jatropha, Pachycereus,* etc.
				Matorral sarcocaulescente	COTECOCA	
				Matorral sarcocaule	INEGI	*Bursera, Jatropha, Ambrosia*, etc.
				Matorral oliocilindrocaule afilo	COTECOCA	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
			Succulent	Cirio	INEGI	*Fouquieria*
				Chollal	INEGI	*Opuntia*
				Nopaleras	Miranda and HX	
				Nopalera	INEGI	
				Matorral de cactos de Guerrero	DINERSTEIN	Cactáceas
				Matorral de cactos del centro de México	DINERSTEIN	
				Matorral de cactos del norte de Sonora	DINERSTEIN	*Cereus*
				Cardonales, tetecheras, etc.	Miranda and HX	*Myrtillocactus, Lemaireocereus, Escontria,* etc.
				Cardonal	INEGI	
				Matorral crasicaule	I GEOGRAFÍA	*Pachycereus, Lophocereus, Cephalocereus, Opuntia*, etc.
				Matorral crasicaule	INEGI	*Opuntia, Myrtillocactus, Carnegia, Stenocereus*
				Matorral crasicaule	COTECOCA	Cactáceas
				Matorral crasicaulescente	COTECOCA	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Matorral arbocrasicaulescente	COTECOCA	*Lemaireocereus, Prosopis, Burseras, Karwinskia*, etc.
				Matorral sarcocrasicaule de neblina	I GEOGRAFÍA	*Fouquieria, Euphorbia, Lycium, Lophocereus*, etc.
				Matorral sarcocrasicaule	I GEOGRAFÍA	*Fouquieria, Yucca, Pachycereus & Stenocereus*
				Matorral sarco-crasicaule	INEGI	*Fouquieria, Pachycereus, Opuntia*, etc.
				Matorral sarcocrasicaulescent e subinerme	COTECOCA	
				Matorral sarco-crasicaule de neblina	INEGI	*Pachycereus, Machaerocereus, Lophocereus, Opuntia*, etc.
				Matorral alto crasicaule espinoso	GLEZ-MED	
				Matorral mediano crasicaulescente espinoso	COTECOCA	
				Matorral bajo crasifolio	COTECOCA	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
			Microphyllous—broadleaved, succulent	Vegetación de dunas	COTECOCA	
				Vegetación de dunas costeras	INEGI	*Opuntia, Coccoloba, Bromelia,* etc.
				Vegetación de dunas costeras	Miranda and HX	*Ipomoea, Croton, Opuntia, etc.*
				Vegetación de desiertos arenosos	INEGI	*Prosopis, Larrea, Opuntia, Atriplex,* etc.
				Vegetación de desiertos arenosos	I GEOGRAFÍA	*Hilaria, Opuntia, Ephedra, Eriogonum*, etc.
	Cold, temperate or tropical (euclimatic)	Evergreen	Broadleaved, microphyllous	Matorrales medianos hidrófilos	GLEZ-MED	
				Matorral claro latifoliado sempervirente	UNESCO	
				Matorral denso latifoliado sempervirente	UNESCO	
				Matorral mayormente sempervirente	UNESCO	
				Matorral claro subdesértico mayormente sempervirente	UNESCO	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
		Deciduous	Broadleaved, microphyllous, succulent	Matorral claro subdesértico mayormente sempervirente	UNESCO	
				Matorrales medianos halófilos	GLEZ-MED	
		Perennial	Angustifolia—cluster	Matorrales medianos gipsófilos	GLEZ-MED	
				Matorrales bajos a mediano arenícolas	GLEZ-MED	
				Matorrales medianos hidrohalófilos	GLEZ-MED	
Herbaceous	Cold or temperate			Pastizal amacollado	GLEZ-MED	
				Pastizal amacollado abierto	COTECOCA	
				Pastizal amacollado de montaña	GLEZ-MED	
				Pastizales de montaña	GLEZ-MED	
				Pastizal amacollado de montaña con arbustos esparcidos	GLEZ-MED	
				Pradera de alta montaña	I GEOGRAFÍA	*Festuca, Calamagrostis, Trisetum, Arenaria*, etc.
				Pradera de alta montaña	INEGI	
				Vegetación graminoide alta	UNESCO	
				Vegetación graminoide alta con una sinusia leñosa que cubre más del 10 %	UNESCO	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Vegetación graminoide alta con una sinusia leñosa que cubre más del 10 %	UNESCO	
				Vegetación graminoide alta con una sinusia leñosa que cubre más del 10 %	UNESCO	
				Zacatonal	DINERSTEIN	
				Zacatonales	Miranda and HX	*Stipa, Muhlenbergia & Festuca*, etc.
			Angustifolia—broad-leaved	Páramo	DINERSTEIN	
				Tundra alpina	COTECOCA	
				Tundra alpina de México	DINERSTEIN	
				Vegetación de páramos de altura	Miranda and HX	*Arenaria, Draba, Muhlenbergia,* etc.
	Dry temperate	Perennial	*Angustifolia*—cluster	Pastizal amacollado arbofrutescente	COTECOCA	Gramineae
				Pastizal amacollado arborescente	COTECOCA	
				Vegetación graminoide alta con sinusia arbórea que cubre el 10–40 %	UNESCO	
				Vegetación graminoide alta con una sinusia arbórea que cubre del 10–40 %	UNESCO	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Vegetación graminoide alta con una sinusia arbórea que cubre del 10–40 %	UNESCO	
			Angustifolia—Caespitose	Herbazal templado	GLEZ-MED	
				Pastizal cespitoso	GLEZ-MED	
				Pastizal cespitoso, con arbustos	GLEZ-MED	
				Pastizal del centro de México	DINERSTEIN	
				Pastizal del oriente de México	DINERSTEIN	
				Pastizal mediano abierto	COTECOCA	
				Pastizal mediano arbofrutescente	COTECOCA	
				Pastizal mediano arborescente	COTECOCA	
				Pastizal natural	INEGI	*Bouteloua*, *Buchloë*
				Pastizal natural (incluye pastizal-hizachal)	I GEOGRAFÍA	*Bouteloua*, *Trichachne*, *Hilaria*, *Aristida*, etc.
				Pastizales	Miranda and HX	*Bouteloua, Muhlenbergia, Lycurus,* etc.
				Vegetación graminoide baja	UNESCO	
				Vegetación graminoide baja sin sinusia leñosa	UNESCO	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Vegetación graminoide de altura intermedia	UNESCO	
				Vegetación graminoide de altura intermedia prácticamente sin sinusia leñosa	UNESCO	
				Vegetación graminoide mesofítica intermedia a baja	UNESCO	
		Deciduous	Angustifolia—microphyllous	Pastizal natural-Huizachal	INEGI	*Bouteloua*, *Sporobolus*, *Muhlenbergia*, *Acacia*,etc.
				Restinga (dunas costeras)	DINERSTEIN	
				Vegetación de dunas costeras	I GEOGRAFÍA	*Ipomoea*, *Sporobolus*, *Uniola*, *Chamaecrista*, etc.
				Vegetación de desiertos áridos arenosos	Miranda and HX	*Panicum*, *Sporobolus*, *Prosopis*, etc.
	Humid or dry tropical	Perennial	Angustifolia—broadleaved	Sabana	INEGI	
				Sabana	Miranda and HX	*Andropogon*, *Paspalum*, *Trichachne*, etc.
				Sabana	I GEOGRAFÍA	*Andropogon*, *Paspalum*, *Setaria*, etc.

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Sabana	COTECOCA	
				Sabana de Tabasco & Veracruz	DINERSTEIN	
				Sabana de Tehuantepec	DINERSTEIN	
				Vegetación graminoide alta con una sinusia arbustos (sabana arbustiva)	UNESCO	
			Angustifolia—Megaphyllous	Sabana de palmas de Jalisco	DINERSTEIN	Gramineae
				Sabana de palmas de Veracruz	DINERSTEIN	
				Vegetación graminoide de altura intermedia con una sinusia abierta de plantas empenachadas	UNESCO	
	Cold, temperate or tropical (euclimatic)	Perennial	Angustifolia	Herbazal angustifolio inundado	GLEZ-MED	
				Herbazal inundable angustifolio	GLEZ-MED	
				Humedal del centro de México	DINERSTEIN	
				Pastizales inundables con o sin árboles esparcidos	GLEZ-MED	
				Popal	INEGI	
				Popal	Rzedowski	*Thalia, Calathea,* etc.

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Popal	Miranda and HX	*Calathea, Thalia, Leersia*, etc.
				Popal-tular	I GEOGRAFÍA	*Calathea, Thalia, Heliconia & Typha*
				Tular	INEGI	
				Tular & carrizal	Rzedowski	*Typha, Phragmites, Scirpus,* etc.
				Tulares, carrizales	Miranda and HX	*Typha, Phragmites, Scirpus,* etc.
			Broadleaved	Comunidad de agua dulce arraigada	UNESCO	
				Comunidad de agua dulce que flota libremente	UNESCO	
				Herbazal flotante	GLEZ-MED	
				Herbazal inundable latifoliado	GLEZ-MED	
				Herbazal latifoliado inundado	GLEZ-MED	
				Herbazal ripario	GLEZ-MED	
				Herbazal ripario	GLEZ-MED	
				Herbazales hidrófilos	GLEZ-MED	
				Otras comunidades herbáceas anfibias & subacuáticas	Rzedowski	*Acrostichum, Ammannia, Crinum*, etc.
				Pastizal hidrófilo con arbustos escuamifolios	GLEZ-MED	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Vegetación flotante	Rzedowski	*Lemna*, *Spirodela*, *Wolffia*, etc.
				Vegetación hidromórfica de agua dulce	UNESCO	
				Vegetación hidrófila dulceacuícola	GLEZ-MED	
				Vegetación de galería	INEGI	
				Vegetación sumergida	Rzedowski	*Cabomba*, *Ceratophyllum*, *Myriophyllum*, etc.
		Deciduous	Angustifolia, broadleaved and succulent	Agrupaciones de halófitos	Miranda and HX	*Suaeda*, *Atriplex*, *Distichlis*, etc.
				Pastizal amacollado arenícola	GLEZ-MED	
				Pastizal amacollado halófilo	GLEZ-MED	
				Pastizal cespitoso gipsófilo	GLEZ-MED	
				Pastizal cespitoso halófilo	GLEZ-MED	
				Pastizal edáfico	GLEZ-MED	
				Pastizal gipsófilo	INEGI	
				Pastizal halófilo	INEGI	
				Pastizal halófito abierto	COTECOCA	
				Pastizal halófito arbofrutescente	COTECOCA	
				Pastizales halófilos amacollados	GLEZ-MED	

(continued)

Appendix A.8 (continued)

Hierarchical level						
I	II	III	IV			V
				Pastizales halófilos cespitosos	GLEZ-MED	
				Pastizales templados edáficos	GLEZ-MED	
				Vegetación halófita	Rzedowski	*Suaeda*
				Vegatación halófita	COTECOCA	
				Vegetación halófila	INEGI	*Atripex*, *Suaeda*, *Batis*, *Frankenia*, etc.
				Vegetación halófila & gipsófila	I GEOGRAFÍA	*Suaeda*, *Atriplex*, *Allenrolfea*, *Ambrosia*, etc.
			Angustifolia	Pastizal cultivado	INEGI	Gramineae
				Pastizal cultivado	I GEOGRAFÍA	
				Pastizal inducido	INEGI	Gramineae
				Pastizal inducido	COTECOCA	
				Pastizal inducido	I GEOGRAFÍA	
Non-vascular	Humid cold or tempera te	Perennial	Not applicable	Formación de pantano turboso de musgos con arbustos enanos	UNESCO	Briofitas
				Tundra mayormente de briofitas	UNESCO	
				Tundra mayormente de líquenes	UNESCO	Líquenes
				Área sin vegetación aparente	I GEOGRAFÍA	

SECLAVEMEX provides sound criteria to organize, name, and describe vegetation types consistently with previous contributions, hierarchically and rigorous in its application. Original vernacular names are given in Spanish to avoid misunderstandings when translating them

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