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Phytosociology of a seasonally dry tropical forest in the State of Michoacán, Mexico

Fitosociología del bosque tropical estacionalmente seco del Estado de Michoacán, México

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Abstract
Background: seasonally dry tropical forests are considered critical and important ecosystems because they harbor exceptional biological diversity. Mexico lacks sound phytosociological studies of Seasonally Dry Tropical Forest and Michoacán is no exception. The present study may be regarded the first phytosociological in most of the Mexican pacific coast where seasonally dry tropical forests occurs.
Questions/Objective: We aimed at describing the representative plant associations of the seasonally dry tropical forest, distributed on western Michoacán and to provide a sintaxonomic classification framework based on the floristic differentiation of the recognized communities and highlight its phytocenotic diversity.
Study site and dates: Estado de Michoacán; 20 years.
Methods: A total of 82 phytosociological inventories were conducted. Data were submitted to multivariate two-way indicator species analyses to depict plant communities and their ecological affinities.
Results: From its analysis and interpretation, nine plant groups were differentiated, of which all but one was given the rank of association, which are *Lysilomo acapulcensis-Heliocarpetum terebinthinacei*, *Ceibo aesculifoliae-Lysilometum divaricatae*, *Caesalpinio platylobae-Cordietum elaeagnoidis*, *Cochlospermo vitifolii-Lueheetum candidae*, *Lysilomo divaricatae-Cordietum elaeagnoidis*; *Stenocereo quevedonis-Cordietum selerianae*, *Guazumo ulmifoliae-Cordietum elaeagnoidis*, *Lonchocarpo huetamoensis-Cordietum elaeagnoidis* and the community of *Spondias purpurea-Cochlospermum vitifolium.*
Conclusions: Comparative floristic and structural profiles among plant communities permitted us to distinguish their bioclimatic relationships. Diagnostic species representative of all plant associations were selected and used for sintaxonomic nomenclature. Plant associations were finally array along bioclimatic and altitudinal gradients and showed in arranged phytosociological tables. The plant association/community'descriptions permitted to compare structural physiognomy, floristic composition, ecological affinities, distribution patterns and bioclimatic liaison among them.
Key words: Associations, low-height tropical jungle, Mexico, phytocenotic diversity, tropical caducifolious forest.

Resumen
Antecedentes: Los bosques tropicales estacionalmente secos se consideran ecosistemas críticos e importantes porque albergan una diversidad biológica excepcional. México carece de estudios fitosociológicos robustos de estos bosques y Michoacán no es la excepción. Este estudio puede ser considerado como el primer análisis fitosociológico en la costa pacífica mexicana donde ocurren los bosques tropicales estacionalmente secos.
Preguntas/Objetivo: Nos propusimos contribuir el registro de las asociaciones mejor representadas en el occidente del Estado y dar una clasificación basada en las afinidades florísticas y resaltar a diversidad fitocenótica.
Sitio y años de estudio: Estado de Michoacán; 20 años.
Métodos: Se realizaron un total de 82 inventarios fitosociológicos. Los datos fueron sometidos a análisis multivariados de especies indicadoras de dos vías para definir las asociaciones y conocer sus afinidades ecológicas.
Resultados: Se diferenciaron nueve agrupaciones de plantas, de las cuales a todas, menos una, se les asignó el rango de asociación y son *Lysilomo acapulcensis-Heliocarpetum terebinthinacei*, *Ceibo aesculifoliae-Lysilometum divaricatae*, *Caesalpinio platylobae-Cordietum elaeagnoidis*, *Cochlospermo vitifolii-Lueheetum candidae*, *Lysilomo divaricatae-Cordietum elaeagnoidis*, *Stenocereo quevedonis-Cordietum selerianae*, *Guazumo ulmifoliae-Cordietum elaeagnoidis*, *Lonchocarpo huetamoensis-Cordietum elaeagnoidis* y la comunidad *Spondias purpurea-Cochlospermum vitifolium.*
Conclusiones: La comparación entre los inventarios posibilitó la individualización de grupos que se pudieron vincular con asociaciones/comunidades vegetales y permitieron su caracterización a través de sus vínculos florísticos y estructurales, y de sus preferencias bioclimáticas. De esta manera se seleccionaron las especies diagnósticas características de cada asociación, sus ambientes preferenciales, su jurisdicción fisiográfica y los pisos bioclimáticos donde se distribuyen.
Palabras clave: Asociaciones, bosques tropicales caducifolios, diversidad fitocenótica, México, selva baja caducifolia.

The Seasonally Dry Tropical Forest (*sensu* Bullock *et al.* 1995, Ceballos *et al.* 2010, Dirzo *et al.* 2011) distributes in regions where the rainfall regime is absent for continuous periods of more than six months, (Bullock *et al.* 1995) and plants contain structural, morphological and physiological adaptations to buffer water stress. Worldwide, it represents 48 % of the tropical forest surface, and it is estimated to cover an area of 1,048,700 km^2 (Murphy & Lugo 1986). Miles *et al.* (2006) and Portillo-Quintero & Sánchez-Azofeifa (2010) reported that 50 % of this surface (519,597 km^2) is distributed over the American continent. In this context, Mexico, compared to the worldwide surface, comprises the highest proportion of this type of forest (17 % or 181,461 km^2).

This so-called ecosystem or vegetation type is notable for harboring a large number of the world's biological diversity (Gentry 1982, 1988, Janzen 1988), even greater than other tropical ecosystems (Bullock *et al.* 1995). In addition, it concentrates the largest number of endemic species in the world (Rzedowski 1991, Martínez-Ramos 1995, Pennington *et al.* 2009), and it is considered a crucial supplier of environmental goods and services, especially non-timber products (Lott *et al.* 1987, Trejo & Dirzo 2000, Maass *et al.* 2005, Dirzo *et al.* 2011).

In contrast to the Humid Tropical Forest and Temperate Forest, the Seasonally Dry Tropical Forest has been primarily transformed into low-performance and short duration grazing area (Janzen 1988, Lambin 1997, FAO 2005, Sánchez-Azofeifa *et al.* 2005a). Seasonally Dry Tropical Forest is also disturbed by shifting cultivation. This activity is nearly unprofitable, it degrades shallows soil fertility quickly, and it must be eventually sustained by using agrochemicals to ensure its yield (not more than about 800 kg/ha of corn for instance). Shifting cultivation in Seasonally Dry Tropical Forest is considered as self-consumption activity (Dirzo *et al.* 2011).

The Seasonally Dry Tropical Forest is one of the ecosystems with the highest degree of disturbance (Houghton *et al.* 1991, Sanchez-Azofeifa *et al.* 2005), and consequently one which has experienced greater deforestation (Miles *et al.* 2006, Portillo-Quintero & Sánchez-Azofeifa 2010). Preservation efforts are limited, inefficient and with a high degree of uncertainty due to the presence of highly marginalized human settlements. For the Latin American continent, Portillo-Quintero & Sánchez-Azofeifa (2010) documented that 23,000 km^2 of its surface has some protection status, of which 65 % is distributed in Bolivia and Brazil. In recent years Mexico has added important surface in a new established protected area covering 2,651 km^2 (Zicuirán, Infiernillo Biosphere Reserve) and contains habitats representative of the low deciduous and sub-deciduous forests). Despite these preservation efforts, the rates of deforestation and disturbance are declining their geographic representation, each year losing large areas where the recovery appears to be an unattainable task (Gillespie *et al.* 2000). To illustrate this type of situation, Trejo & Dirzo (2000) conducted a study where they reported a deforestation rate of 1.4 %, while Burgos & Maass (2004) estimated a rate of 0.5 %. The legal protection efforts expressed in protected natural areas in Mexico, as well as in the rest of most of the countries of Latin America, are inefficient (Miles *et al.* 2006, Figueroa & Sánchez-Cordero 2008). Because of the above, Dirzo *et al.* (2011) stated that Mexican Seasonally Dry Tropical Forest must be regarded as an endangered ecosystem.

One of the key lacking aspects in the study of the Seasonally Dry Tropical Forest concerns phytosociological classification and phytocenotic diversity. According to the most recent study by Lysenko *et al.* (2020), phytocenotic diversity, meaning the arrangement of plant communities along their degree of rarity, threat and unicity, has been crucial to set the conservation agenda in Europe. The concept of phytocenotic diversity has been adopted worldwide and currently “Greebooks” are being prepared indicating priorities for plant community conservation actions (Cardinale *et al.* 2012, Gubbay *et al.* 2016, Joseph *et al.* 2020). In this respect, phytocenotic diversity is urgent to set conservation priorities of the plant communities comprised in the Seasonally Dry Tropical Forest; such research approaches are still scanty in Mexico (Peinado *et al.* 2008).

The distribution of the Seasonally Dry Tropical Forest in Mexico prevails along the coasts of the Pacific, Atlantic, Gulf of Mexico and the Caribbean Sea, between sea level and an elevation of about 1,800 m in places where the drought extends for at least six months. The average annual temperature and precipitation is 25 °C and 700 mm, respectively (de Ita-Martínez & Barradas 1986, Burgos & Maass 2004), although their ranges of heat and precipitation distribution allow it to develop in different bioclimatic situations (Macías-Rodríguez *et al.* 2014, Gopar-Merino *et al.* 2015). Mexico is the limit of northern distribution of the Seasonally Dry Tropical Forest (Trejo & Dirzo 2000), and given its distribution pattern, it overlaps with humid tropical forests, temperate forests, thorny-dominated forests and scrublands.

Despite the recognized floristic combinations within the Seasonally Dry Tropical Forest of Mexico, resulting from heterogeneity of its biogeographical, bioclimatic and ecological attributes, we state that to date there is no synthetic research that describes the mosaic of plant communities comprising large species diversity with different phenological and structural expressions (phytocenotic diversity). It is assumed by most authors, that given its richness and floristic complexity, the classical

models of classification of plant communities are limited. Its high percentage of endemics and rare species accentuates this position (Rzedowski 1978, Gentry 1988, Peinado *et al.* 2008, Pérez-Vega *et al.* 2010). This has led to the understanding of its ecosystem as a continuum without apparent discrete limits among plant communities. The present article´s objective aims at providing a classification framework of the plant associations comprised in the Seasonally Dry Tropical Forest in western Michoacán based upon species composition and structural and ecological features and highlight its phytocenotic diversity.

Materials and methods

Study area. Our research took place along the western border of the State of Michoacan, in central Mexico. The study area lies within 20º 23' 37" - 17º 53' 50" N and 100º 03' 32" - 103º 44' 49" W, geographic coordinates. The whole surveyed area covered 39,315 km², equivalent to 67 % of the whole surface of the State of Michoacán (a bit larger than the surface of Quintana Roo State). This area represents the contact point of four large physiographic-geological units, namely: El Bajio, La Meseta Purepecha, El Valle de Tepalcatepec and Sierra Madre del Sur (INEGI 2014). Our surveyed area is limited by the border of Jalisco and Colima; to the north it is limited by Guanajuato and Queretaro, to the southeast it borders with Guerrero and to the south with the Pacific Ocean. The Territory concerned, covers the main extensions where the analyzed ecosystem is present, located in the northeastern, western, central and southern portions of the state, as discontinuous bands interrupted by the mountain ranges of the Transmexican Volcanic Belt and the Sierra Madre del Sur (Figure 1).

The complexity of the study area provides large altitudinal variability (0 to 3,840 m); its main elevations, associated with volcanic summit, are: The Pico Tancítaro (3,840 m above sea level) and several summits of more than 3,000 m that occur throughout this system. In the Sierra Madre del Sur, the most notorious elevations are around 3,000 m asl. A half-slope of these systems, at about 2,400 m asl, start the ravines that continue in slopes that run towards the foothills and lowlands, being the ones that descend towards the valley of the Tepalcatepec as the most notorious (Garduño 2005, Mendoza *et al.* 2009). All these hills, except those of the lowlands, are dominated by steep middle-gradient slopes, responsible for the marked vegetation contrasts that occur in the altitudinal transect lines.

Considering the classification of Köppen (1948) modified by García *et al.* (1961, 1970), the climatic subgroups present in the study area (Antaramián 2005) and their distribution are: *Aw:* warm sub-humid (tropical rainy, with

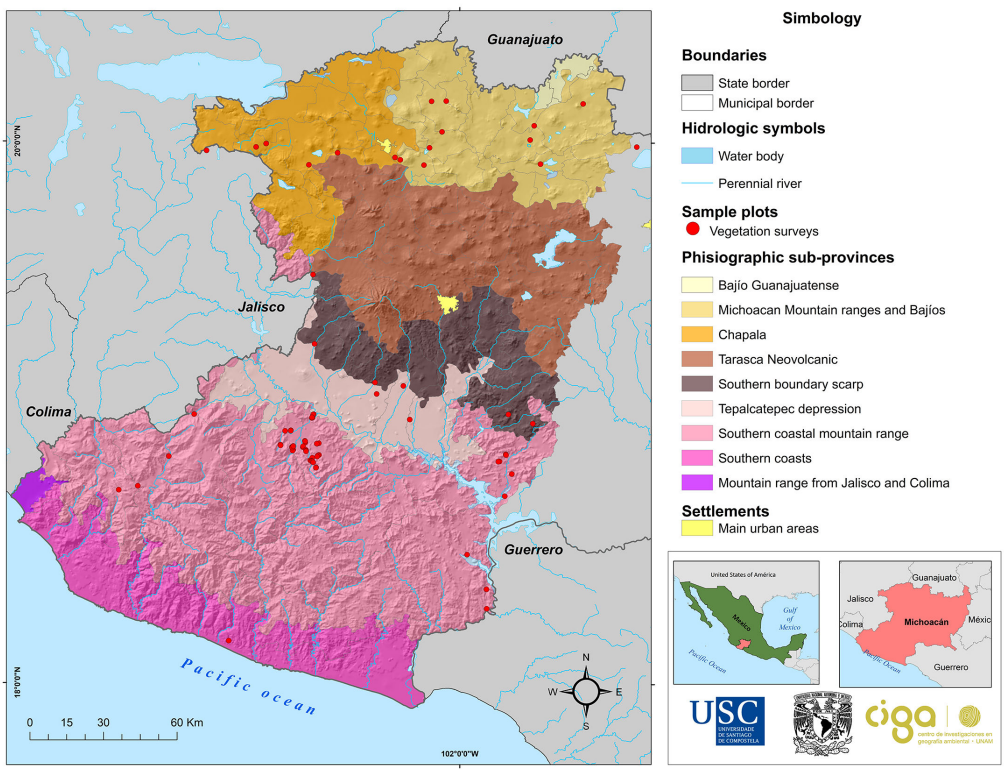

Figure 1. Emplacement of study area along western border of the state of Michoacan in Central Mexico.

predominant rains in summer) in most of the Sierra Madre del Sur, in the coastal plain and in the southern slope of the Transmexican Volcanic Belt. *BS:* dry and semi-dry (dry steppe) in the depression of the rivers Tepalcatepec and Balsas. *Cw:* sub humid temperate (temperate with rain in summer) in the volcanic belt and in the associated plateaus. *Cf:* (temperate with rains throughout the year) in the highest parts of the volcanic summit.

Altitudinal variations and thereof climatic conditions, impact distribution of the vegetation. Gopar-Merino *et al.* (2015) conducted a bioclimatic mapping of the state by establishing the isobioclimates represented (*sensu* Rivas-Martinez *et al.* 1999). In general, these are tropical bioclimates with seasonal precipitation and Tropical Xeric, while at the Isobioclimates level there are 13 types present, which gives an idea of the great variability of vegetation and soils which occur along the altitudinal gradient.

Vegetation Analysis. Sampling units, hereafter denoted as relevés, were placed in representative rather homogeneous and well-conserved vegetation areas. For the conducting vegetation surveys and their subsequent analysis and interpretation, the postulates of the phytosociological method were followed (Westhoff & van der Maarel 1978, Braun-Blanquet 1979). The phytosociological approach aims at providing rigorous vegetation description of plant communities and their distribution along environmental gradients (Rivas-Martínez *et al.* 1999). Plant communities are eventually typified following protocols which must be accomplished to select diagnostic species and nomenclatural guidelines valid worldwide (Velázquez *et al.* 2016). Methodologically, two phases must be implemented in phytosociological studies: firstly, data gathering in the field by means of surveys or relevés which consider complete species inventories and structural and ecological descriptions of each site; secondly data analyses in order to classify relevés and species into phytosociological packages by means of multivariate analyses. One of the most widely used statistical multivariate analytical packages is TWISNSPAN (Hill 1979, now available in PC ORD Version 5). At these stage, generic plant communities turn into plant associations with a unique combination of diagnostic species and a unique name. Finally, it should be noted that the taxonomic and nomenclature aspects considered in the proposals are based on definitions, rules and recommendations of the International Code of Phytosociological Nomenclature (CNF) (Weber *et al.* 2000). A thorough step-by-step explanation of the phytosociological approach may be consulted at Velázquez *et al.* (2016). The concept of potential vegetation was also considered, (Tüxen 1956, Rzedowski 1978, Géhu 2006), to dissociate close physiognomic formations of the Seasonally Dry Tropical Forest but with different ecological states. Finally, to add that for circumscribe the distribution of the associations have been considered the physiographic provinces and sub-provinces defined for the state by INEGI (2014). Extensive recognition is first performed so that vegetation type borders are elucidated. Relevés in tree dominated areas covered 20 by 20 meters as suggested by Kent & Coker (1992). Because of the floristic complexity and rich species composition, close by relevés were often surveyed to complete a robust description of the plant communities. A detailed floristic, phenological and physiognomic characterization is then performed at each relevé. Furthermore, ecological, geographical and emplacement data are also gathered. Structurally, the tree layer (above 5 m), the shrub layer (one to three m) and the herb layer (less than one meter) were first surveyed.

Due to the variety of forest types, we adopted the typology of Rivas-Martínez *et al.* (1999) namely: megaforest (taller than 50 m), macroforest (between 22 and less than 50 m tall), mesoforest (between 12 and less than 22 m), and microforest (between four to 12 m).

Each plant species was listed, and its total cover was estimated given their cover values in classes as suggested by Braun-Blanquet (1979) and adapted by Van der Maarel (1979). The classes were: Class 9: 75 a 100 %; Class 8: 50 a 75 ; Class 7: 25 a 50 %; Class 6: 5 a 25 %; Class 1: abundant but cover of less than 5 %; Class +: occasional but cover of less than 5 %; and Class r: rare species.

Likewise, the diagnostic species were identified, by means of a synthetic analysis between the different groupings of inventories, which allowed pondering their frequency of appearance in each one of the communities as well as its ecological and distributional suitability.

Floristic analyses. In the field, plant species were identified to species level. This is done with the aid of field guides and expertise knowledge of the authors. In many cases, plant specimens were not identified, so that plant specimens were collected and brought to the herbariums for further identification with the aid of floristic experts. In some cases, the quality of the samples for identification was not possible so that rather than species name a genus of the plant specimen was assigned. The following regional floras were consulted in this process: Flora of the Valley of Mexico (Rzedowski 2001), Flora of the Bajío and of adjacent regions (Rzedowski & Calderón de Rzedowski 1985-2015), Flora Novogaliciana (McVaugh 1987) and Tropical Trees of Mexico (Pennington & Sarukhán 2005). The updates to the Mesoamerican Flora were also considered (www.tropicos.org/Project/FM). The group of Pteridophyta was determined following Mickel & Beitel (1988) and the families published in the Flora of the Bajio (Rzedowski & Calderón de Rzedowski *op. cit.*). The scientific names of the species follow the proposal of International Plant Name

Index (www.ipni.org). Of the majority of the registered plants, a duplicate has been housed in the Herbarium of the Institute of Ecology, AC. (IEB-Pátzcuaro).

The field work was carried out in successive botanical campaigns developed between 1994 and 2013. In obtaining the floristic information we are aware of the possible absence of species of difficult detection as certain epiphytes or plants with optimal phenological in a period of time different to that in which the relevé was carried out; this should not be an obstacle to question the classification results obtained.

Information processing. The inventories considered were up-loaded into a gross table (Excel) for analysis and classification. Excel document further served as reference for conducting a multivariate exploratory analysis that allowed identifying the statistical weight that differentiates each group. This analysis was carried out with the PC-ORD package (Mccune & Mefford 1999); in specific, the analyses used were principal components and canonical discrimination (Ludwig & Reynolds 1988). The indexes obtained in the field were transformed to the scale proposed by Van der Maarel (1979), and thus be able to submit it to the statistical analysis using the analysis PC-Ord of the Program TWINSPAN Version 5 (Hill 1979). This method classifies species and samples, producing successive and hierarchical groups as levels of analysis advance; likewise, the process allowed generating dendrograms of the established groupings, which relate to the recognized communities. After the final arrangement of the inventories, the indexes were re-transformed to the Braun-Blanquet scale; thus, obtained tables served as reference for the diagnosis of the recognized associations. Furthermore, diagnostic species (characteristics and exclusive) were identified, by means of a synthetic analysis between the different groupings of inventories, which allowed pondering their frequency of appearance in each one of the communities as well as its ecological and distributional suitability.

Results

As a result of the field work in which 82 inventories were made, 1,491 plant specimens were collected and identified for compiling a list of 338 species and 131 genera belonging to 34 families. The vernacular name given by 47 collectors is also given. The information obtained from the 82 inventories served as a reference for the separation of the groups considered potential plant communities. Successive classification analyses allowed to separate the 9 groups of inventories that support the respective plant groups identified (8 associations and 1 community) (Figure 2). The results showed that communities follow a discontinuity gradient throughout the entire study area. In the analysis process, successive cutting levels (between 3 and 6) were carried out, which led to the identification of the relevés grouped per plant association/community.

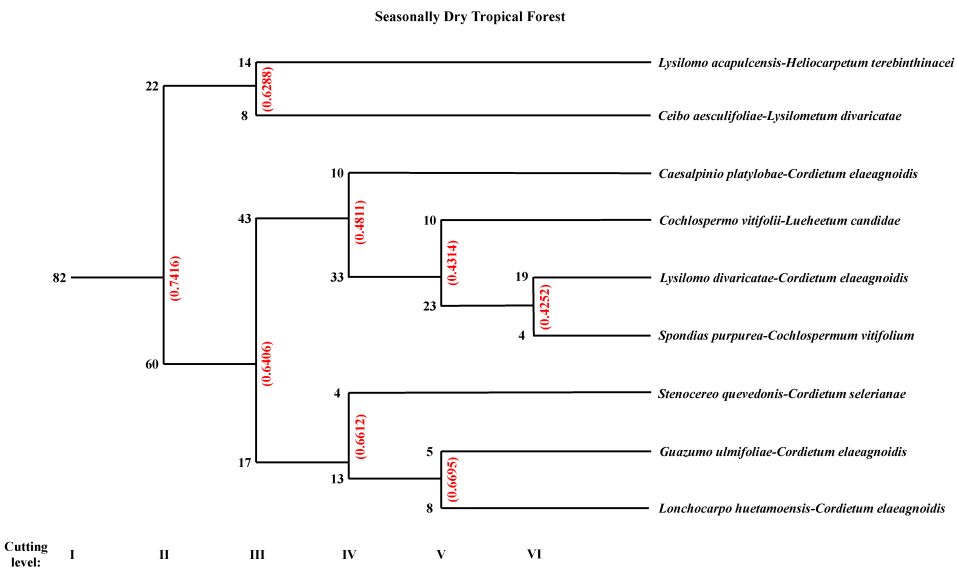

Figure 2. Classification of the plant associations harbored in the Seasonally Dry Tropical Forest. The dendrogram illustrates the process of (di) similarities among relevés. Cut levels refer to the number rounds needed to depict significant differences among packages of species denoting associations. The numbers in black denote the number of *relevés* comprising plant associations. The Alpha value (λ) given in red are indicative of the statistical difference between associations. This multivariate analysis was performed in PC-Ord Version 5 software (Grandin 2006)

From the groupings obtained, we analyzed the fidelity of the most representative species of each group by means of a comparison among the most frequent species. A first filter allowed selecting those that were dominant or exclusive on each situation, obtaining thus a filtered and ordered fidelity table (Table 1); it identifies the groups of species selected as diagnoses, which were considered later in the selection of characteristics and differentials of associations. The values of the crosses obtained between species and groups are differentiated in two terms: the first is the weighted frequency of the number of inventories where the species is present, while the second indicates the average cover of the species.

Based on the identified clusters and trends in the emergence of the diagnostic species and their indicator value, the tables of the recognized communities were organized. In most of them the reference information was considered enough to propose them as associations. For each situation the description has been structured in a series of attributes related to physiognomy, structure and floristic composition, ecology and distribution, variability and observations. Next to the name of the proposed association/ community, the number of the reference phytosociological table and the number of the selected type inventory are attached. The tables were continuously placed after the diagnosis of the associations. Full description of the nine plant associations/communities is provided in following paragraphs.

Lysilomo acapulcensis - Heliocarpetum terebinthinacei *(Table 2, inventory nº 3 in table 2)*. Physiognomy, structure and floristic composition.- Deciduous Micro-forest between 6 and 12 (15) m of height, dominated by trees microphyllous, and, to a lesser extent, broad-leaf and thorny, profusely branched, sun shielded and twisted plant species with frequent epiphytes and lianas. It has an average cover of 80 %, with a shrub layer of heterogeneous cover that sometimes extends in an intermediate (sub arboreal), which hinders its differentiation. The herbaceous stratum covers much of the understory with cover around 80 % and can be dominated by species indicating a certain disturbance. As characteristic species of the association the following have been selected: the *Heliocarpus terebinthinaceus* Hochr, *Lysiloma acapulcense* (Kunth) Benth., *Ipomoea murucoides* Roem. & Schult., *Vachellia pennatula* (Schltdl. & Cham.) Seigler & Ebinger and *Eysenhardtia polystachya* (Ortega) Sarg., which together with *Bursera* spp., *Ceiba aesculifolia* Britt. & Baker f., *Zanthoxylum fagara* Sarg. and *Forestiera phillyreoides* Torr. dominate the arboreal canopy. Occasionally, those species may be present also in the understory, where *Croton* sp., *Opuntia* sp., *Vachellia farnesiana* (L.) Wight & Arn, *Tecoma stans* (L.) Juss. ex Kunth, *Celtis caudata* Planch. and *Mimosa* sp. are the dominant species. The herbaceous stratum is very heterogeneous and diverse in terms of its composition and participation, without a clear group of recurring species; in any case, representatives of the genera *Salvia* L., *Senecio* L., *Aegopogon, Lasiacis* (Griseb.) Hitchc. and *Heimia salicifolia* Link stand out.

Ecology and distribution.- The characteristic species of this association have an endemic distribution to Mesoamerica, with the exception of the representatives of *Heliocarpus* L. and *Eysenhardtia* Kunth, which are exclusive to Mexico. Its presence is linked to hills and slopes of the physiographic sub-provinces Sierra and Bajio Michoacano and Chapala, to the north and northwest of the state; the geographical exception includes an inventory located in the southern coastal Mountain Range sub-province (Table 2, Inventory 4), which was included in this block of inventories during the grouping analysis.

The altitudinal range fluctuates between the dimensions of 1,300 and 2,200 m; towards the latter its presence is restricted to sunny spots and rocky inclined slopes. This association distributes within the Dry superior Thermotropical, between the Mesotropical and Low sub-humid bioclimatic belts.

Variability and observations.- Inventories 1 and 10 represent situations marked by the notable discontinuity of the arboreal stratum due to tree extraction. On the other hand, inventories 9 to 11 have a low representation of characteristic species, which did not prevent the statistical analysis from linking them with other inventories. In the area of potential distribution of the association, linked to abandoned agricultural land or cleared forests, there is a high thorny thicket of secondary trait dominated by representatives of *Vachellia* Wight & Arn., *Mimosa* L. and *Opuntia* Mill., as well as Grasses (*Aegopogon* Humb. & Bonpl. ex Willd., *Lasiacis* (Griseb.) Hitchc.) and used extensively by cattle. The unit of thorny forest defined by Rzedowski (1978) for the zone would be included in this association, as a stable and permanent variant of secondary character.

Ceibo aesculifoliae-Lysilometum divaricatae *(Table 3; Inventory nº 3 in table 3)*. Physiognomy, structure and floristic composition.- Deciduous Micro-forest, between 7 and 15 m high, with a physiognomy similar to that of the previous association, with occasional nubs protruding from the canopy. *Ceiba aesculifolia* Britt. & Baker f., *Lysiloma divaricatum* (Jacq.) Benth., *Ipomoea murucoides* Roem. & Schult. and *Zanthoxylum fagara* Sarg, dominates its arboreal stratum; the first three are proposed as characteristics of the association, together with

Table 1. Fidelity table of the diagnostic species of the plant communities recognized.

Association (Table)	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**	**T9**	**T10**
Nº of inventories	**11**	**11**	**10**	**10**	**19**	**4**	**5**	**6**	**6**
Lysiloma acapulcense	V-1								
Heliocarpus terebinthinaceus	IV-3								
Ipomoea murucoides	IV-1	III-2							
Vachellia pennatula	IV-1								
Eysenhardtia polystachya	IV-2								
Lysiloma divaricatum		IV-2		V-2	IV-2			IV-2	II-1
Ceiba aesculifolia.		III-2				IV-2			
Zanthoxylum fagara		III-2							
Cordia elaeagnoides			V-3		IV-2	IV-1		V-3	V-2
Caesalpinia platyloba			III-3						
Cordia dodecandra			III-2						
Bursera coyucensis			III-2						
Caesalpinia eriostachys			III-2						
Luehea candida				V-2					
Poeppigia procera				III-1					
Tabebuia ochracea				III-1					
Cochlospermum vitifolium				IV-1		V-3			II-1
Spondias purpurea						IV-2			
Arrabidaea viscida					III-2	IV-2			
Heliocarpus donnellsmithii					III-2				
Cordia seleriana							V-2		
Stenocereus quevedonis							V-1		V-1
Apoplanesia paniculata			IV-2				V-2		
Randia capitata							V-1		
Amphipterygium glaucum							III-1		
Salpianthus arenarius							III-1		
Guazuma ulmifolia								IV-1	
Crescentia alata								IV-1	
Lonchocarpus huetamoensis									V-1
Tabebuia impetiginosa									V-1
Cyrtocarpa procera									V-1
Lysiloma tergeminum									IV-1
Randia echinocarpa									IV-1
Coccoloba acapulcensis									IV-1

Table 2. Association of: *Lysilomo acapulcatsis-Heliocarpetum terebinthinacei*

Elevation (m asl)	**179**	**191**	**194**	**129**	**190**	**181**	**180**	**177**	**217**	**182**	**205**
Exposition	**E**	**SW**	**SE**	**N**	**W**	**NW**	**SW**	**SW**	**S**	**N**	**SW**
Slope steepness (%)	**17.6**	**26.7**	**17.6**	**57.7**	**70**	**8.7**	**17.6**	**8.7**	**36.3**	**17.6**	**46.6**
Area (× 10 m²)	**50**	**60**	**40**	**60**	**50**	**60**	**50**	**50**	**50**	**40**	**40**
Tree cover (%)	**50**	**75**	**80**	**85**	**80**	**70**	**80**	**70**	**70**	**50**	**90**
Shrub cover (%)	**100**	**30**	**25**	**40**	**80**	**50**	**50**	**60**	**60**	**20**	**80**
Herb cover (%)	**80**	**70**	**25**	**90**	**80**	**80**	**80**	**60**	**40**	**90**	**40**
Height of vegetation (m)	**7**	**6**	**9**	**15**	**7**	**6**	**12**	**6**	**8**	**6**	**12**
Nº of Species	**21**	**33**	**23**	**31**	**29**	**36**	**30**	**24**	**26**	**15**	**31**
Nº of array	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Characteristic species											
Heliocarpus terebinthinaceus Hochr.	2	3	3	1	5	2	3	3			
Lysiloma acapulcense (Kunth) Benth.	2	1	1	3	1	1	1	2			1
Ipomoea murucoides Roem. & Schult.	2	2	2		3	3	2	1			1
Vachellia pennatula (Schltdl. & Cham.) Seigler & Ebinger	1	+	1	1		1			2	1	
Eysenhardtia polystachya (Ortega) Sarg.	2	1	3	1	2				2	3	
Companion species											
Bursera cuneata Engl.		+	2			1		2			
Ceiba aesculifolia Britt. & Baker f.		1	1			1	2				
Zanthoxylum fagara Sarg.		2	1			+		2			
Forestiera phillyreoides (Benth.) Torr.							+		2	1	1
Croton sp.					1	1			+	+	2
Opuntia sp.		+				+	+	2		+	+
Vachellia farnesiana (L.) Wight & Arn.	1					1	1	1		1	
Tecoma stans (L.) Juss. ex Kunth		2	2		1			1	+		
Salvia sp.		+		+	1	+			+		
Satecio sp.		1		3					+		1
Aegopogon sp.		+			5	+					
Celtis caudata Planch.		1				1	1				
Heimia salicifolia Link						+	1			+	
Lasiacis sp.					2		+				1
Mimosa sp.	3							+		2	
Opuntia sp. *I*			+				1				1
Serjania racemosa Schum.	2	+				2					
Trixis inula L.						+	+	+			

Species occurring in only two relevés: *Acalypha* sp. + at 6 and at 9; *Anoda crenatiflora* Ortega + at 1 and 2 at 5; *Asterohyptis mociniana* Epling + at 2 and 2 at 5; *Bouteloa* sp. + at 2 and at 6; *Buddleja parviflora* Kunth 1 at 5 and + at 11; *Bursera fagaroides* Engl. 1 at 1 and at 6; *Bursera* sp. I 1 at 2 and 3 at 3; *Bursera* sp. II 1 at 5 and + at 7; *Bursera* sp. III 1 at 3 and 2 at 7; *Bursera* sp. IV 1 at 1 and at 11; *Castilleja tenuiflora* Benth. + at 2 and at 9; *Castilleja arvensis* Cham & Schltdl. + at 9 and at 11; *Clematis dioica* L. 2 at 3 and 1 at 11; "Compuesta" 1 at 3 and at 7; *Croton ciliatoglandulifer* Ortega 2 at 2 and 1 at 9; *Desmodium* sp. + at 4 and 2 at 5; *Erythrina* sp. 1 at 7 and at 11; *Euphorbia* sp. 1 at 4 and at 6; *Hyptis mutabilis* Briq. 5 at 5 and 1 at 8; *Iresine calea* Standl. 3 at 7 and 2 at 8; *Lantana camara* L. 1 at 2 and 2 at 8; *Lasianthaea crocea* (A. Gray) K.M. Becker 2 at 8 and 3 at 9; *Loeselia glandulosa* (Cav.) G. Don 1 at 3 and 5 at 7; *Loeselia mexicana* Brand 2 at 3 and 1 at 11; *Lysiloma divaricatum* (Jacq.) J.F. Macbr. 1 at 2 and at 6; "Malpighiácea" + at 6 and at 9; *Mandevilla foliosa* Hemsl. 1 at 3 and 2 at 8; *Porophyllum viridiflorum* DC. + at 2 and 1 at 9; *Quercus deserticola* Trel. 3 at 9 and + at 11; *Quercus* sp. + at 4 and at 6; *Randia thurberi* S. Watson 1 at 6 and 2 at 10; *Ruellia* sp. + at 1 and 1 at 7; *Mandevilla hypoleuca* (Benth.) Pichon 1 at 1 and + at 6; *Verbesina fastigiata* B.L. Rob. & Greenm. + at 2 and 1 at 4; *Viguiera* sp. + at 4 and 1 at 11.

Species occurring in only one relevé: *Salvia tiliifolia* Vahl + at 1; *Triumfetta stellata* Lay + at 1; *Fleischmannia pycnocephala* (Less.) R.M. King & H.Rob. + at 1; "Rubiácea" + at 1; "Leguminosa arbórea" 2 at 1; "Leguminosa arbórea" II 1 at 1; *Verbesina oncophora* B.L. Rob. & Seaton 2 at 1; *Albizia plurijuga* Britton & Rose at 1; "Arbusto" I 3 at 1; *Stenocereus queretaroensis* (F.A.C. Weber) Buxb. + at 2; *Montanoa* sp. + at 2; "Malvácea" + at 2; *Lasiacis nigra* Davidse + at 2; *Condalia velutina* I.M. Johnst. + at 2; *Buddleja cordata* Kunth + at 2; *Viguiera dentata* (Cav.) Spreng. 1 at 2; *Bursera palmeri* x *bipinnata* 1 at 2; *Verbesina sphaerocephala* A. Gray 2 at 2; *Crossopetalum managuatillo* (Loes.) Lundell + at 3; *Montanoa frutescens* Mairet ex DC. 1 at 3; *Iresine* sp. 1 at 3; *Toxicodendron radicans* (L.) Kuntze 2 at 3; "Acanthácea" 2 at 3; *Bocconia arborea* S. Watson + at 4; *Ageratum corymbosum* Zuccagni + at 4; *Diospyros* sp. + at 4; *Ficus cotinifolia* Kunth subsp. *cotinifolia* + at 4; *Adiantum* sp. + at 4; *Guazuma ulmifolia* Lam. + at 4; *Lantana* sp. + at 4; *Salvia* sp. II + at 4; *Solanum* sp. + at 4; *Valeriana* sp. + at 4; *Passiflora* sp. + at 4; *Verbesina* sp. 1 at 4; *Vitex mollis* Kunth 1 at 4; *Adiantum poiretii* Wikstr. 1 at 4; *Bursera bipinnata* Engl. 1 at 4; *Montanoa grandiflora* DC. 2 at 4; *Brickellia* sp. 2 at 4; *Quercus magnoliifolia* Née 3 at 4; *Pinus devoniana* Lindl. 5 at 4; *Oplismenus* sp. 5 at 4; *Salvia carnea* Kunth + at 5; *Eupatorium* sp. + at 5; *Tagetes erecta* L. 1 at 5; *Salvia polystachia* Cav. 1 at 5; *Tagetes lunulata* Ortega 1 at 5; *Ageratina brevipes* (DC.) R.M. King & H.Rob. 1 at 5; *Piqueria trinervia* Cav. 1 at 5; "Gramínea" 1 at 5; "Arbusto" II 1 at 5; *Sida glutinosa* Cav. 2 at 5; "Arbusto" III 2 at 5; *Ageratina parayana* (Espinosa) B.L. Turner 3 at 5; "Herbácea" 5 at 5; *Pilosocereus* sp. + at 6; *Tagetes* sp. + at 6; *Acmella radicans* (Jacq.) R.K. Jansen + at 6; *Acourtia* sp. + at 6; *Gomphrena* sp. + at 6; *Baccharis* sp. + at 6; *Hibiscus* sp. + at 6; "Leguminosa" + at 6; *Nissolia microptera* Poir. 1 at 6; *Heliocarpus americanus* L..1 at 6; *Vachellia* sp. 2 at 6; *Sida haenkeana* C. Presl + at 7; *Stenocereus* sp. + at 7; *Tillandsia recurvata* (L.) L. + at 7; *Vitex hemsleyi* Briq. + at 7; *Bromelia* sp. + at 7; *Chusquea* sp. + at 7; *Asplenium* sp. + at 7; *Abutilon abutiloides* (Jacq.) Garcke ex Hochr. + at 7; *Dicliptera peduncularis* Nees 1 at 7; *Ruellia* sp. I 1 at 7; *Lysiloma tergeminum* Benth 5 at 7; *Eupatorium collinum* DC. + at 8; *Pseudobombax ellipticum* (Kunth) Dugand 1 at 8; *Vachellia constricta* (Benth.) Seigler & Ebinger 1 at 8; *Croton morifolius* Willd. 2 at 8; *Asterohyptis stellulata* Epling 2 at 8; *Lasianthaea* sp. 2 at 8; *Bromus dolichocarpus* Wagnon 2 at 8; *Ageratina mairetiana* (DC.) R.M. King & H.Rob. 5 at 8; *Bursera microphylla* A. Gray 5 at 8; *Lippia umbellata* Cav + at 9; *Lobelia laxiflora* Kunth + at 9; *Calliandra grandiflora* (L'Hér.) Benth. + at 9; *Eryngium carlinae* F. Delaroche + at 9; *Salvia lavanduloides* Kunth + at 9; *Pseudognaphalium chartaceum* (Greenm.) Anderb. + at 9; *Muhlenbergia* sp. + at 9; *Xylosma flexuosa* (Kunth) Hemsl. 1 at 9; *Mimosa albida* Humb. & Bonpl. ex Willd. 1 at 9; *Opuntia* sp. I, 2 at 9; *Rhynchelytrum repens* (Willd.) C.E. Hubb. 3 at 9; *Spondias purpurea* L. + at 10; *Psittacanthus* sp. + at 10; "Anacardiácea" + at 10; *Mimosa aculeaticarpa* Ortega + at 10; *Ipomoea* sp. 1 at 10; *Karwinskia humboldtiana* (Schult.) Zucc. 1 at 10; *Porophyllum* sp. + at 11; *Tillandsia violacea* Baker + at 11; *Acourtia turbinata* DC. + at 11; *Adiantum braunii* Mett. ex Kuhn + at 11; *Garrya laurifolia* Hartw. ex Benth. 1 at 11; *Bursera* sp. II 1 at 11; *Lysiloma* sp. 1 at 11; *Serjania* sp. 1 at 11; *Alloispermum* sp. 3 at 11; *Senecio* sp. II 3 at 11; *Salvia oreopola* Fernald 3 at 11; *Lobelia fenestralis* Cav. 3 at 11; *Montanoa arborescens* DC. 3 at 11; *Cedrela odorata* L. 3 at 11; *Iresine interrupta* Benth. 3 at 11.
Localities: **1:** ± 4 km E of Jiquilpan, road San José de Gracia-Jiquilpan, Jiquilpan (19°59'55"N, 102°45'27"W) **2:** E La Campana, Janamuato, Puruándiro (20° 08' 47" N, 101° 30' 59" W) **3:** ± 9 km N of Tlazazalca, road. Tlazazalca-Churintzio, Tlazazalca (20° 02' 37" N, 102° 04' 10" W) **4:** ± 7 km S of Coalcomán, road Coalcomán-Aquila, Coalcomán (18° 43' 52" N, 103° 14' 54" W) **5:** N of Churintzio, Churintzio (20° 09' 27" N, 102° 03' 10" W) **6:** NE of El Tigre, to the W of Penjamillo, Puruándiro (20° 03' 57" N, 101° 42' 30" W) **7:** ± 6 km NE of Panindícuaro, Panindícuaro (20° 00' 48" N, 101° 43' 28" W) **8:** E of Gómez Farias, Tangancícuaro (19° 55' 15" N, 102° 08' 24" W) **9:** E of San José de Gracia, hill base Puerto Larios, Valle de Juárez, Jalisco (19° 58' 19" N, 102° 59' 26" W) **10:** ± 10 km to the W of Jiquilpan, Jiquilpan (19° 59' 10" N, 102° 47' 49" W) **11:** between Villa Jiménez and Copándaro, ± 1 km to the N of Chapitiro, Villa Jiménez (19° 55' 26" N, 101° 41' 03" W).

Pseudobombax ellipticum (Kunth) Dugand. In this stratum can also be present *Bursera* spp., *Vachellia pennatula* (Schltdl. & Cham.) Seigler & Ebinger, *Heliocarpus terebinthinaceus* Hochr., *Cardiospermum halicacabum* L., *Celtis caudata* Planch, *Eysenhardtia* sp., *Ipomoea* sp., *Stenocereus queretaroensis* (F.A.C. Weber) Buxb., as the most representative species. In the shrub stratum, the best-represented genera are *Opuntia* Mill., *Vachellia* Wight & Arn., *Agave* L., *Randia* L., *Montanoa* Cerv., *Salvia* L. and *Ageratina* Spach with an average cover of 50 %; as in the previous case, elements of the arboreal stratum can be present. The herbaceous stratum, of very heterogeneous composition and with an average cover of 60 %, is dominated by a few species in most of the different cases, although with a predominance of the compound group.

Ecology and distribution.- The association is distributed mainly at the northwest of the state, linked to slopes and hills of low or medium gradient, on low developed soils. From the physiographic point of view, it is present in favorable enclaves of the sub-provinces Chapala, Sierra and Bajio Michoacano, Coastal Mountain Range of the South and, punctually, Trans-Mexican Volcanic Belt and Southern Border Escarpment. The altitudinal range of distribution in these units oscillates between 900 and 1,900 m. From the bioclimatic point of view, these are the dry thermotropical soils and to a lesser extent the lower Mesotropical horizon of dry ombrotype, where most of the backup inventories are located; punctually it can arise also in favorable enclaves of the Lower Sub-humid Lower Mesotropical horizon.

Variability and observations.- The community is affected by the same processes of alteration commented for the previous association which lead to the presence of secondary shrubs for cattle use, which form mosaics with it.

The three communities described below come from the information published by several of us (Pérez-Vega *et al.* 2010) for the San José de Chila river basin (Sierra Madre del Sur, Michoacán), which addresses the attributes that best explain the patterns that differentiate the plant communities found (lithology, altitude and soil depth). The information in the table was transcribed into the general reference table; indicate that this information lacks data relating to herbaceous and subshrub strata (< 3 m). From the

Table 3. Association of: *Ceibo aesculifoliae-Lysilometum divaricatae*

Elevation (m asl)	**192**	**159**	**177**	**178**	**107**	**165**	**156**	**178**	**103**	**90**	**110**
Exposition	**S**	**N**	**S**	**S**	**NE**	**S**	**NE**	**W**	**SE**	**S**	**E**
Slope steepness (%)	**46.6**	**46.6**	**17.6**	**57.7**	**57.7**	**36.3**	**17.6**	**8.7**	**26.7**	**8.7**	**57.7**
Area (× 10 m²)	**60**	**50**	**60**	**60**	**60**	**60**	**30**	**60**	**50**	**40**	**60**
Tree cover(%)	**90**	**90**	**70**	**80**	**90**	**80**	**95**	**80**	**80**	**70**	**90**
Shrub cover(%)	**50**	**60**	**30**	**70**	**70**	**50**	**20**	**20**	**60**	**70**	**60**
Herb cover (%)	**80**	**50**	**40**	**60**	**70**	**80**	**90**	**90**	**35**	**30**	**-**
Height of vegetation (m)	**10**	**7**	**7**	**8**	**20**	**7**	**8**	**12**	**15**	**10**	**8**
Nº of Species	**20**	**24**	**30**	**29**	**35**	**22**	**17**	**23**	**35**	**24**	**19**
Nº of array	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Characteristic species											
Lysiloma divaricatum (Jacq.) J.F. Macbr.	2	2	5		2	2	1	1			2
Ceiba aesculifolia Britt. & Baker f.	3	1	1	+		+			2	2	
Ipomoea murucoides Roem. & Schult.	1	2	2	3	1			2			
Pseudobombax ellipticum (Kunth) Dugand		1	1	1		1			2	2	
Companion species											
Zanthoxylum fagara Sarg.	2	2		3	2	2	2				
Bursera sp.			1			1		2		3	2
Opuntia sp.	+		+	+			+	+			
Vachellia pennatula (Schltdl. & Cham.) Seigler & Ebinger			1			1		1			
Compuesta	2	1						1		3	
Heliocarpus terebinthinaceus Hochr.	1		1	2	3						
Lasiacis nigra Davidse	2			2	1					3	
Agave sp.									+	+	2
Bursera cuneata Engl.	3							2	2		
Cardiospermum halicacabum L.					+		+				+
Celtis caudata Planch.	1						+	3			
Eysenhardtia sp.						3	1	1			
Ipomoea sp.						1	+	1			
Stenocereus queretaroensis (F.A.C. Weber) Buxb.						+	+	+			
Lasianthaea fruticosa (L.) K.M. Becker				+	1					3	
Montanoa arborescens DC.				2	+				+		
Montanoa sp.			+					2			1
Randia sp.		1				1	+				
Verbesina sp.						2		+	2		
Vachellia sp.		2		1			+				
Acourtia sp.		2	+	+							
Tillandsia sp.		+	+	+							
Brickellia sp.			1	+	+						

Species occurring in only two relevés: *Bursera microphylla* A. Gray 1 at 3 and 5 at 4; *Chloris virgata* Sw. 2 at 3 and at 4; *Cucurbita* sp. 2 at 1 and at 5; *Ficus cotinifolia* Kunth 3 at 2 and 2 at 5; *Gaudichaudia* sp. 2 at 3 and at 4; *Russelia* sp. 2 at 4 and + at 5; *Albizia occidentalis* Brandegee 5 at 1 and 1 at 8; *Hyptis urticoides* kunth+ at 4 and at 5; *Eupatorium* sp. + at 3 and 2 at 4; *Lysiloma acapulcense* (Kunth) Benth. + at 3 and 3 at 9; "Acanthácea" + at 3 and at 4; *Alvaradoa amorphoides* Liebm. + at 7 and 3 at 11; *Bidens* sp. 1 at 4 and at 9; *Bouvardia* sp. 1 at 3 and 2 a t 4; *Bursera bipinnata* Engl. 2 at 6 and + at 9; *Guazuma ulmifolia* Lam. 2 at 5 and 1 at 10; *Heliocarpus* sp. 2 at 2 and at 6; *Lantana camara* L. + at 3 and 1 at 9; *Lasiacis* sp. + at 3 and 2 at 11; "Leguminosa" + at 4 and at 10; *Lonchocarpus* sp. 1 at 1 and at 9; "Malvácea" 1 at 6 and at 7; *Porophyllum* sp. + at 2 and 1 at 4; *Randia thurberi* S. Watson 1 at 3 and 2 at 8; *Serjania* sp. + at 2 and 2 at 6; *Stemmadenia* sp. 1 at 5 and at 11; *Tagetes* sp. 2 at 4 and + at 9; *Tillandsia usneoides* (L.) L. + at 2 and at 9.

Species occurring in only one relevé: *Ziziphus* sp. 2 at 1; *Triumfetta* sp. 2 at 1; "Acanthácea" 2 at 1; "Leguminosa" 2 at 1; *Iresine* sp. 3 at 1; *Salvia carnea* Kunth 3 at 1; *Leucaena macrophylla* Benth. + at 2; *Salvia* sp. II + at 2; *Crossopetalum managuatillo* (Loes.) Lundell + at 2; *Pavonia oxyphylla* var. *melanommata* (B.L. Rob. & Seaton) Fryxell + at 2; *Salvia* sp. + at 2; *Senna uniflora* (Mill.) H.S. Irwin & Barneby + at 2; *Celtis iguanaea* (Jacq.) Sarg. 2 at 2; *Acourtia reticulata* (Lag. ex D. Don) Reveal & R.M. King + at 3; *Gomphrena* sp.+ at 3; *Mimosa albida* Humb. & Bonpl. ex Willd. + at 3; *Stenocereus* sp. + at 3; *Tagetes lunulata* Ortega 1 at 3; *Vicia* sp. 1 at 3; *Schkuhria pinnata* (Lam.) Kuntze 2 at 3; *Eysenhardtia punctata* Pennell 3 at 3; *Salvia melissodora* Lag. + at 4; *Acourtia cordata* (Cerv.) B.L. Turner + at 4; *Castilleja arvensis* Cham & Schltdl. + at 4; *Leucaena esculenta* (DC.) Benth. 1 at 4; *Ageratina mairetiana* (DC.) R.M. King & H.Rob. 1 at 4; *Croton adspersus* Benth. 1 at 4; *Prunus prionophylla* Standl. 1 at 4; *Canavalia villosa* Benth. 1 at 4; *Salvia sessei* Benth. 2 at 4; *Eysenhardtia platycarpa* Pennell & Saff. 3 at 4; *Stevia nepetifolia* Kunth 3 at 4; *Heteropterys laurifolia* A. Juss. 5 at 4; *Cuscuta* sp. + at 5; *Adiantum* sp. + at 5; "Compuesta" + at 5; *Iresine diffusa* Humb. & Bonpl. ex Willd. + at 5; *Iresine interrupta* Benth. + at 5; *Lonchocarpus eriocarinalis* Micheli + at 5; *Carminatia tenuiflora* DC. + at 5; "Polemonácea" + at 5; "Rutácea" + at 5; *Sicyos* sp. + at 5; *Spilanthes alba* L'Hér. + at 5; *Cissampelos pareira* L. + at 5; *Oreopanax echinops* Decne. & Planch. + at 5; *Paullinia sessiliflora* Radlk. + at 5; *Colubrina* sp. 1 at 5; *Thevetia ovata* A.DC. 1 at 5; *Thouinia serrata* Radlk. 1 at 5; *Oplismenus compositus* P. Beauv. 2 at 5; *Cedrela odorata* L. 2 at 5; *Iresine ajuscana* Suess. & Beyerle 3 at 5; *Vachellia farnesiana* (L.) Wight & Arn. 1 at 6; *Pithecellobium lanceolatum* Benth. 1 at 6; *Telosiphonia hypoleuca* (Benth.) Henrickson 1 at 6; *Lysiloma tergeminum* Benth. 1 at 6; *Solanum* sp. + at 7; *Conzattia multiflora* Standl. + at 7; *Karwinskia humboldtiana* (Schult.) Zucc. + at 7; *Opuntia* sp. II + at 8; *Mimosa rhodocarpa* (Britton & Rose) R. Grether 1 at 8; *Erythrina coralloides* DC. 1 at 8; *Trifolium* sp. 1 at 8; *Bouteloa* sp. 1 at 8; *Heliocarpus pallidus* Rose 2 at 8; *Bursera fagaroides* Engl. 2 at 8; *Albizia plurijuga* Britton & Rose 3 at 8; *Stachys rotundifolia* Moc. & Sessé ex Benth. + at 9; *Tecoma stans* (L.) Juss. ex Kunth + at 9; *Trichilia hirta* L. + at 9; *Castilleja tenuiflora* Benth. + at 9; *Bursera glabrifolia* Engl. + at 9; *Bursera glabrifolia* (Kunth) Engl. + at 9; *Passiflora mexicana* Juss. + at 9; *Eupatorium collinum* DC. + at 9; *Enterolobium cyclocarpum* (Jacq.) Griseb. 1 at 9; *Asterohyptis stellulata* Epling 1 at 9; *Trema micrantha* (L.) Blume 1 at 9; *Guardiola mexicana* Bonpl. 1 at 9; *Haematoxylum brasiletto* H. Karst. 1 at 9; *Cissus alata* Jacq. 1 at 9; *Lippia* sp. 1 at 9; *Clematis dioica* L. 1 at 9; *Ipomoea wolcottiana* Rose 2 at 9; *Bursera copallifera* (Sessé & Moc.) Bullock 2 at 9; *Dodonaea viscosa* Jacq. 2 at 9; *Phaseolus* sp. + at 9; *Vitex mollis* Kunth 2 at 9; *Licania arborea* Seem.3 at 9; *Acalypha* sp. 2 at 10; *Tithonia rotundifolia* (Mill.) S.F. Blake + at 10; *Mimosa* sp. + at 10; "Cactácea" + at 10; *Spondias mombin* L. 1 at 10; *Commelina erecta* L. 1 at 10; *Helicteres baruensis* Jacq. 1 at 10; *Zanthoxylum* sp. 1 at 10; *Dalbergia* sp. 1 at 10; *Platymiscium lasiocarpum* Sandwith 1 at 10; *Diospyros salicifolia* Willd. 1 at 10; *Euphorbia tanquahuete* Sessé & Moc. 2 at 10; *Albizia lebbeck* (L.) Benth. 2 at 10; *Justicia candicans* (Nees) L.D. Benson 2 at 10; *Lasianthaea aurea* (D. Don) K.M. Becker 3 at 10; *Carica mexicana* (A. DC.) L.O. Williams + at 11; *Dioscorea* sp. + at 11; *Euphorbia* sp. 1 at 11; *Euphorbia* sp. I 1 at 11; "Cactácea columnar" 1 at 11; *Croton* sp. 1 at 11; *Plumeria rubra* L. 1 at 11; "Capparidácea" 1 at 11; *Asclepias* sp. 2 at 11.
Localities: 1: Road. Huandacareo to Puruándiro, Huandacareo (19° 59' 09" N, 101° 18' 26" W) 2: Chaparaco, Tangancícuaro (19° 56' 56" N, 102° 15' 12" W) 3: N of Urepetiro, Tlazazalca (19° 59' 05" N, 102° 07 '05" W) 4: E of El Platanal, Tangancícuaro (19° 56' 25" N, 102° 13' 57" W) 5: ± 8 km N of Coalcomán, Coalcomán (18° 50' 28" N, 103° 07'44" W) 6: ± 20 km W of Zamora, Tangamandapio (19° 57' 56" N, 102° 28' 41" W) 7: Ranch El Aguacate, Villamar (19° 55' 15" N, 102° 35' 24" W) 8: N of Patzímaro, E of Churintzio, Churintzio (20° 09' 23" N, 102° 06' 37" W) 9: El Jorullo volcano, Mata de Plátano Community, La Huacana (18° 57' 54" N, 101° 42' 59" W) 10: Glen of Los Chorros del Varal, Peribán (19° 30' 55" N, 102° 34' 20" W) 11: ± 3 km W of the crossroad from Coalcomán to Villa Victoria, Chinicuila (18° 42' 57" N, 103° 19' 19" W).

physiographic point of view, these sites are located within the Southern Coastal Mountain Range Sub province. The main differences between these communities are related to their structure, floristic composition, and altitudinal range of distribution and bioclimatic affiliation. Next, a characterization of the four referred communities is presented:

Caesalpinio platylobae - Cordietum elaeagnoidis *(Table 4; Inventory type nº 5 in table 4)*. Physiognomy, structure and floristic composition.- Deciduous Micro-forest, between 6 and 10 m high, formed by leafed trees and deciduous winter microphyllous, several of them thorny. Its arboreal stratum has an almost continuous canopy dominated by *Cordia elaeagnoides* A. DC., *C. dodecandra* DC., *Caesalpinia platyloba* S. Watson, *C. eriostachys* Benth., *Apoplanesia paniculata* C. Presl and *Bursera coyucensis* Bullock, species selected as association characteristics. Other arboreal species of more sporadic presence are: *Tabebuia ochracea* (Cham.) Standl., *Malpighia mexicana* A. Juss., *Pachycereus pecten-aboriginum* Britton & Rose and *Caesalpinia velutina* Standl. In the shrub stratum, *Erythroxylum mexicanum* Kunth, *E. rotundifolium* Lunan, *Croton flavescens* Greenm., and *Manihot intermedia* Weath. are usually present.

Ecology and distribution.- Of the four communities belonging to the basin, this is the one at a lowest altitude, between 250 and 500 m, being this dominant factor against others such as the lithological or the depth of the soil. Most of the inventories are oriented to the west and are on slopes of steep gradients, between 20 and 40 %. The bioclimatic floor (Horizon) where it is located corresponds to the lower dry upper infratropical.

Cochlospermo vitifolii - Lueheetum candidae *(Table 5, inventory type nº 5 in table 5)*. Physiognomy, structure and floristic composition.- Deciduous Micro-forests with an average height of 14 m, although they can reach up to 20 m (Meso-forest). A tree stratum dominates it with a cover close to 100 %, where abundant leafed elements with some thorny and microphyllous can be found, among which are *Luehea candida* Mart., *Cochlospermum vitifolium* (Willd.) Spreng., *Lysiloma divaricatum* (Jacq.) Benth., *Poeppigia procera* C. Presl and *Tabebuia ochracea* (Cham.) Standl., all of which were selected as characteristics of the

Table 4. Association of: *Caesalpinio platylobae-Cordietum elaeagnoidis*

Elevation (m asl)	**288**	**34**	**39**	**358**	**325**	**285**	**35**	**368**	**36**	**44**
Exposition	**W**	**W**	**W**	**W**	**W**	**W**	**W**	**W**	**SW**	**NW**
Slope steepness (%)	**46.6**	**57.7**	**26.7**	**36.3**	**36.3**	**36.3**	**36.3**	**57.7**	**46.6**	**46.6**
Area (× 10 m²)	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**
Tree cover (%)	**95**	**95**	**95**	**90**	**95**	**95**	**85**	**95**	**95**	**70**
Height of vegetation (m)	**10**	**7**	**6**	**7**	**6**	**6**	**7**	**8**	**8**	**7**
Nº of Species	**12**	**13**	**10**	**14**	**13**	**10**	**10**	**9**	**8**	**6**
Nº of array	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Characteristic species										
Cordia elaeagnoides DC.	3	2	2	3	3	3	3	3	3	3
Caesalpinia platyloba S. Watson	2	3	3		2	3	2			
Cordia dodecandra DC.	2	2	3	2		2		2		
Apoplanesia paniculata C. Presl	2	2	3	2	3				2	
Bursera coyucensis Bullock	1	2	2				2		1	
Caesalpinia eriostachys Benth.	1				3	2	2	1		
Companion species										
Erythroxylum mexicanum Kunth				1	1	2	1			1
Croton flavescens Greenm.	2	2	1		1				1	
Erythroxylum rotundifolium Lunan			1	2	1	2	1			
Vachellia sp.	1	4				2	1			
Manihot intermedia Weath.				1	2		1	2		
Tabebuia ochracea (Cham.) Standl.	2	1		2				2		
Malpighia mexicana A. Juss.		1			1				1	
Pachycereus pecten-aboriginum Britton & Rose						1				1
Caesalpinia velutina Standl.						2				2
Guettarda elliptica Sw.				1	1					
Lonchocarpus sp.					1				1	
Poeppigia procera C. Presl		1						1		
Bursera sp.				1				1		
Cordia alliodora (Ruiz & Pav.) Oken				1						2
Randia sp.	2	1								

Species occurring in only one relevé: *Lippia umbellata* Cav 1 at 1; *Lysiloma divaricatum* (Jacq.) J.F. Macbr. 1 at 1; *Cupania dentata* Moc. & Sessé + at 2; *Cyrtocarpa procera* Kunth 2 at 2; *Bursera grandifolia* Engl. 2 at 3; *Opuntia excelsa* Sánchez-Mej. 2 at 3; *Godmania aesculifolia* Standl. 1 at 3; *Jatropha* sp. + at 4; *Cordia curassavica* (Jacq.) Roem. & Schult. 1 at 4; *Croton draco* Standl. 1 at 4; *Lonchocarpus caudatus* Pittier 1 at 4; *Selaginella* sp. + at 5; *Bauhinia divaricata* L. 1 at 5; *Ruprechtia fusca* Fernald + at 6; *Plumeria rubra* L. 2 at 7; *Ceiba aesculifolia* Britt. & Baker f. 1 at 7; *Bursera excelsa* Engl. 1 at 8; *Lonchocarpus eriocarinalis* Micheli 1 at 8; *Bursera heteresthes* Bullock 1 at 9; *Haematoxylum brasiletto* H. Karst. 1 at 9; *Gliricidia sepium* (Jacq.) Kunth + at 10.

Localities: All inventories belong to the San José de Chila basin 1: Middle slope, Apatzingán (18° 59' 08" N, 102° 34' 29" W) 2: High middle slope, Apatzingán (18° 59' 12" N, 102° 34' 19" W) 3: Upper slope, Aguililla (18° 51' 53" N, 102° 38' 54" W) 4: Low slope, Apatzingán (18° 59' 15" N, 102° 34' 27" W) 5: Upper slope N, Apatzingán (18° 59' 55" N, 102° 34' 08" W) 6: Slope N, Apatzingán (18° 59' 57" N, 102° 34' 03" W) 7: Slope N, Apatzingán (18° 59' 41" N, 102° 34' 13" W) 8: Upper slope NW, Apatzingán (18° 59' 15" N, 102° 34' 27" W) 9: Middle slope to NW, Apatzingán (18° 57' 00" N, 102° 34' 35" W) 10: Hillside S, Aguililla (18° 52' 04 N, 102° 38' 47" W).

Table 5. *Cochlospermo vitifolii-Lueheetum candidae*

Elevation (m asl)	**400**	**505**	**780**	**420**	**340**	**720**	**750**	**335**	**435**	**630**
Exposition	**S**	**S**	**S**	**SE**	**S**	**S**	**S**	**W**	**SE**	**S**
Slope steepness (%)	**46.6**	**57.7**	**70**	**36.3**	**36.3**	**83.9**	**46.6**	**57.7**	**36.3**	**57.7**
Area (× 10 m²)	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**
Tree cover (%)	**90**	**60**	**95**	**70**	**80**	**100**	**90**	**85**	**60**	**65**
Height of vegetation (m)	**12**	**16**	**20**	**15**	**10**	**15**	**20**	**7**	**12**	**12**
Nº of Species	**17**	**7**	**9**	**7**	**13**	**12**	**10**	**17**	**7**	**5**
Nº of array	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Characteristic species										
Luehea candida Mart.	2	3	2	3	3	3	2	2	2	2
Cochlospermum vitifolium Spreng.	1	1	2	1	2	1	1		1	
Lysiloma divaricatum (Jacq.) Benth.	1	2	4	2		2	2	3	3	3
Poeppigia procera C. Presl	1	1	2	1	1			2		
Tabebuia ochracea (Cham.) Standl.	2	1			2	1		1	1	
Companion species										
Eysenhardtia polystachya (Ortega) Sarg.	3		1					1	1	
Lonchocarpus caudatus Pittier	3						1	2		2
Bursera grandifolia Engl.			1		1					2
Cordia elaeagnoides A. DC.			2				1		1	
Ceiba aesculifolia Britten & Baker f.							3			2
Astronium graveolens Jacq.						3	1			
Ruprechtia fusca Fernald	2	2								
Erythroxylum rotundifolium Lunan				2					2	
Bauhinia ungulata L.					1			1		
Caesalpinia velutina Standl.						1	1			
Leguminosa "zopilotillo"	1				1					
Bauhinia divaricata L.							1	1		
"Tamalero"	1		1							
Randia sp.	1			1						
"Zarapillo"	1					2				
Trema micrantha (L.) Blume		1			2					
Caesalpinia eriostachys Benth.					1			2		

Species occurring in only one relevé: *Fridericia viscida* (Donn. Sm.) L.G. Lohmann + at 1, *Randia* sp. I 1 at 1; *Montanoa leucantha* (Lag.) S.F. Blake 1 at 1; *Spondias purpurea* L. 1 at 1; *Heliocarpus donnellsmithii* Rose 2 at 1; *Bursera heteresthes* Bullock 1 at 3; *Tabebuia donnell-smithii* Rose 1 at 4; "Leguminosa" + at 5; *Caesalpinia coriaria* (Jacq.) Willd. 1 at 5; *Coccoloba barbadensis* Jaqcq.1 at 5; *Amphipterygium adstringens* (Schltdl.) Standl. 1 at 5; "Hortigo" + at 6; *Sideroxylon capiri* Pittier + at 6; *Carica mexicana* (A. DC.) L.O. Williams 2 at 6; *Pseudobombax ellipticum* (Kunth) Dugand 2 at 6; *Cupania dentata* Moc & Sessé 3 at 6; *Lonchocarpus hintonii* Sandwith 1 at 7; *Jatropha* sp. + at 8; *Piptadenia constricta* J.F. Macbr. + at 8; *Morisonia americana* L. 1 at 8; *Tabebuia rosea* DC. 1 at 8; *Bursera instabilis* McVaugh & Rzed. 1 at 8; *Apoplanesia paniculata* C. Presl 1 at 8; *Guettarda elliptica* Sw. 2 at 8; *Coccoloba* sp. 2 at 8.

Localities: : All inventories belong to the San José de Chila basin 1: Upper slope to the NW, Apatzingán (18° 52' 03" N, 102° 35' 51" W) 2: Middle slope to the SE, Apatzingán (18° 51' 50" N, 102° 35' 47" W) 3: Upper slope to the SE, Apatzingán (18° 49' 38" N, 102° 34' 34" W) 4: Upper slope to the S, Apatzingán (18° 52' 39" N, 102° 36' 32" W) 5: Midde slope to the N, Apatzingán (18° 53' 39" N, 102° 35' 59" W) 6: Middle slope to the NE, Apatzingán (18° 49' 17" N, 102° 34' 07" W) 7: ÷Upper slope to the N, Apatzingán (18° 49' 29" N, 102° 34' 16" W) 8: Lower slope to the N, Apatzingán (18° 54' 02" N, 102° 36' 04" W) 9: Lower slope to the W, Apatzingán (18° 52' 49" N, 102° 36' 30" W) 10: Middle slope to the N, Apatzingán (18° 49' 45" N, 102° 34' 50" W).

association. Other elements that may appear in the community are *Eysenhardtia polystachya* (Ortega) Sarg., *Lonchocarpus caudatus* Pittier, *Bursera grandifolia* (Schltdl.) Engl. and *Cordia elaeagnoides* A. DC.

Ecology and distribution.- It is distributed largely above the previous community, between 330 and 800 m of altitude, on moderate slopes (between 20 and 40 %) and oriented preferably to the South. This site corresponds to the lower dry upper infratropical soil (Horizon), although inventories made at higher elevations can be linked to the Thermotropical soil the lower horizon.

Variability and observations.- In the original classification analysis of Pérez-Vega *et al.* (2010) two sub communities associated with the different lithology were differentiated. One with *Ceiba aesculifolia* Britt. & Baker f. and *Lonchocarpus caudatus* Pittier corresponding to soils developed on granite; the other with *Poeppigia procera* C. Presl and *Eysenhardtia polystachya* (Ortega) Sarg., on schists. However, in the general context of this study, such differentiation was not recognized due to the low weight of the inventories and the species used for it.

Lysilomo divaricatae - Cordietum elaeagnoidis *(Table 6, Inventory type nº 2 in table 6)*. Physiognomy, structure and floristic composition.- Deciduous Micro-forest between 8 and 16 m of height, dominated by leafed elements and microphyllous, and with the presence of some species with exfoliating stems. It has a tree stratum with cover around 80% that is dominated by *Cordia elaeagnoides* A. DC., *Lysiloma divaricatum* (Jacq.) Benth., *Fridericia viscida* (Donn. Sm.) L.G. Lohmann and *Heliocarpus donnellsmithii* Rose, which have been selected as characteristics of the association. Trees and tall shrubs, some spinous, such as *Bursera* spp., *Randia* spp., *Lonchocarpus hintonii* Sandwith, *Haematoxylum brasiletto* H. Karst., *Luehea candida* Mart, *Tabebuia ochracea* (Cham.) Standl., *Cochlospermum vitifolium* (Willd.) Spreng. and *Apoplanesia paniculata* C. Presl, may also occur sporadically.

Ecology and distribution.- It occupies a strip between the altitudes of 350 and 1,000 m on slopes moderately inclined (between 20 and 30 %) oriented preferably to the south. Its physiognomic characteristics, its bioclimatic site and its framing in the vegetation units considered match those of the previous association.

Comunity of Spondias purpurea-Cochlospermum vitifolium *(Table 7)*. Physiognomy, structure and floristic composition.- Deciduous Micro-forest, poor in species, with an average altitude of 13 m of height and with a cover around 80 %, dominated by leafed or without awn microphanerophyte. In addition to the species that give the name to the community, other species of the arboreal and shrub strata may be present, such as: *Ceiba aesculifolia* Britt. & Baker f., *Cordia elaeagnoides* A. DC., *Erythroxylum mexicanum* Kunth, *Ipomoea arborescens* Sweet, *Fridericia viscida* (Donn. Sm.) L.G. Lohmann, *Amphipterygium adstringens* (Schltdl.) Standl., *Bursera instabilis* McVaugh & Rzed., *Lonchocarpus eriocarinalis* Micheli and *Randia* spp.

Ecology and distribution.- The community has been registered between the altitudes of 410 and 710 m, with a majority exposure to the south and on slopes with an average gradient of 30°. Its physiographic and bioclimatic positions remain similar to the previous association described.

Stenocereo quevedonis - Cordietum selerianae *(Table 8, Inventory type nº 3 in table 8)*. Physiognomy, structure and floristic composition.- High shrub dominated by deciduous and spiny elements with height ranging from 4 to 10 m, which leads to classifying it. The upper stratum has a low and discontinuous coverage, around 40 % and highlights the columnar eminences of the Pitaya cactus (*Stenocereus quevedonis* (J.G. Ortega) Buxb.); This heterogeneity favors the entry of light into the shrub stratum that reaches an average cover close to 70 %; Usually the two strata are interspersed making their differentiation difficult, and their species can participate interchangeably in both. The more conspicuous arboreal elements are: *Cordia seleriana* Fernald, *Stenocereus quevedonis* (J.G. Ortega) Buxb., *Apoplanesia paniculata* C. Presl, *Randia capitate* DC., *Amphipterygium glaucum* (Hemsl. & Rose) Hemsl. & Rose, which together with the shrub *Salpianthus arenarius* Bonpl., were selected as characteristic of the association. Other low trees or shrubs with sporadic presence in the community are *Lonchocarpus eriocarinalis* Micheli, *Amphipterygium adstringens* (Schltdl.) Standl., *Gliricidia sepium* (Jacq.) Kunth ex Walp., *Haematoxylum brasiletto* H. Karst., *Lysiloma divaricatum* (Jacq.) Benth., *Cordia elaeagnoides* A. DC., *Erythroxylum rotundifolium* Lunan, *Bursera trimera* Bullock, *Bursera sarukhanii* Guevara & Rzed. and *Cordia nelsonii* I.M. Johnst. In the shrub stratum the most constant species are *Salpianthus arenarius* Bonpl., *Eysenhardtia* sp., and *Opuntia* sp.; others of more sporadic appearance are *Croton* sp., *Randia* spp., *Bursera* spp., *Fouquieria formosa* Kunth and *Colubrina heteroneura* Standl. In the herbaceous stratum, elements of the families Acanthaceae and Compositae prevailed.

Table 6. Association of: *Lysilomo divaricatae-Cordietum elaeagnoidis*

Elevation (m asl)	**44**	**48**	**36**	**36**	**49**	**50**	**47**	**40**	**79**	**63**	**39**	**96**	**95**	**93**	**38**	**52**	**57**	**38**	**71**
Exposition	**W**	**SW**	**W**	**W**	**SW**	**SW**	**S**	**W**	**S**	**S**	**W**	**SE**	**SE**	**SE**	**SW**	**W**	**S**	**SW**	**SW**
Slope steepness (%)	**57**	**46**	**57**	**36**	**57**	**36**	**70**	**46**	**46**	**46**	**46**	**70**	**57**	**57**	**36**	**57**	**46**	**26**	**57**
Area (× 10 m²)	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**	**40**
Tree cover (%)	**-**	**40**	**50**	**50**	**70**	**75**	**40**	**50**	**70**	**-**	**50**	**35**	**40**	**70**	**50**	**-**	**-**	**80**	**95**
Height of vegetation (m)	**-**	**15**	**5**	**11**	**16**	**15**	**14**	**11**	**20**	**-**	**13**	**20**	**12**	**14**	**16**	**-**	**-**	**8**	**12**
Nº of Species	**12**	**10**	**17**	**7**	**11**	**16**	**12**	**9**	**12**	**10**	**8**	**12**	**12**	**12**	**14**	**8**	**6**	**10**	**7**
Nº of array	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
Characteristic species																			
Cordia elaeagnoides A. DC.	3	2	3	3	2	2	1	3		3	3						2	2	2
Lysiloma divaricatum (Jacq.) Benth.	2	2	2	1	3	1	3	2	3		2			2	1				
Fridericia viscida (Donn. Sm.) L.G. Lohmann	2	2					2	2	3	2		2	3	2	2	4			
Heliocarpus donnellsmithii Rose	2	2	2	2	1	2			2	2		2	2						
Companion species																			
Bursera sp.	1	1			3	3	2	3		2	1	3		2	2	2	2		
Vachellia sp.					1	2			2	1				1	1	2	2		
Randia sp.	2	2	2	1	2	2					2				5			3	
Lonchocarpus hintonii Sandwith				3	3	3			3		1		2	1				2	1
Haematoxylum brasiletto H. Karst.			1	2				2		2	1				2			2	
Luehea candida Mart.			2	+		1	2		2	1			1						+
Tabebuia ochracea (Cham.) Standl.	1	1	1				2		1							4			
Cochlospermum vitifolium Spreng.		3	1			2			1					1					
Bursera coyucensis Bullock							1					1		1			1		
Bursera simaruba Sarg.								1				2	2		1			1	
Gliricidia sepium (Jacq.) Kunth	2														1			2	
"Tamalero"					+	1	2		1							2			
Apoplanesia paniculata C. Presl			1									1	1				1		
Ceiba aesculifolia Britten & Baker f.		2					1					1			1				
Erythroxylum rotundifolium Lunan			1			1													1
"Zopilotillo"									+						2	1		1	
Amphipterygium adstringens (Schltdl.) Standl.							1			1									
Bauhinia divaricata L.			2						1										3
Coccoloba sp.												2		2			3		
Cordia alliodora (Ruiz & Pav.) Oken	1		1				1												
Lonchocarpus caudatus Pittier								2						1					
Lysiloma acapulcense (Kunth) Benth.												2	2						1
Brogniartia sp.					1	1												1	
Senna pallida (Vahl) H.S. Irwin & Barneby					1			1								2			
Spondias purpurea L.												1			2				
Caesalpinia platyloba S. Watson								1		3									
Dalbergia granadillo Pittier													2	2					
Melochia tomentosa L.						+							+	1					
Poeppigia procera C. Presl		1	2			+													

Species occurring in only two relevés: *Lysiloma divaricatum* (Jacq.) Benth.2 at 11 and 4 at 14; *Croton flavescens* Greenm. 1 at 3 and + at 11; *Montanoa leucantha* (Lag.) S.F. Blake 1 at 12 and at 13; "Balsamillo" 2 at 15 and at 18; *Quercus glaucoides* M. Martens & Galeotti 2 at 9 and 3 at 19.

Species occurring in only one relevé: *Eysenhardtia polystachya* (Ortega) Sarg. 1 at 1; *Ipomoea arborescens* (Humb. & Bonpl. ex Willd.) G. Don 1 at 1; *Randia* sp. I 2 at 1; *Cordia dodecandra* DC. 1 at 3; *Caesalpinia cacalaco* Bonpl. 1 at 3; *Caesalpinia coriaria* (Jacq.) Willd. 1 at 3; *Lonchocarpus eriocarinalis* Micheli 3 at 5; *Chiococca alba* Hitchc. 1 at 6; "Hortigo" + at 6; *Tabebuia donnell-smithii* Rose 1 at 7; *Opuntia excelsa* Sánchez-Mej. 1 at 10; *Pseudosmodingium perniciosum* (Kunth) Engl. 1 at 15; *Cordia sonorae* Rose 1 at 16; *Stemmadenia donnell-smithii* (Rose) Woodson + en 16; *Caesalpinia velutina* Standl. 1 en 18; *Piptadenia constricta* J.F. Macbr. 2 en 18; *Bursera grandifolia* Engl. 1 en 19; *Coccoloba barbadensis* Jacq.1 at 21.
Localities: 1: Middle slope to the S, Apatzingán (18° 53' 32" N, 102° 32' 49" W) 2: Upper slope to the N, Aguililla (18° 52' 39" N, 102° 39' 05" W) 3: Upper slope to the S, Apatzingán? (18° 53' 58" N, 102° 36' 01" W) 4: Lower slope to the N, Aguililla (18° 56' 22" N, 102° 39' 21" W) 5: Middle slope to the SE, Aguililla (18° 52' 36" N, 102° 39' 04" W) 6: Middle slope to the N, Aguililla (18° 52' 33" N, 102° 39' 01" W) 7: Lower slope to the S, Aguililla (18° 51' 44" N, 102° 35' 48" W) 8: Southern slope, Aguililla (18° 56' 14" N, 102° 39' 16" W) 9 Upper slope to the N Apatzingán (18° 49' 32" N, 102° 34' 30" W) 10: Upper slope to the S, Aguililla (18° 53' 01" N, 102° 41' 44" W) 11: Upper slope to the S, Aguililla (18° 56' 16" N, 102° 39' 23" W) 12: Upper slope to the SW, Aguililla (18° 48' 10" N, 102° 33' 27" W) 13: Upper slope to the SW, Agulilla (18° 48' 09" N, 102° 33' 26" W) 14: Upper slope to the S, Aguililla (18° 48' 05" N, 102° 33' 28" W) 15: Middle slope to the SE, Aguililla (18° 52' 53" N, 102° 38' 47" W) 16: Middle slope to the N, W, Apatzingán (18° 53' 25" N, 102° 33' 18" W) 17: Upper slope to the N, Aguililla (18° 53' 11" N, 102° 41' 47" W) 18: Middle slope to the SE, Aguililla (18° 52' 51" N, 102° 38' 46" W) 19: Lower slope NW Aguililla, Aguililla (18° 50' 19" N, 102° 34' 21" W).

Ecology and distribution.- The association is presented in the lower and arid regions of the Tepalcatepec River basin, between 150-400 m altitude, within the physiographic subregions of the Tepalcatepec depression and the Coastal Mountain Range of South. It occupies stony slopes with moderate gradient oriented preferably to the N. From a bioclimatic point of view, it has its optimal distribution in the upper Infratropical horizon, under the upper and lower dry semiarid ombrotypes.

Guazumo ulmifoliae - Cordietum elaeagnoidis *(Table 9; Inventory n° 2 in table 9)*. Physiognomy, structure and floristic composition.- Low forest or high shrub dominated by deciduous microfilated and spiny free species, which form a semi-continuous canopy with a height between 5 and 15 m, which allows it to be placed in the Micro-forest category. In comparison with other neighboring communities, this presents, in most cases, a notable poverty of species, being *Cordia elaeagnoides* A. DC., *Lysiloma divaricatum* (Jacq.) Benth., *Guazuma ulmifolia* Lam. and *Crescentia alata* Kunth the most recurrent, selected as characteristics of the association, while being at the same time the dominant ones of the arboreal stratum, in particular the first two. In the shrub stratum of these communities, spinous and crasicaules species are sporadically present, such as *Opuntia* spp., *Stenocereus quevedonis* (J.G. Ortega) Buxb., *Acanthocereus* sp., *Cardiospermum halicacabum* L., *Bursera* spp., *Backebergia militaris* (Audot) Bravo ex Sánchez-Mej., *Acaciella angustissima* (Mill.) Britton & Rose, *Senna atomaria* (L.) H.S. Irwin & Barneby, *Heliocarpus* sp., *Caesalpinia platyloba* S. Watson, *Alvaradoa amorphoides* Liebm., etc. In the herbaceous stratum elements of the families Compositae and Acanthaceae are present.

Ecology and distribution.- Samples of the community have been taken between 180 and 620 m of altitude, on stony slopes of moderate gradient; it is distributed preferably in the subprovince physiographic of the Tepalcatepec depression and in a marginal form in the coastal mountain range of the south.

It is recognized in the inventories 5 and 6, a group of exclusive species that could denote some ecological factor, and that are *Bursera palmeri* S. Watson, *Backebergia militaris* (Audot) Bravo ex Sánchez-Mej. and *Acaciella angustissima* (Mill.) Britton & Rose *var. angustissima.*

Lonchocarpo huetamoensis - Cordietum elaeagnoidis *(Table 10; Inventory° 4 in table 10)*. Physiognomy, structure and floristic composition.- Low deciduous forest with a dense and multi-specific arboreal stratum between 10 and 15 m of height, which allows it to be placed in the Micro-forest category (Meso-forest). The dominant species are: *Stenocereus quevedonis* (J.G. Ortega) Buxb., *Lonchocarpus huetamoensis* M. Sousa & J.C. Soto, *Tabebuia impetiginosa* (Mart. ex DC.) Standl., *Cyrtocarpa procera* Kunth, *Lysiloma tergeminum* Benth., *Coccoloba acapulcensis* Standl., all of them selected as characteristics of association; other species present in this stratum are *Lysiloma divaricatum* (Jacq.) J.F. Macbr., *Ceiba aesculifolia* Britt. & Baker f., *Erythrina* sp., etc. In the shrub or subarboreal stratum, the previous species and others may participate, such as: *Randia* spp., *Erythroxylum rotundifolium* Lunan, *Euphorbia tanquahuete* Sessé & Moc.and other representatives of the genera, mainly: *Croton* L., *Albizia* Durazz., *Triumfetta* L. and *Lantana* L. The herbaceous stratum presents variable cover of up to 50 % or more and is quite heterogeneous in its composition with predominance of *Leptochloa* P. Beauv., *Elytraria* Michx., *Aegopogon* Humb. & Bonpl. ex Willd. and several species of the family Acanthaceae, Malphigiaceae and Malvaceae.

Ecology and distribution.- The association is described as belonging to middle and low slopes with moderate gradients, found at the municipality of La Huacana, in depression of the Balsas River. From the physiographic point of view this location belongs to the subprovince Coastal Mountain Range of the South. The altitude in which

Table 7. Community of: *Spondias purpurea* - *Cochlospermum vitifolium*

Elevation (m asl)	**69**	**58**	**71**	**41**
Exposition	**SW**	**S**	**S**	**NW**
Slope steepness (%)	**70**	**57.7**	**57.7**	**57.7**
Area (× 10 m²)	**40**	**40**	**40**	**40**
Tree cover (%)	**85**	**80**	**70**	**75**
Height of vegetation (m)	**12**	**15**	**11**	**15**
Nº of Species	**7**	**5**	**6**	**6**
Nº of array	**1**	**2**	**3**	**4**
Characteristic species				
Cochlospermum vitifolium Spreng.	3	3	2	3
Spondias purpurea L.	3	2	2	
Fridericia viscida (Donn. Sm.) L.G. Lohmann	2	3	2	
Ceiba aesculifolia Britt. & Baker f.	1	2		2
Cordia elaeagnoides A. DC.	2	+		1
Erythroxylum mexicanum Kunth	1		1	+
Ipomoea arborescens (Humb. & Bonpl. ex Willd.) G. Don			1	1

Species occurring in only one relevé: *Randia* sp. 1 at 1 Amphipterygium adstringens (Schltdl.) Schiede ex Standl. 1 at 1; *Bursera instabilis* McVaugh & Rzed. 2 at 3; *Lonchocarpus eriocarinalis Micheli* 2 at 4.
Localities: All inventories belong to the San José de Chila basin. 1: Slope, Apatzingán (18° 50' 35" N, 102° 33' 12" W) 2: Lower slope, Apatzingán. (18° 50' 55" N, 102° 32' 46" W) 3: Upper slope, top, Apatzingán (18° 50' 49" N, 102° 33' 03" W) 4: Slope to the N, Agulilla (18° 51' 53" N, 102° 38' 54" W).

the strip is present oscillates between 330 and 520 m and the most frequent exposure is N. The bioclimatic floor which best fits the association is the upper Infratropical of Dry ombrotype, being able to present also in the upper Semiarid upper Infratropical, and in the low Dry Thermotropical.

Variability.- Two restricted species packages are recognized respectively in the inventories 1, 2 and 3, of the first, and 4, 5 and 6 of the second. From the first, the most frequent exclusive species are the "Pachón", an unidentified arborescent cactus, *Vitex mollis* Kunth, *Karwinskia humboldtiana* (Schult.) Zucc., *Randia* sp., *Cordia morelosana* Standl. and *Coursetia* sp. From the second group *Apoplanesia paniculata* C. Presl, *Heliocarpus occidentalis* Rose, *Bursera trimera* Bullock and *B. fagaroides* Engl. are typical. Both variants allow intuiting a differentiated behavior motivated by some unkwon factor of the environment.

As a biogeographical affiliation and considering the associations in the vegetation units proposed by Rzedowski (1978), and its distribution within the physiographic sub provinces of INEGI (2014), the following correspondences are recognized: Tropical Deciduous Forest of Bajio: *Lysilomo acapulcensis-heliocarpetum terebinthinacei* and *Ceibo aesculifoliae-Lysilometum divaricatae*. Tropical Deciduous Forest of the Tepalcatepec Valley: *Lysilomo divaricate-Cordietum elaeagnoidis*. Tropical Deciduous Forest of the Coastal Mountain Range of the South: *Ceibo aesculifoliae-Lysilometum divaricatum*, *Caesalpinio platylobae-Cordietum elaeagnoidis*, *Cochlospermo vitifolii-Luheetum candidae*, *Lonchocarpo huetamoensis-Cordietum elaeagnoidis* and Community of *Spondias purpurea* L.-*Cochlospermum vitifolium* (Willd.) Spreng.. Xeric Thicket of the Valley of Tehuantepec: *Stenocereo quevedonis-Cordietum selerianae*.

The nine Phytosociological tables supporting the associations and communities described, resulting in the process of sorting and classification as shown in Figure 2, are presented next.

Sintaxonomic Scheme. The proposed taxonomic units are included in the provisional phytosociological class of *Pachycereo pecten-aborigini-Lysilometea divaricati* (Peinado *et al.* 2008), which gathers tropical deciduous forests and thorny forests and shrubs, distributed in the Xerophytic-Mexican and Caribbean region (*sensu* Rzedowski 1978). Bioclimatically they cover the lower Semiarid ombrotypes (Spiny shrubs), upper Semiarid (Spiny Forests) and Dry (Deciduous Forests); the thermotypes covered are Infratropical and Thermotropical (Macías-Rodríguez *et al.* 2014).

Table 8. Association of: *Stenocereo quevedonis-Cordietum selerianae*

Elevation (m asl)	**315**	**185**	**225**	**328**	**370**
Exposition	**NW**	**NW**	**NNE**	**NNE**	**NE**
Slope steepness (%)	**57.7**	**57.7**	**46.6**	**36.3**	**57.7**
Area (x 10 m2)	**50**	**50**	**50**	**50**	**30**
Tree cover (%)	**75**	**70**	**0**	**70**	**0**
Shrub cover (%)	**60**	**70**	**70**	**50**	**90**
Herb cover (%)	**20**	**30**	**30**	**50**	**70**
Height of vegetation (m)	**10**	**10**	**4**	**10**	**4**
Nº of Species	**40**	**33**	**26**	**31**	**20**
Nº of array	**1**	**2**	**3**	**4**	**5**
Characteristic species					
Cordia seleriana Fernald		2	2	2	3
Stenocereus quevedonis (J.G. Ortega) Buxb.	2	+	1	1	
Apoplanesia paniculata C. Presl	1		2	1	2
Randia capitata DC.	2	1	2		+
Amphipterygium glaucum (Hemsl. & Rose) Hemsl. & Rose	+	+		+	
Salpianthus arenarius Bonpl.	2	1	+		
Companion species					
Eysenhardtia sp.	2	2		3	
Croton sp.	+	+		+	
Pithecellobium sp.	2	+			+
Opuntia sp.	1	1	+		
Erythrina sp.	+		+		
Lonchocarpus eriocarinalis Micheli			+	+	
Amphipterygium adstringens (Schltdl.) Schiede ex Standl.		+		+	
Gliricidia sepium (Jacq.) Kunth ex Walp.	+		+		
Haematoxylum brasiletto H. Karst.	+				+
Lysiloma microphyllum Benth.	+			+	2
Cordia elaeagnoides A. DC.	+		+		
Erythroxylum rotundifolium Lunan	+				1
Bursera trimera Bullock	1		+		
"Pachón"	1		+		
“Acanthacea”	1				+
Bursera sp.		+	1		
Cissus trifoliata L.				1	1
Bursera linanoe (La Llave) Rzed., Calderón & Medina	+	+			
Randia echinocarpa DC.	1	+			
Colubrina heteroneura Standl.	+	1			
Fouquieria Formosa Kunth	1	1			
Mammillaria sp.	1	1			
"Cactácea"	1	2			
"Arbusto"	3	1			
Bursera sarukhanii Guevara & Rzed.			2	2	
Cordia nelsonii I.M. Johnst.			2		3

Species occurring in only one relevé: *Forchhammeria pallida* Liebm. + at 1; *Ziziphus mexicana* Rose + at 1; *Bursera fagaroides* var. *elongata* McVaugh & Rzed. + at 1; *Bursera longipes* Standl. + at 1; *Diphysa* sp. + at 1; *Albizia occidentalis* Brandegee + at 1; *Cordia dodecandr*a DC. + at 1; *Lonchocarpus hintonii*Sandwith + at 1; *Waltheria* sp.1 at 1; *Ipomoea pauciflora* M. Martens & Galeotti 1 at 1; *Tabebuia impetiginosa* Standl. 1 at 1; *Euphorbia fulva* Stapf 1 at 1; Calliandra sp. 1 at 1; *Erythroxylum rotundifolium* Lunan 1 at 1; *Bursera lancifolia* Engl. 2 at 1; *Pseudosmodingium perniciosum* (Kunth) Engl. + at 2; *Opuntia excelsa* Sánchez-Mej. + at 2; *Tillandsia* sp. + at 2; “Agavacea” + at 2; *Hechtia* sp. + at 2; “Leguminosa” + at 2; *Crotalaria* sp. + at 2; *Bursera trifoliolata* Bullock 1 at 2; *Leucaena* sp. 1 at 2; *Senna wislizeni* var. *pringlei* (Rose) H.S. Irwin & Barneby 1 at 2; *Heliocarpus occidentalis* Rose 1 at 2; *Bursera copallifera* (Sessé & Moc.) Bullock 1 en 2; *Plumeria rubra* L. 1 at 2; *Mimosa* sp. 1 at 2; *Caesalpinia platyloba* S. Watson 1 at 2; “Crucífera” + at 3; *Lonchocarpus caudatus* Pittier + at 3; *Eupatorium* sp. + at 3; *Lonchocarpus peninsularis* Pittier1 at 3*; Senna wislizeni* (A. Gray) H.S. Irwin & Barneby 1 at 3; *Waltheria pringlei* Rose & Standl. 1 at 3; *Hintonia latiflora* Bullock 1 at 3; *Hintonia standleyana* Bullock 1 at 3; *Stenocereus* sp. 1 at 3; *Byttneria aculeata* Jacq. 2 at 3; *Mimosa polyantha* Benth. 3 at 3; *Bursera simaruba* Sarg. + at 4; *Bursera paradoxa* Guevara & Rzed. + at 4; *Jacquinia pringlei* Bartlett

+ at 4; *Pachycereus pecten-aboriginum* Britton & Rose + at 4; *Bursera crenata* Paul G. Wilson + at 4; *Ceiba pentandra* (L.) Gaertn. + at 4; *Inga* sp. + at 4; *Verbesina* sp. + at 4; *Vachellia* sp. + at 4; *Ceiba aesculifolia* Britten & Baker f. + at 4; *Cnidoscolus* sp. 1 at 4; "Compuesta" 1 at 4; *Mimosa* sp. 1 at 4; *Phaseolus nelsonii* Maréchal, Mascherpa & Stainier 1 at 4; *Randia malacocarpa* Standl. 1 at 4; *Vitis cinerea* (Engelm.) Millardet 1 at 4; *Crossopetalum managuatillo* (Loes.) Lundell 1 at 4; *Dicliptera* sp. 1 at 4; *Lippia* sp. 1 at 4; *Backebergia militaris* (Audot) Bravo ex Sánchez-Mej. 1 at 4; *Vachellia campechiana* (Mill.) Seigler & Ebinger 2 at 4; *Piptadenia constricta* J.F. Macbr. 2 at 4; *Karwinskia humboldtiana* (Schult.) Zucc. 2 at 4; "espina de rosa" 2 at 4; *Randia aculeata* L. 2 at 4; "Leguminosa" 1 at 5; *Lysiloma* sp. 1 at 5; *Mimosa brandegei* B.L. Rob. 1 at 5; *Croton adspersus* Benth. 2 at 5; *Randia thurberi* S. Watson 2 at 5; *Senn*a sp. 3 at 5.
Localities: 1: Slope, Infiernillo, Arteaga, (18° 21' 13" N,101° 53' 49" W) 2: Side curtain of the Infiernillo Dam, Arteaga (18° 16' 55" N, 101° 53' 46" W) 3: N of Cueramo, Rancho El Canelo, La Huacana (18° 41' 50" N, 101° 49' 32" W) 4: Rancho EL Cuirundal, Arteaga (18° 28' 54" N, 101° 58' 18" W) 5: Road Apatzingán-Cuatro Caminos, 5 km approx. 500 m E of Apatzingán, Apatzingán (19° 04' 29" N, 102° 19' 23" W).

In the absence of more ph ytosociological information of the surrounding territories to the one considered here, the correspondence of the associations described, and its floristic and ecological features, along with the units of higher range with which we propose their following phytosociological classification and phytocenotic diversity array (Table 11).

Discussion

The present research allowed to characterize and to compare attributes such as phenotype, structure, floristic composition, ecological affinities and distribution to define (dis)similarities among association/community. Our outcomes unravel two orders, three alliances and eight associations. The novel phytosociological classification here presented and its related syntaxonomical scheme (Table 11) comprised the choice of the characteristic and exclusive species of each association, its preferred environments and its physiographic and bioclimatic jurisdiction. In addition, one community (*Spondias purpurea* and *Cochlospermum vitifolium*) was described and further detailed floristic surveys must be conducted to eventually name this as a new association.

The first two years of intensive geobotanical survey were not enough to distinguished phenotypic and floristic contrasts among associations but orders. Alliances were further distinguished in the next five years by revisiting areas as well as adding sampling units and deepen on floristic inventories. A few additional years of sampling and long-term phenotypic expressions derived from outstanding dry and wet climatic seasons were crucial to eventually confirm the phytosociological scheme here presented at association level. This is clearly the case of the *Lysilomo acapulcenis-Heliocarpetum terebinthinacei* and *Ceibo aesculifoliae-Lysilometum microphyllae* associations; which phenotypes remain as rather tropical dry on temperate sub-humid or temperate dry climatic conditions accordingly to García (2004). These two associations in wet climatic seasons truly change their physiognomy denoting adaptation attributes such as reducing substantially the proportion of leaves to be dropped in heavily rainy seasons of consecutive years.

Another long-term observation and vegetation affinity concern the *Spondias purpurea* and *Cochlospermum vitifolium* community. Floristically, this community was very consisting throughout the years. Geoedaphical conditions and degree of human disturbance play a role to denote a common physiognomic variation closely related to the vegetation type known as Xerophytic Shrubland.

We regard out outcomes as complete, phyotosociologically, for the Seasonally Dry Tropical Forest of Michoacan. Azonal associations limited by site or local outstanding conditions are yet to be described. There may be a couple more zonal associations yet to be described in neighboring areas with Guerreo and Colima states, especially along costal landscapes. Hernández-Toro (2003) contributes a series of inventories of the area of Cabo Corrientes (Jalisco) linked to the Seasonal Dry Tropical Forest where the dominant tree species present are *Amphipterygium adstringens* (Schltdl.) Standl., *Plumeria rubra* L., *Caesalpinia eriostachys* Benth. and *Lysiloma divaricatum* (Jacq.) Benth. to a lesser extent, among others, *Piranhea mexicana* (Standl.) Radcl.-Sm., *Lonchocarpus luteomaculatus* Pittier, *Pachycereus pecten-aboriginum* Britton & Rose, *Bursera vazquezyanesii* Rzed. & Calderón or *Tabebuia rosea* DC. Although it shares with our inventories some species and a similar structure, they also have in common the great diversity of species in the understory strata, which includes many species present in very few inventories, preventing the establishment of phytosociological similarities with the associations proposed here. It is likely that at the level of order or phytosociological alliance, links can be established. However, the collection of the field information carried out by Hernández-Toro (2003) with inventories by strata and without establishing continuity between them, considerably hinders the phytosociological interpretation of the data. As we have observed, certain changes in environmental conditions favor the transit of this formation towards Spiny Forest and Sub-deciduous Tropical Forest.

Table 9. Association of: *Guazumo ulmifoliae-Cordietum elaeagnoidis*

Elevation (m asl)	**342**	**610**	**495**	**185**	**610**	**595**
Exposition	**NW**	**NE**	**SW**	**SW**	**E**	**E**
Slope steepness (%)	**26.7**	**46.6**	**8.7**	**17.6**	**36.3**	**36.3**
Area (× 10 m²)	**50**	**60**	**40**	**60**	**50**	**60**
Tree cover (%)	**0**	**80**	**50**	**70**	**70**	**80**
Shrub cover (%)	**65**	**40**	**40**	**20**	**30**	**30**
Herb cover (%)	**10**	**25**	**10**	**60**	**20**	**20**
Height of vegetation (m)	**5**	**10**	**7**	**15**	**10**	**10**
Nº of Species	**21**	**26**	**11**	**35**	**11**	**24**
Nº of array	**1**	**2**	**3**	**4**	**5**	**6**
Characteristic species						
Cordia elaeagnoides A. DC.	1	3	3	2	3	3
Lysiloma divaricatum (Jacq.) Benth.	+	3		3		2
Guazuma ulmifolia Lam.	1	2	1	+		
Crescentia alata Kunth	1		+		1	+
Companion species						
Caesalpinia sp.	+	1			1	
Cardiospermum halicacabum L.		+	+			
Bursera sp.	+					1
Opuntia sp.	+					1
Bursera sp. I					1	1
Bursera palmeri S. Watson					2	2
Backebergia militaris (Audot) Bravo ex Sánchez-Mej.					2	2
Acaciella angustissima (Mill.) Britton & Rose var. *angustissima*					1	1
Senna atomaria (L.) H.S. Irwin & Barneby				1		1
Mimosa sp.		1				1
Cordia sp.	1					2
Heliocarpus sp.		2	2			
Vachellia campechiana (Mill.) Seigler & Ebinger		1	2			
Alvaradoa amorphoides Liebm.		1		2		
"Arbusto"	2				2	
Caesalpinia platyloba S. Watson	3					1

Species occurring in only one relevé: *Acanthocereus* sp. + at 1; *Diphysa minutifolia* Rose + at 1; *Prosopis laevigata* (Humb. & Bonpl. ex Willd.) M.C. Johnst. + at 1; *Ziziphus amole* (Sessé & Moc.) M.C. Johnst. + at 1; *Bursera* sp. II + at 1; *Stenocereus quevedonis* (J.G. Ortega) Buxb. + at 1; *Apoplanesia paniculata* C. Presl + at 1; *Pithecellobium acatlense* Benth. 1 at 1; *Haematoxylum brasiletto* H. Karst. 1 at 1 *Cercidium praecox* (Ruiz & Pav. ex Hook.) Harms 2 at 1*; Hoffmannseggia watsonii* Rose 3 at 1; *Tagetes* sp. + at 2; *Calliandra* sp. + at 2; *Tabebuia rosea* DC.+ at 2; "Zapotácea" + at 2; *Bursera* sp. III + at 2; *Bursera* sp. IV 1 at 2; *Casearia* sp. 1 at 2; *Diospyros* sp. 1 at 2; *Bursera* sp. V 1 at 2; "Leguminosa" 1 at 2; *Lasiacis* sp. 1 at 2; *Cochlospermum vitifolium* Spreng.1 at 2; *Aralia* sp. 2 at 2; "Malvácea" 2 at 2; *Viguiera* sp. 2 at 2; *Lonchocarpus* sp. 2 at 2; *Zanthoxylum fagara* Sarg. 2 at 2; *Tetramerium nervosum* Nees 1 at 3; *Lonchocarpus huetamoensis* M. Sousa & J.C. Soto 1 at 3; *Salpianthus arenarius* Bonpl. 1 at 3; *Mimosa spirocarpa* Rose 2 at 3; *Pileus mexicanus* I.M. Johnst. 2 at 3; *Croton* sp. 2 at 3; *Crotalaria pumila* Ortega + at 4; *Cydista aequinoctialis* Miers + at 4; *Entada polystachya* (L.) DC. + at 4; *Euphorbia calyculata* Kunth + at 4; *Hyperbaena ilicifolia* Standl. + at 4*; Ipomoea* sp. + at 4; *Ipomoea* sp.I + at 4; *Ipomoea* sp. II + at 4; *Ipomoea* sp. III + at 4; *Ipomoea* sp. IV + at 4; *Marsdenia astephanoides* (A. Gray) Woodson + at 4; *Neopringlea integrifolia* S. Watson + at 4; *Pithecoctenium crucigerum* (L.) A.H. Gentry + at 4; *Randia laevigata* Standl. + at 4; *Serjania* sp. + at 4; "Compuesta"+ at 4; *Oreopanax echinops* Decne. & Planch. + at 4; *Ipomoea pauciflora* M. Martens & Galeotti + at 4; *Chiococca alba* Hitchc. + at 4; *Ilex brandegeana* Loes. + at 4; *Passiflora* sp. + at 4; *Lantana camara* L. + at 4; *Alloispermum integrifolium* (DC.) H. Rob. 1 at 4; *Annona muricata* L. 1 at 4; *Ficus petiolaris* Kunth 1 at 4; *Senna skinneri* (Benth.) H.S. Irwin & Barneby 1 at 4; *Brosimum alicastrum* Sw. 1 at 4; *Schoepfia* sp. 1 at 4; *Pithecellobium* sp. 2 at 4; *Aphelandra verticillata* Nees 3 at 4; *Brickellia* sp. + at 5; *Pilosocereus* sp. 1 at 5; *Randia* sp. 2 at 5; *Mammillaria* sp. + at 6; *Cordia seleriana* Fernald + at 6; *Lonchocarpus eriocarinalis* Micheli + at 6; *Amphipterygium adstringens* (Schltdl.) Standl. + at 6; *Eysenhardtia* sp. + at 6; *Bursera* sp. VI 1 at 6; *Pilosocereus* sp. 1 at 6; *Piscidia carthagenensis* Jacq. 1 at 6; *Randia nelsonii* Greenm. 1 at 6; *Diphysa* sp. 1 at 6; *Bursera fagaroides* (Kunth) Engl. 1 at 6.

Localities: 1: La Soledad Ranch (El Jabalí), to the East of Apatzingán, Múgica. (18° 58' 49" N, 102° 11' 39" W) 2: ±4 km S of El Carrizo, Coalcomán (18° 59' 51" N, 103° 01' 54" W) 3: Road Apatzingán-Acahuato, Apatzingán (19° 07' 01" N, 102° 19' 47" W) 4: 20 km from Caleta de Campo towards Manzanillo, passing the El Chico Bridge, Aquila (18° 09' 42" N, 102° 53' 32" W) 5: 10 km before Parácuaro, Parácuaro (19° 06' 16" N, 102° 13' 09" W) 6: Pueblo Viejo, ± 5 km N of Buenavista, Buenavista. (19° 15' 31" N, 102° 33' 54" W).

Table 10. Association of: *Lonchocarpo huetamoensis-Cordietum elaeagnoidis*

Elevation (m asl)	**388**	**430**	**332**	**374**	**500**	**513**
Exposition	**N**	**SW**	**N**	**NE**	**N**	**NW**
Slope steepness (%)	**26.7**	**12.2**	**57.7**	**36.3**	**70**	**70**
Area (× 10 m²)	**50**	**50**	**50**	**50**	**50**	**50**
Tree cover (%)	**80**	**70**	**80**	**70**	**80**	**80**
Shrub cover (%)	**60**	**50**	**60**	**70**	**70**	**60**
Herb cover (%)	**20**	**20**	**50**	**50**	**40**	**75**
Height of vegetation (m)	**15**	**10**	**10**	**10**	**10**	**12**
Nº of Species	**30**	**27**	**42**	**39**	**29**	**31**
Nº of array	**1**	**2**	**3**	**4**	**5**	**6**
Characteristic species						
Cordia elaeagnoides A. DC.	2	2	2	2	1	+
Lonchocarpus huetamoensis M. Sousa & J.C. Soto	+		+	1	2	2
Stenocereus quevedonis (J.G. Ortega) Buxb.	1	1	1	+	+	
Tabebuia impetiginosa (Mart. ex DC.) Standl.	+	+		+	+	+
Cyrtocarpa procera Kunth	1	+	1	1	+	
Lysiloma tergeminum Benth.	+			1	2	2
Randia echinocarpa Sessé & Moc. ex DC.		+		1	1	+
Coccoloba acapulcensis Standl.	2	+		1	+	
Companion species						
Lysiloma divaricatum (Jacq.) Benth.	+	+	1	2	1	3
Ceiba aesculifolia Britt. & Baker f.	+			+	1	1
Randia capitata DC.	3	2	3		1	+
Erythrina sp.	+	+		+		
Asclepias sp.	+		+			+
“Malpighiacea”		+			1	+
"Pachón"	1	1	1			
Vitex mollis Kunth	+	1	+			
Karwinskia humboldtiana (Schult.) Zucc.	1		2			
Cordia morelosana Standl.	+		1			
Coursetia sp.	2		2			
		1	+			
Ziziphus amole (Sessé & Moc.) M.C. Johnst.		1	1			
Apoplanesia paniculata C. Presl				1	2	2
Heliocarpus occidentalis Rose				+	+	1
Bursera trimera Bullock				+	1	1
Bursera fagaroides (Kunth) Engl.				1	1	1
Mimosa sp.	1			+		+
Erythroxylum rotundifolium Lunan			+	2	+	
Bursera sp.	1	1			+	
Euphorbia tanquahuete Sessé & Moc.	1	1				2
Hintonia standleyana Bullock			+		2	2

Species occurring in only two relevés: *Quadrella angustifolia* (Kunth) Iltis & Cornejo + at 5 and at 6; *Cochlospermum* vitifolium (Willd.) Spreng. + at 5 and at 6; *Euphorbia cymosa* Poir. 1 at 5 and 2 at 6; *Trichilia hirta* L.+ at 3 and at 5; *Opuntia excelsa* Sánchez-Mej. + at 3 and at 4; *Amphipterygium adstringens* (Schltdl.) Schiede ex Standl. + at 1 and at 3; *Carica mexicana* (A. DC.) L.O. Williams + at 1 and 1 at 4; *Bursera copallifera* (DC.) Bullock + at 4 and 1 at 6; *Plumeria rubra* L. + at 3 and 1 at 5; *Backebergia militaris* (Audot) Bravo ex Sánchez-Mej. + at 2 and 1 at 4; *Lonchocarpus caudatus* Pittier 1 at 4 and + at 6; *Haematoxylum brasiletto* H. Karst. 1 at 1 and at 6.

Species occurring in only one relevé: *Serjania racemosa* Schum. + at 1; *Malpighia mexicana* A. Juss. + at 1; *Crossopetalum managuatillo* (Loes.) Lundell + at 1; Ziziphus mexicana Rose + at 1; *Bonellia macrocarpa subsp. pungens* (A. Gray) B. Ståhl & Källersjö + at 1; *Pithecellobium unguis-cati* (L.) Benth. 1 at 1; *Bursera* sp. I 1 at 1; *Pilosocereus* sp. + at 2; *Carica mexicana* (A. DC.) L.O. Williams + at 2; *Cupania dentata* Moc. & Sessé+ at 2;
Mammillaria sp. + at 2; *Vachellia pennatula* (Schltdl. & Cham.) Seigler & Ebinger + at 2; *Caesalpinia pulcherrima* (L.) Sw. 1 at 2 *Ziziphus sonorensis* S. Watson 2 at 2; *Thouinidium decandrum* Radlk. 2 at 2; *Senegalia picachensis* Britton & Rose 3 at 2; *Bursera* sp. I + at 3; *omphrena pringlei* J.M. Coult. & Fisher + at 3; *Gossypium herbaceum* L.+ at 3; *Ipomoea batatoides* Choisy + at 3; *Leptochloa filiformis* (Pers.) P. Beauv. + at 3; "Mirtácea" + at 3; *Bursera denticulata* McVaugh & Rzed. + at 3; *Bouteloa* sp.+ at 3; *Forestiera phillyreoides* (Benth.) Torr. + at 3; *Cordia seleriana* Fernald + at 3; *Croton* sp. + at 3; *Albizia tomentosa* Standl. 1 at 3; *Heliocarpus* sp. 1 at 3; *Crateva tapia* L.1 at 3; *Bursera coyucensis* Bullock 1 at 3; *Stenocereus chrysocarpus* Sánchez-Mej. 1 at 3; *Pithecellobium leucospermum* Brandegee 1 at 3; *Randia obcordata* S. Watson 1 at 3; *Bursera longipes* Standl. 1 at 3; *Mariosousa acatlensis* (Benth.) Seigler & Ebinger 2 at 3; *Setaria* sp. 2 at 3; "Boraginácea" 3 at 3; *Hintonia latiflora* Bullock + at 4; *Bursera fagaroides var. elongata* McVaugh & Rzed. + at 4; *Swietenia humilis* Zucc. + at 4; *Bursera crenata* Paul G. Wilson + at 4; *Vachellia* macracantha (Humb. & Bonpl. ex Willd.) Seigler & Ebinger + at 4; *Zanthoxylum fagara* Sarg. + at 4; "Acanthácea" 1 at 4; *Bauhinia* sp. 1 at 4; *Capparis flexuosa* (L.) L. 1 at 4; *Karatas plumieri* E. Morren 1 at 4; *Erythroxylum* sp. 1 at 4; *Caesalpinia coriaria* (Jacq.) Willd. 1 at 4; *Euphorbia* sp. 1 at 4; *Pithecellobium* sp. 1 at 4; *Vachellia schaffneri* (S. Watson) Seigler & Ebinger 2 at 4; *Acaciella tequilana* (S. Watson) Britton & Rose + at 5 *Blepharodon mucronatum* (Schltdl.) Decne. + at 5; "Malpighiácea" + at 5; *Dicliptera* sp. + at 5; Mimosa sp. II 3 at 5; *Elytraria bromoides* Oerst. 1 at 6; *Pristimera celastroides* (Kunth) A.C. Sm. 1 at 6; *Cordia dentata* Poir. 1 at 6; *Triumfetta* sp. 1 at 6; "Acanthácea" 1 at 6; *Ruprechtia fusca* Fernald 1 at 6; *Aegopogon* sp. 1 at 6; *Lantana velutina* M. Martens & Galeotti 1 at 6.
Localities: 1: N of Guadalupe Oropeo, La Huacana (18° 49' 29" N, 101° 51' 01" W) 2: Los Cachorros I ranch, Community of Oropeo, La Huacana (18° 49' 32" N, 101° 50' 45" W) 3: La Tarjea ranch, Community of the Ejido Guadalupe Oropeo, La Huacana (18° 46' 45" N, 101° 47' 53" W) 4: El Tumbiriche ranch, Community of Capire de Oropeo, La Huacana (18° 59' 57" N, 101° 48' 40" W) 5: Capire de Oropeo, approx. 3 km from Oropeo, La Huacana (18° 51' 06" N, 101° 49' 18" W) 6: Capire de Oropeo, La Huacana (18° 50' 58" N, 101° 49' 13" W).

The present phytocenotic diversity comprised in the Seasonally Dry Tropical Forest (SDTF) of western Michoacán contrasts with traditional classification schemes (Table 12). Low-height caducifolious jungle (Miranda & Hernandez-X 1963) and Tropical caducifolious forest (Rzedowski 1978) are the most outstanding denominations of the SDTF plant formation. González-Medrano (2003) distinguished three subformations, namely: Low-height caducifolious forest, Tropical dry forest, High succulent spiny scrubland. INEGI (2014), furthermore, in a crucial effort to construct a hierarchical vegetation scheme for the National Forest Inventory distinguished three subformations, namely: Subtropical Scrubland, Low height caducifolious jungle and Single steam succulent scrubland. These four previous classification schemes at national level follow untraceable attributes to define their vegetation classes, levels of aggregation and nomenclature principles. Deep floristic understanding as well as ecological characteristics are the common attributes considered by these authors. Velázquez *et al.* (2016) provided a framework to gain from these previous vegetation schemes and order physiognomic, climatic, phenotypic, botanical and floristic attributes to hierarchically organize and named global vegetation types. A synthetic correspondence of the present phytocenotic diversity comprised in the Seasonally Dry Tropical Forest (SDTF) of western Michoacán and the ones provided by these five previous authors was comprised in Table 12.

Regional studies to further split SDTF do not exist, nor in Jalisco, neither in Guerrero nor Oaxaca states where the same SDTF extends its distribution range. Authors working for decades in Chamela (Bullock *et al.*1995, Burgos & Maass 2004), central Mexico (Trejo & Dirzo 2000) and Puebla (Valiente-Banuet *et al.* 2000) have deepen in the description of floristic aspects of the SDTF plant formation. These studies have focused in documenting the astonishing floristic diversity, rarity and endemicity of plant species harbored in the SDTF plant formation. Valiente-Banuet *et al.* (2000) provided detailed description of plant associations within the SDTF, namely "Cuajiotal", "Izotal", "Mezquital" and their variations within the Tehuacán-Cuicatlan study area. The hardly noticeable dominance of species and the smooth gradient of change in the SDTF has discourage most scholars to formally described distinguishable and discrete plant communities. All the previous authors have chiefly provided the floristic basis to attend the second phase of a sound vegetation study so that plant communities may be soon will be described for the entire distribution range pf the SDTF. In this sense, the present contribution may serve as a guideline to advance in the pending task concerning the complete inventory of plant communities contained in the Mexican SDTF.

At the local level, these communities present different dynamic stages, often interspersed, resulting from the unequal incidence of human activities, especially the extraction and those associated with grazing, leading to the establishment of a continuous decline in space (Burgos & Maass 2004). This disturbance hinders the discrimination of these communities using images obtained by remote sensing. Several authors say that more than 80 % of the current area has been or is used for migratory cultivation and extensive livestock production (Trejo & Dirzo 2000, Sánchez-Azofeifa *et al.* 2005a, 2005b, 2014). This incidence in the conservation state is reflected, in some of our inventories, in the dominance of indicator species, especially in the shrub stratum, in addition to the presence

of obvious signs such as stumps, sprouts or cattle trails. The knowledge of the successional dynamics of these forests, and the incidence and degree of disturbance they present, is essential for the development of preservation strategies (Burgos & Maass 2004, Quesada *et al.* 2009). Although the local inhabitants constitute the moving force behind such a situation, the underlying triggers and the controllers responsible for the current state of the SDTF have not been determined. Castillo *et al.* (2005) blame the model of agricultural invasion promoted by the Mexican government for decades, with the aim of seeking the expansion of profitable uses of the land. The alternative social explanation points to recurrent patterns of extreme poverty, inequality of opportunities, organized drug cartels, and the general lack of governability. In our opinion, these socioeconomic factors are probably the most important underlying forces that cause the disturbance of the SDTF.

In short, most Mexican SDTF are disturbed and their use for production and conservation are contested management alternatives. The productive use of the land is important to reduce poverty and inequity, while conservation is a priority since the SDTF represents a real genetic bank. However, the extraction of wood is technically absent since the few species of trees with commercial value (for example the genera *Bursera*, *Cordia*, *Heliocarpus*, *Ipomoea*, *Lonchocarpus*, *Lysiloma*, *Tabebuia*) are not profitable nor worth investing in.

Systematic studies of plant communities comprised in Seasonally Dry Tropical Forest is yet a pending task, globally. “Caatinga” and “Cerrado” in Brazil; “Bosque Bajo Andino” and “Bosques costeros del Caribe” in Colombia and other local nomenclature used for similar ecosystems in Africa and Asia are simple examples of the relevance of adopting a unifying framework to classify and name plant communities of this most threaten ecosystems. The present contribution was largely slow-down by the lack of complete floristic inventories and the biased geographic distribution of the floristic surveys. Semi-desertic conditions prevailed for most of the year and when rains fall, these are heavy, short, and catastrophic in most valleys. It was therefore that we needed over 20 years to make sure that our associations exist. We trust that further studies and especially public environmental policies to consider the outstanding phytocenotic diversity comprised in the Seasonally Dry Tropical Forest. This ecosystem looks homogenous, species- poor, resourceless, and unpleasant in the dry season but it is rather heterogenous, species-rich, resourceful and fascinating in the rainy season.

Table 11. Phytosociological classification and syntaxonmy of the orders, alliance, associations and community as derived from the present study. The present schem fits within the *PACHYCEREO PECTEN-ABORIGINI - LYSILOMETEA DIVARICATI* Class (Peinado *et al.* 2008).

Order	**Alliance**	**Association/community**
Lysilometalia acapulcensis ordo novo	*Lysilomo acapulcensis - Ipomoeion murucoidis* allianza nova	*Lysilomo acapulcensis -Heliocarpetum terebinthinacei* associatio nova
		Ceibo aesculifoliae - Lysilometum divaricate associatio nova
Cordietalia elaeagnoidis ordo novo	*Lysilomo divaricatae - Cordion elaeagnoidis* allianza nova	*Guazumo ulmifoliae - Cordietum elaeagnoidis* associatio nova
		Caesalpinio platylobae - Cordietum elaeagnoidis associatio nova
		Cochlospermo vitifolii - Lueheetum candidae associatio nova
		Lysilomo divaricatae - Cordietum elaeagnoidis associatio nova
		Spondiax purpurea - Cochlospermum vitifolium community
	Stenocereo quevedoni - Cordion elaeagnoidis allianza nova	*Stenocereo quevedonis - Cordietum selerianae* associatio nova
		Guazumo ulmifoliae - Cordietum elaeagnoidis associatio nova
		Lonchocarpo huetamoensis - Cordietum elaeagnoidis associatio nova

Table 12. Present phytosociological classification scheme as derived from this article and affinity with traditional classification proposals of the Seasonal Dry Tropical Forest of Mexico. Authors are listed chronologically. Name of traditional classification of veegtaion types were kept in Spanish in order to avoid inprecise translations.

Phytosociological scheme	Miranda & Hernández X. (1963)	Rzedowski (1978)	González-Medrano (2003)	INEGI (2014)	SECLAVEMEX (Velázquez *et al.* 2016)
Lysilomo acapulcenis - Heliocarpetum terebinthinacei ass. nova	Selva baja caducifolia	Bosque tropical caducifolio	Bosque tropical bajo caducifolio	Matorral subtropical	Bosque templado seco caduco lati-microfoliado de *Heliocarpus y Lysiloma*
Ceibo aesculifoliae - Lysilometum microphyllae ass. nova				Selva baja caducifolia	Bosque templado subhúmedo/ tropical seco caduco micro-latifoliado de *Lysiloma*, *Zanthoxylum* y *Ceiba*
Caesalpinio platylobae - Cordietum elaeagnoidis ass. nova			Bosque tropical seco		Bosque tropical seco caduco latifoliado de *Cordia*, *Caesalpinia* y *Apoplanesia*
Cochlospermo vitifolii - Lueheetum candidae *ass. nova*			Bosque tropical bajo caducifolio		Bosque tropical seco caduco latifoliado de *Luehea*, *Lysiloma* y *Cochlospermum*
Lysilomo divaricatae - Cordietum elaeagnoidis *ass. nova*					Bosque tropical seco caduco latifoliado de *Cordia*, *Lysiloma* y *Cochlospermum*
Community of *Spondias purpurea* and *Cochlospermum vitifolium*			Bosques tropicales secos		Bosque tropical seco caduco latifoliado de *Cochlospermum*, *Spondias* y *Arrabidaea*
Guazumo ulmifoliae - Cordietum elaeagnoidis ass. nova			Bosque tropical bajo caducifolio		Bosque tropical seco caduco lati-microlatifoliado de *Cordia*, *Lysiloma* y *Guazuma*
Lonchocarpo huetamoensis - Cordietum elaeagnoidis *ass. nova*					Bosque tropical seco caduco latifoliado subinerme de *Cordia, Stenocerus, Cyrtocarpa* y *Lonchocarpus*
Stenocereo quevedonis - Cordietum selerianae *ass. nova*	Cardonales, tetecheras, etc.	Matorral xerófilo	Matorral alto crasicaule espinoso	Matorral sarco-caule	Matorral tropical seco caduco subinerme latifoliado de *Cordia*, *Stenecereus*, *Cyrtocarpa* y *Lonchocarpus*

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