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CENTRAL AMERICAN ECOSYSTEMS MAP
ECOSYSTEM DESCRIPTIONS

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OBJECTIVE AND METHOD

The present document lists the descriptions of the ecosystems as observed in the field and mapped on the map of the "Ecosystems of Central America". The descriptions cover all structural classes of the map. Sub-divisions are listed when appropriate. Some small aquatic ecosystems have been described even though they were too small to appear on the scale 1:250,000 map.

The descriptions combine information of the database with professional knowledge of the participating scientists and literature. The participating scientists filled out standardised description forms of each ecosystem in their country. Next the information of the different countries was combined and completed with information from the database and literature from each country. The combined information is presented in this document.

In part, aquatic ecosystems have been dealt with somewhat differently. Many lakes are briefly described individually. For aquatic ecosystems zoological information is essencial, given the circumstances that they represent the most visible biological elements of open water ecosystems.

It is important to take note that it was not the intention of the authors to pretend that these descriptions are final and based on statistical scientific analysis. The objective of this document is to initiate a process of description development based on scientific data. By ordening and describing existing knowledge - where possible in combination with the recently collected data of the database - the authors hope to direct the users in what to expect in the field and into the efficient collection of field data. Researchers may consult the the relevant descriptions before going into the field and observe to which extend the descriptions are correct and what needs adaptation or completion. It is hoped that such focussed field analyses may lead to more focussed data entry in the database and that the information in the database gradually improves so that descriptions may be based on ample field data.

DESCRIPTIONS

	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE AND MAP CODE	**IA1a(1)(a) / 1, 1-1, 1-2, 1-VG, 1-ZA, 1-CG, 1-VT, 1-C, 1-ST**
NAME	**Tropical evergreen broad-leaved lowland forest, well-drained (1)** **Bosque tropical siempreverde latifoliado de tierras bajas, bien drenado (1)**
PHYSICAL CONDITIONS	
ECOSYSTEM DYNAMICS	
GEOLOGY	Belize: C, ST, VT: Non-calcareous substrate. Nicaragua: Hills with tertiary sediments.
CLIMATIC CONDITIONS	Belize: C, ST, VT: In the south of Belize, average precipitation between 2,500- 4,000 mm a year, with a dry season from February to May. Nicaragua: Average precipitation 1,800-3,400 mm a year, with average temperatures between 24-26°C with 80% humidity.
FIRE EXPOSURE	Belize: C: Not known. VT: Under pressure from burning Pine may enter this vegetation type. VT: Not known. Nicaragua: Fire not significant in this ecosystem.
SPECIAL CONDITIONS	Belize: 0- 500 m. C : Variant *Calophyllum*. Usually high forests in the wetter part of south Belize. ST: Variant *Simarouba – Terminalia*. VT: Variant *Vochysia-Terminalia*: Found in the wetter parts foothills of the Maya Mountains.
SOIL CHARACTERISTICS	
SOIL TYPE	Belize: C: Soils non-calcareous, in the high parts of Tolado. Susceptible to erosion. ST: Soils, Sandy Clays with stones. VT: Soils Stony clays, non-calcareous; subsoil with gravel mixed with iron oxides. In Nicaragua: Soil Clay, well-drained, undulating or rugged, soils: Alfisols and Ultisols, metamorphic and sedimentary in lower areas. Costa Rica: IA1a(1)(a)- VG/ Terraba: Over Latosols, soil from marine

	sediments and some Inceptisols, to 800 m. IA1a(1)(a)- ZA (Atlantic Zone). Latosols, reddish brown, deep with volcanic ash; somewhat acid, a mix of alluvial and volcanic substrate. IA1a(1)(a)- CG (17.1): Substrate of volcanic origin, lava fields, rugged with slopes of between 15 and 60% as well as Ultisols. Honduras: Tawahka: Honduras shows how the vegetation varies according to soil conditions in a ecosystem of this type, see Table 1.
Soil color	Belize: ST: Reddish brown or gray VT: Gray Nicaragua: Ochre brown, Reddish brown, red, and the same but darker when organic material accumulates.
Cover mineral soil	The mineral layer can be deep, generally more than 1 m, sometimes in altered ecosystems mineral panning can occur.
Cover and nature organic matter	Generally with high concentrations of organic material in the superficial horizon, arising from decaying leaves twigs and trunks decomposed by insects and fungi.
Cover rock	Its rare to find superficial rocks, and then only on the hill sides.
WATER REGIME	
Moist regime	Belize: Well-drained. Nicaragua: Humid to very humid, in areas close to rivers brooks and streams. In low laying areas with undulating or broken terrain (0-300 m) but always well-drained.
Water cover	In the previously mentioned areas after heavy rains its possible to find areas inundated for short periods.
VEGETATION DATA	
Species	Evergreen trees to 30 m in height, crowns that intertwine (canopy cover >75%). Immature trees (< 5m.) common in the undergrowth. The canopy always with foliage though some individuals might loose their leaves for a few weeks. Buds with little or no protection from the cold or drought. Leaves with pointed appendages (drip points). Various quick growing species, some up to 50 m in height, generally with soft bark and buttresses. The undergrowth is sparse predominantly of seedlings; though also some palms shrubs and vines and especially false climbers (germinate in the branches and grow down to the ground). In lowlands, the

vascular epiphytes are more abundant, especially where mists are present, for example close to the coast. Crustate Lichens blue-green algae are also found as epiphytes. When this forest type has been intervened [IA1a(1)(a)-2], some of the timber species might be missing.

Agudelo (1987) describes this ecosystem for Honduras, but for a much wider range of climatic and altitudinal conditions (includes evergreen moderately drained, evergreen well-drained, evergreen submontane, seasonal evergreen moderately well-drained, seasonal evergreen well-drained and seasonal evergreen submontane): The Very Humid Subtropical forest; bmh-S; 0- 1,000 m; 2,000-4,000 mm; 18- 24° C; 1- 3 months dry season, sometimes with no apparent dry season. Soils infertile, evergreen or seasonal evergreen, dense high forest, trees diverse, vigorous, trunks thick, straight usually smooth high branches buttresses and aerial roots, narrow evergreen crowns, complex stratification though not always recognizable, canopy closed at 25-30 m, emergents to 40 m. Epiphytes common (orchids, bromeliads, aráceae, ferns and mosses); the climbers and vines are well developed; some deciduous species such as *Tabebuia guayacan* and *Vochysia hondurensis*. Abundant tree ferns (*Cyathea*) and palms (*Bactris, Astrocaryum, Chamaedorea*) generally occupying the undergrowth though some reach the canopy. Its possible to find Pines broad-leaved species dominate.

Co-dominant species

Socratea exorrhiza, Guatteria spp., *Licania* spp., and *Mouriri* spp. and *Bursera simarouba*.

Frequent species

Agudelo (1987) In Honduras: Anacardiaceae: *Mauria sessiflora, Dydimopanax morotoni, Tabebuia guayacan, Cordia alliodora, Cordia gerascanthus, Cynometra retusa, Zollernia tango, Calophyllum brasiliensis, Symphonia globulifera, Terminalia amazonia, Curatella americana, Hieronyma alchornoides, Dalbergia tucurensis, Pterocarpus officinalis, Vatairea lundelli, Magnolia yocoronte*, redondo; *Cedrela odorata, Swietenia macrophylla, Schizolobium parahybum, Brosimum alicastrum, Castilla elastica, Castilla tunu, Virola guatemalensis, Virola koschnyi, Huertea cubensis, Sterculia mexicana, Ampelocera hottlei, Vochysia hondurensis.*

In Nicaragua amongst the most frequent trees: *Inga* spp., *Luehea seemannii, Cecropia obtusifolia, Ficus* spp., *Calophyllum brasiliense var. rekoi, Pentaclethra macroloba, Dialium guianense, Manilkara zapota, Xylopia sericophylla, Symphonia globulifera, Vochysia ferruginea, Guarea guidonea, Vochysia guatemalensis, Dipterix*

panamensis, Ceiba pentandra, Bursera simarouba, Spondias mombin, Virola koschnyi, Sloanea spp., *Clusia flava*.

Costa Rica:
IA1a(1)(a)- VG/ Terraba:
Ardisia spp., *Aspidosperma myristicifolia, Astrocaryum alatum, Caryocar costaricense, Coccoloba padiformis, Coccoloba standleyana, Coccoloba tuerckheimii, Cordia gerascanthus, Cryosophila guarara, Eleagia auriculata, Genipa americana, Gustavia angustifolia, Jacaratia costaricensis, Socratea* spp. Above 800 m 28.2 (submontane) of a similar composition.

IA1a(1)(a)- ZA (Atlantic Zone):
(34.1): *Anacardia excelsum, Astronium graveolens, Bursera simaruba, Calophyllum brasiliensis, Chimarris latifolia, Cordia alliodora, Ocotea palmana, Sloanea terniflora, Ceiba pentandra, Virola* spp.
(37.1): *Achras zapota, Alchornea costaricensis, Anaxagora costaricensis, Calophyllum brasiliensis, Casearia arborea, Dussia macroprophyllata, Hirtela racemosa.*
(38.1): *Lecythidaceae, Aspidosperma megalocarpum, Dialium guianense, Hasseltia floribunda, Ocotea* spp., *Ormosia* spp., *Pouteria* spp., *Quarirabea parvifolia, Tetragastris panamensis*

IA1a(1)(a)- CG: *Bertiera guianensis, Dalbergia excelsa, Drypetes lateriflora, Inga* spp., *Maytenus schippii, Ocotea* spp., *Persea palida, Licania hypoleuca, Picramnia quaternaria, Randia armata.* The Ultisol forest has a undergrowth similar to the volcanic soils but less species rich.

In Panamá (L.Berger Int.Inc., ANAM & CBMAP, 2,000) reports: *Anacardium excelsum, Virola* spp. *Vochysia ferruginea, V. hondurensis, Pouteria* spp., *Sloanea* spp., *Eschweileria* spp., *Carapa guianensis, Symphonia globulifera* and *Manilkara zapota.*

TREE STRATUM

Tree hight

Belize
C: 20- 30 m.
ST: 15- 25 m.

Nicaragua: 30-35 m high;
In Panama its reported that the forest canopy can reach 50 m.

Canopy cover

Belize: Closed.

	Nicaragua: 75 to 80%.
Canopy morphology	Evergreen ombrophyllous. Intertwining crowns, from 1 to 3 strata, in the second and third strata its possible to find palms.
Leaf phenology	Evergreen.
Vines	Belize VT: present. Nicaragua: Some vines, generally woody.
Arboreal palms	Belize: C: *Attalea cohune* ST: *Attalea cohune* VT: *Euterpe precatoria* Nicaragua: the most frequent palms are: *Attalea butyracea, Asterogyne martiana, Acoelorrhaphe wrightii, Socratea exorrhiza,* and *Bactris* spp. In Panama its mentioned that on the coastal lowlands there is an abundance of palms.
Tree ferns	Belize: C: Some. ST: *Cyathea* spp. VT: Yes.
Drapery epifytes	Nicaragua: *Epiphyllum spp*., *Columnea spp*., *Maxillaria spp*.
Sessile epifytes	Belize: VT: Few C: Some ST: Some Nicaragua: Many hydrophiles, leaves smooth and accumulate water in the central groove. Amongest them: *Guzmania* spp., *Aechmea spp, Anthurium* spp., *Epidendrum* spp., *Bulbophyllum* spp., *Sobralia* spp.
Climbing epifytes	Philodendron spp., Syngonium spp.
SHRUB STRATUM	Diferentes *Miconia* spp., *Cespedesia macrophylla, Isertia haenkeana, Piper* spp., *Quassia amara, Psychotria* spp, *Cephaelis* spp., *Acisanthera bivalvis and Casearia* spp. Panama: The undergrowth is dense with a large number of shrubs and leaf litter.
Lower height	Generally de 1.5 m
Upper height	3 m.
Canopy cover	Less than 25% in mature forests. Branches not very dense stems with out bark. Saplings abundant (brinzals and latizals).
Acaule palms	Belize: ST: Includes *Astrocaryum mexicanum* VT: Many, including *Astrocaryum mexicanum*

	Nicaragua: Few in some humid areas, *Geonoma* spp. and *Cardulovica* spp.
Herbaceous cover (herbs considerably taller than 1.5M)	Frequent, including: *Heliconia* spp,. *Costus* spp., *Maranta* spp.
Leaf morphology	Broad-leaved glabrous or with some hairs.
Shrub phenology	Evergreen.
Tall herbs periodicity	Evergreen.
GROUND STRATUM	Amongest the most frecuently encountered herbs are: *Piper* spp., *Psycotria* spp., *Polypodium* spp. and *Adiantum* spp. some *Marantas* spp.
Overall herbaceous cover of the ground stratum	Up to 50% cover
Graminoids cover	Very few.
Forbes cover (including juvenile trees and acaule palms)	40%
Cover of inferior cryptogamytes (no ferns)	Ferns and terrestrial Selaginaceae. Mosses, epiphytic lichens on trunks and stones.
Acaule palms cover	Less than 5%
FAUNISTIC OBSERVATIONS	Villa (1972) mentions the following species of amphibians for this ecosystem in Nicaragua: *Gymnopis multiplicata proxirna, Hyla phlebodes, Oedipina collaris, Oedipina cyclocauda Smilisca puma, Bufo coniferus, Bufo haetmatiticus, Dendrobates auratus, Gastrophryne pictiventris, Hyla elaeochroa, Hyla rufitela, Agalychnis saltator, Rana palmipes, Hyla boulengeri, Leptodactylus pentadactylus, Centrolenella fleischmanni, Agalychnis callidryas, Eleutherodactylus bransfordii, Eleutherodactylus cerasinus, Eleutherodactylus fitzingeri, Eleutherodactylus gollineri, Eleutherodactylus rugulosus, Eleutherodactylus talamancae, Eteutherodactylus mimus, Eteutherodactylus rugosus, Bufo valliceps, Hyla ebraccata, Smilisca phaeota, Eleutherodactylus noblei, Rana pipiens.*
OTHER OBSERVATIONS	In Nicaragua: There exists a study of the regeneration of this ecosystem after hurricanes (Vandermeer, Michigan State University).
LITERATURE	VT: Wright et al. 1959: 12,12a,12b; Iremonger and Brokaw 1995: I.2.3.3.2. C: Wright et al. 1959: 8, 8a, 8b, 8c, Iremonger and Brokaw 1995: I.2.3.3.3. ST: Stevenson 1942, Brokaw 1991, Meerman 1999a, Wright et al. 1959: 9, 9a, 9b, 9c, 9d, 9e, Iremonger and Brokaw 1995: I.2.3.3.4.

CHARACTERISTICS	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1a(1)(a)K / 2-r, 2-s**
NAME	**Tropical evergreen broad-leaved lowland forest, well-drained on karstic hills (2)** **Bosque tropical siempreverde latifoliado de tierras bajas, bien drenado en colinas cársticas (2)**
PHYSICAL CONDITIONS	
ECOSYSTEM DYNAMICS	Ancient.
GEOLOGY	Over Calcareous rocks.
CLIMATIC CONDITIONS	Found in the 2,500 - 4,000 mm annual rainfall areas with a dry season from February through May.
FIRE EXPOSURE	K-s: Fires can do tremendous damage to this vegetation type. Wild fires become hotter as they creep up the slopes and often completely destroy the trees on the tops of the hills. Additionally, the soils on these hills are very shallow. Once the forest is destroyed, these soils very quickly erode, and it is very difficult for a forest to re-establish itself. The vegetation of such hilltops is then replaced by vines such as *Bidens squarrosa* and *Calea* spp. or more commonly with the fern *Pteridium caudatum*.
SOIL CHARACTERISTICS	
SOIL TYPE	K-r: Clays over limestone. K-s: Clay. Soils may be extremely organic due to the leaching of the mineral soil and the build-up of organic matter in the limestone cracks and fissures.
Soil color	K-r: Dark. K-s: Brown.
Cover mineral soil	K-s: Generally low. The amount of mineral soil can be very limited.
Cover and nature organic matter	K-r: Usually a well developed organic layer. K-s: Usually a well developed organic layer, there is a strong build-up of organic matter in the limestone cracks and fissures.
Cover rock	K-r: Some protruding rock but generally less than 10% K-s: Extensive.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	K-r: Found in rolling terrain. These forests are distinguished by topography because there are distinct differences between the less well-drained lowland forests and those covering the hills. These forests display characteristics intermediate between lowland tropical

forests and the submontane forests of higher altitudes. Due to the prolonged dry season there is some drought stress, but deciduousness is not a pronounced feature.

K-s: Found in steep terrain over calcareous rocks, often where there is more non-vegetated ground surface, particularly bare rock. Altitude is less important than steepness and the vegetation cover is dictated by the seasonal droughts.

Species

Frequent species

K-r: Common woody plants are: *Ampelocera hottlei, Aspidosperma megalocarpon, Attalea cohune, Bauhinia guianensis, Brosimum alicastrum, Calophyllum brasiliense, Calyptrogyne ghiesbrechtiana, Castilia elastica, Cedrela odorata, Chamaedorea oblongata, Croton glabellus, Crysophila stauracantha, Cymbopetalum mayarum, Diallium guianensis, Guarea glabra, Hirtella americana, Licaria peckii, Lonchocarpus castilloi, Lonchocarpus guatemalensis, Manilkara zapota, Sideroxylon foetidissimum, Ouratea lucens, Peperomia spp., Pimenta dioica, Pouteria amygdalina, Pouteria durlandii, Rinorea* spp., *Sabal mauritiiformis, Schizolobium parahybum, Sebastiana tuerckheimiana, Spondias mombin, Talisia olivaeformis, Talisia floresii, Tabebuia rosea, Terminalia amazonia, Trichilia minutiflora, Trichilia moschata, Vatairea lundellii.* Rubiaceae of the genus *Psychotria* are abundant in the shrub layer.

K-s: Distinctive species include: *Acalypha* spp., *Achimenes erecta, Alseis yucatenensis, Aphelandra scabra, Astronium graveolens, Bauhinia divaricata, Bernoullia flammea, Brosimum* spp., *Bursera simaruba, Ceiba aesculifolia, Clusia* spp., *Coccoloba acapulcensis, Crysophila stauracantha, Dendropanax arboreus, Desmoncus orthacanthos, Drypetes brownii, Louteridium donnell-smithii, Manilkara zapota, Malmea depressa, Metopium brownei, Oreopanax obtusifolius, Pimenta dioica, Piper psilorrhachis, Piper spp., Plumeria rubra, Pouteria campechiana, Pouteria reticulata, Protium copal, Pseudobombax ellipticum, Sapindus saponaria, Sebastiania tuerckheimiana, Trichilia minutiflora and Vitex gaumeri.*

TREE STRATUM

Tree hight

K-r: 15–40 m.
K-s: 15-35 m.

Canopy cover

Canopy closed

Canopy morphology

Broad-leaved ombrophyllous.

Leaf phenology	Evergreen. Because of the high rainfall figures, deciduousness is not a conspicuous feature even on these steep hills.
Vines	Lianas are frequent but especially so after disturbance.
Arboreal palms	K-r: Frequent. In Belize the most common palms in this vegetation type are *Attalea cohune, Crysophila stauracantha* and *Sabal mauritiiformis*. K-s: Infrequent.
Tree ferns	None.
Drapery epifytes	Uncommon.
Sessile epifytes	Frequent but never reaching high densities.
Climbing epifytes	Frequent. Often Cacti.
SHRUB STRATUM	
Lower height	3 m.
Upper height	4 m.
Acaule palms	Understory palms such as *Calyptrogyne ghiesbrechtiana* and *Chamaedorea oblongata* are common.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	Variable but groundcover often well developed.
LITERATURE	K-r: Brokaw & Lloyd-Evans 1987, Iremonger & Sayre 1994, Meerman 1998b, Wright et al. 1959; Iremonger and Brokaw 1995. K-s: (Brokaw & Lloyd-Evans 1987, Iremonger & Sayre 1994, Meerman 1998b, 1999a, c, Hawkins et al. 1998, Schultze and Whitacre 1999, Wright et al. 1959.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1a(1)(b) / 3, 3-2, 3-PN, 3-VG, 3-ZA**
NAME	**Tropical evergreen broad-leaved lowland forest, moderately drained (3)** **Bosque tropical siempreverde latifoliado de tierras bajas, moderadamente drenado (3)**
PHYSICAL CONDITIONS	Nicaragua: Forest.
GEOLOGY	Nicaragua: Between 0-200 m, on undulating terrain or lowland plains of alluvial origin. Substrate sedimentary. .
CLIMATIC CONDITIONS	Nicaragua: Average precipitation between 2,500-3,000 mm a year, relative humidity 90% and average temperature between 26-30 °C.
FIRE EXPOSURE	Nicaragua: Only small fragments cut over, or burned, for agriculture generally near rivers on alluvial soils.
SOIL CHARACTERISTICS	
SOIL TYPE	Nicaragua: Soils Ultisols clay, with poor drainage.
Soil color	Nicaragua: Reddish or blackish, the last with abundant organic matter.
Cover mineral soil	Nicaragua: In disturbed areas with forest regeneration lateritic horizons are found.
Cover rock	Nicaragua: It is rare to find areas with rocks at the surface.
WATER REGIME	
Moist regime	Nicaragua: In the wet season very humid, areas close to rivers and lagoons might contain standing water and small marshes.
VEGETATION DATA	
Species	Nicaragua: The neighbor of evergreen well-drained forest that's present on more undulating ground. Similar floristic components though with species adapted to the poor drainage conditions [IA1f(2)].
Frequent species	Nicaragua: Amongst the most frequent trees: *Inga* spp., *Luehea seemannii, Cecropia obtusifolia, Ficus* spp., *Calophyllum brasiliense* var. *rekoi, Pentaclethra macroloba, Dialium guianense, Xylopia sericophylla, Symphonia globulifera, Vochysia ferruginea, Guarea guidonea, Vochysia guatemalensis, Dipterix panamensis, Ceiba pentandra, Guatteria* spp., *Bursera simarouba, Spondias mombin, Virola koschnyi* and *Clusia flava, Lecythis ampla, Cecropia obtusifolia, Dypterix panamensis, Dialium guianensis, Carapa guianensis, Hyeronima* spp., *Lacmellea panamensis, Enterolobium*

shomburkii, Achras sp, Guettarde spp., *Inga* spp., *Xylopia* spp., *Ormosia* spp., *Tetragastris panamensis, Swetenia macrophylla, Zuelania guidonia, Vismia* spp.

Costa Rica:
Valley general (VG): acording to Gómez (1986) this ecosystem contains: *Achras zapota, Alchornea costaricensis, Anacardium excelsum, Andira inermis, Apeiba aspera, A. tibourbou, Aspidosperma megalocarpum, Billia colombiana, Brosimum alicastrum, B. Terrabanum, B. Utile, Bursera simaruba, Catola costaricense, Calophyllum brasiliense, Carapa guianensis, Cariniana pyriformis, Castilla elastica, Ceiba pentandra, Chimarris latifolia, Coccoloba standleyana, Compsoneura sprucei, Couratari panamensis, Cymbopetalum costaricense, Dussia cuscatlanica, Ficus nymphaefolia, Grias fendleri, Guarea* spp., *Hernandia sonora, Hieronyma alchornoides, Hymenaea courbaril, Inga coruscans, Lacistema aggregatum, Lacmellea panamensis, Lonchocarpus* spp., *Minquartia guianensis, Pachira aquatica, Parkia pendula, Peltogyne purpiurea, Pithecolobium arboreum, Platymiscium pinnatum, Pourouma aspera, Pouteria neglecta, Protium* spp., *Qualea paraensis, Rheedia madruno, Saccoglottis amazonica, Sapium* spp., *Schizolobium parahybum, Sloanea laurifolia, Sterculia recordiana, Swartzia simplex, Symphonia globulifera, Tachygalia versicolor, Talisia nervosa, Terminalia amazonia, T. bucidolies, Tococa grandifolia, Trattinickia* spp., *Vantanea barbouri, Virola* spp., *Vochysia ferruginea, V. Hondurensis, Welfia georgii*.

Atlantic Zone (ZA): As well as the species mentioned for the pacific side also: *Allophylus psilospermus, Anaxagorea costaricensis, Astrocaryum alatum, Brosimum panamense, Capparis pittieri, Carpotroche platyptera, Casearia spp, Cespedezia macrophylla, Cynometra retusa, Dendropanax arboreus, Gloeospermum diversipetalum, Hedyosmum calloso-serratum, Hernandia didymantha, Jacaratia* spp., *Laetia procera, Lecythis costaricensis, Mortoniodendron membranaceum, Pentaclethra macroloba, Protium spp, Sloanea medusula, Sterculia apetala, Stryphnodendron excelsum, Tomovita nicaraguensis, Veconcibea pleiostemona* (Gómez, 1986).

TREE STRATUM

Tree hight Nicaragua: 25-30 m.

Canopy cover Nicaragua: 75-80%.

Canopy morphology	Nicaragua: crowns intertwining, can have 2 to 4 strata.
Leaf phenology	Nicaragua: Evergreen, glabrous or with dispersed hairs.
Vines	Nicaragua: Woody and herbaceouse such as: *Bauhinia guianensis, Passiflora quadrangularis, P. vitifolia*
Arboreal palms	Nicaragua: The most frequent palms are: *Attalea butyracea, Asterogyne martiana, Acoelorrhaphe wrightii and Astrocaryum alatum, Bactris hondurensis, Reihardtia latisecta, Prestoea decurrens*.
Tree ferns	Nicaragua: They have been observed but are rare.
Sessile epifytes	Nicaragua: *Aechmea* spp., *Anthurium* spp.,
Climbing epifytes	Nicaragua: *Philodendrum* spp., *Syngonium* spp., *Anthurium* spp.
SHRUB STRATUM	Nicaragua: Between shrubs and herbs the most frequent are: *Miconia* spp., *Cespedesia macrophylla, Isertia haenkeana, Piper* spp., *Cephaelis* spp., *Acisanthera bivalvis, Casearia* spp., *Quassia amara, Psychotria aubletiana.*
Lower height	Nicaragua: 1.5 m.
Upper height	Nicaragua: 3.0 m.
Canopy cover	Nicaragua: 20-30%
Acaule palms	Nicaragua: *Geonoma* spp., *Cyclanthus bipartitus, Zamia* spp. (the last 2 similar to the palms*).*
Herbaceous cover (herbs considerably taller than 1.5M)	Nicaragua: *Carica pennatula, Renealmia cernua, Costus* spp., *Heliconia* spp.
GROUND STRATUM	Nicaragua: *Psychotria* spp., *Maranta* spp., *Adiantum* spp., *Polypodium* spp. *Piper* spp.
Overall herbaceous cover of the ground stratum	Nicaragua: 40-50%
Graminoids cover	Nicaragua: Almost absent.
Forbes cover (including juvenile trees and acaule palms)	Nicaragua: 30-35%.
Cover of inferior cryptogamytes (no ferns)	Nicaragua: Ferns and terrestrial Selaginaceae. Mosses epiphytic lichens on trunks and rocks.
Acaule palms cover	Nicaragua: 10%
Predominant periodicity of herbaceous cover	Nicaragua: Evergreen.
FAUNISTIC OBSERVATIONS	Nicaragua: Various insects have been observed (Dipteros, Coleópteros, Formícides, Hymenopteros, Lepidopteros), as well as frogs and hummingbirds. This is the territory of the white lipped and ringed Peccary, Tapir and Jaguar, though they are difficult to see. Parrots, Macaws and Toucans are common. Villa (1972) mentions the following species of amphibians this ecosystem in Nicaragua: *Gymnopis multiplicata proxirna, Hyla phlebodes, Oedipina collaris,*

Oedipina cyclocauda, Smilisca puma, Bufo coniferus, Bufo haetmatiticus, Dendrobates auratus, Gastrophryne pictiventris, Hyla elaeochroa, Hyla rufitela Fouquette, Agalychnis saltator, Rana palmipes, Hyla boulengeri, Leptodactylus pentadactylus, Centrolenella fleischmanni, Agalychnis callidryas, Eleutherodactylus bransfordii, Eleutherodactylus cerasinus, Eleutherodactylus fitzingeri, Eleutherodactylus gollineri, Eleutherodactylus rugulosus, Eleutherodactylus talamancae, Eteutherodactylus mimus, Eteutherodactylus rugosus, Bufo valliceps, Hyla ebraccata, Smilisca phaeota, Eleutherodactylus noblei, Rana pipiens.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1a(1)(b)K / 4**
NAME	**Tropical evergreen broad-leaved lowland forest, moderately drained on calcareous soils (4)** **Bosque tropical siempreverde latifoliado de tierras bajas, moderadamente drenado en suelos calcáreos (4)**
ECOSYSTEM DYNAMICS	Ancient.
GEOLOGY	
CLIMATIC CONDITIONS	Found in the 2500 - 4000 mm annual rainfall areas with a dry season from February through May.
FIRE EXPOSURE	Limited to areas with slash and burn cultivation.
SPECIAL CONDITIONS	
SOIL CHARACTERISTICS	
SOIL TYPE	Soils are clays derived from calcareous shales and sandy limestones of the Toledo Beds.
Soil color	Pale gray brown.
VEGETATION DATA	
Species	
Frequent species	Frequently encountered species include *Acosmium panamense, Manilkara chicle, Calophyllum brasiliense, Terminalia amazonia, Cojoba arborea, Swietenia macrophylla,* and *Vochysia hondurensis.*
TREE STRATUM	
Tree hight	30-40m.
Canopy morphology	Broad-leaved.
Leaf phenology	Evergreen.
Vines	Woody climbers frequent.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	Megaphyllous herbs common.
OTHER OBSERVATIONS	Most of the land area that was once covered by these forests is now under agriculture as the soils are fertile and the areas accessible.
LITERATURE	Wright et al. 1959: 4b, Iremonger and Brokaw 1995: I.2.1.1.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1a(1)(b)P / 5**
NAME	**Tropical evergreen broad-leaved lowland forest, moderately drained on poor or sandy soils (5)** **Bosque tropical siempreverde latifoliado de tierras bajas, moderadamente drenado en suelos pobres o arenosos (5)**
ECOSYSTEM DYNAMICS	Ancient.
CLIMATIC CONDITIONS	Found in the 2500 - 4000 mm annual rainfall areas of southern Belize with a dry season from February through May.
FIRE EXPOSURE	Where fires have penetrated this system, small patches of scrubby "savanna" occur with associated species such as *Byrsonima crassifolia* and *Pinus caribaea* appearing. High rainfall figures in these areas prevent major expansion of these savannas but under a regime of recurring droughts and increased human pressure, these forests may well degenerate towards savanna under the pressure of fire.
SOIL CHARACTERISTICS	
SOIL TYPE	Corresponding to where they occur in lowland areas, soils are acidic clays, often stony.
Soil color	Dull reddish-brown, brown or gray, often mottled.
Cover mineral soil	Often visible.
Cover and nature organic matter	Organic layer very limited.
Cover rock	None.
WATER REGIME	
Moist regime	Drainage varies. Often badly drained.
VEGETATION DATA	
Species	
Frequent species	Distinctive species include: *Acosmium panamense, Acoelorrhaphe wrightii, Aspidosperma cruenta, Attalea cohune, Bactris* spp., *Calophyllum brasiliense, Chrysobalanus icaco, Clidemia* spp., *Coccocypselum herbaceum, Dialium guianense, Dicranopteris, Erblichia odorata, Ficus* spp., *Guarea* spp., *Guettarda combsii, Licania hypoleuca, Licania platypus, Miconia* spp., *Mouriri exilis, Mouriri myrtilloides, Pouteria mammosa, Psychotria poeppigiana, Pterocarpus rohrii, Scleria bracteata, Simarouba glauca, Spondias mombin, Symphonia globulifera, Terminalia amazonia, Tetracera volubilis, Tococca* spp., *Virola koschnyi, Vismia ferruginea, Vochysia hondurensis and Xylopia frutescens.*

TREE STRATUM

Tree hight	15-25 m.
Canopy cover	Generally dense forests with a broken canopy.
Canopy morphology	Broad-leaved.
Leaf phenology	Evergreen.
Vines	Common.
Arboreal palms	*Attalea cohune* is usually the only emergent palm.
Tree ferns	Occasional.
Drapery epifytes	Rare.
Sessile epifytes	Frequent.
Climbing epifytes	Rare.

SHRUB STRATUM

Acaule palms	*Acoelorrhaphe wrightii* and *Bactris* spp. are the most prevalent understory palms.

GROUND STRATUM

Graminoids cover	The sedge *Scleria bracteata* is usually dominant in the understory.
LITERATURE	Meerman 1999a, Wright et al. 1959; Iremonger and Brokaw 1995.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1b(1) / 6, 6-1, 6-2, 6-ND, 6-CG, 6-VG, 6-ZA**
NAME	**Tropical evergreen broad-leaved submontane forest (6)** **Bosque tropical siempreverde latifoliado, submontano (6)**
GEOLOGY	Topography broken and rugged.
CLIMATIC CONDITIONS	Belize: Average precipitation more than 2,500 mm a year. Nicaragua: Annual precipitation 3,000-3,400 mm., Average temperature 24-25 °C, relative humidity 80%.
SPECIAL CONDITIONS	Honduras: ND = Sierra Nombre Dios/Sierra la Esperanza.
SOIL CHARACTERISTICS	
SOIL TYPE	Nicaragua: Soils present Mollisols, Alfisols and Ultisols, developed from tertiary volcanic material, superficial landslides are common.
Soil color	Nicaragua: Yellowish or black when high in organic material.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Dominant species	In Panama: *Billia columbianum, Citharexylum* spp., *Catola costaricensis, Dedyosmum bonplandianum, Meliosma glabrata, Siparouna pauciflora, Oreomunnea mexicana, Pouteria* spp., *Manilkara* spp., *Sloanea* spp., and *Eschweileria* spp. Common species in the Lauraceae, Sapotaceae and Myrtaceae.
Co-dominant species	On "Cerro Jefe", Panama in various strata are found: *Calophyllum longifolium, Podocarpus guatemalensis, Wettinia* spp., *Pouteria* spp., plams like: *Welfia regia, Socratea exorrhiza, Euterpe precatoria.* On "Cerro Hoya": *Demopsis oerstedii, mollinedia stipitata, Calophyllum longifolium, Tretorchidium rotumdatum, Pllalesta discolor, Erblichia adorata* and *Cassipourea elliptica*.
Frequent species	Belize: *Aspidosperma cruenta, Calophyllum brasiliense, Euterpe precatoria, Pseudolmedia* spp., *Simarouba glauca,* *Terminalia amazonia, Vismia ferruginea, Vochysia hondurensis,* and *Xylopia frutescens* and Melastomataceae in the understory. Guatemala: *Clusia* sp., *Vismia camparaguey, Vochysia hondurensis, Schizolobium parahybum, Amphitecna*

macrophylla, Pithecellobium spp.*, Tonduzia longifolia.*

ND (Honduras): *Brosimum alicastrum, Bursera simaruba, Calophylum brasiliense, Cedrela odorata, Coccoloba anisophylla, Cordia alliodora, Ficus colubrinae, Ficus insípida, Ficus tonduzii, Guarea grandifolia, Hernandia stenura, Licania platypus, Luhea candida, Nectandra* spp.*, Ochroma pyramidale, Pithecellobium donnell-smithii, Pouteria campechiana, Pouteria sapota, Rinorea guatemalensis, Symphonia globulifera, Swietenia macrophylla, Tabebuya chrysantha, Terminalia amazonia, Virola koschnyi, Vochysia guatemalensis.*

In Nicaragua: *Inga* spp., *Quercus* spp., *Ficus* spp., *Cecropia* spp., *Nectandra* spp., *Calophyllum brasiliense, Dalbergia tucurensis, Cordia collococca, Calatola costaricensis, Persea shiedeana, Trophis mexicana, Ardisia* spp, *Heliocarpus appendiculatus, Hedyosmum mexicanum.*

In Costa Rica:
IA1b(1)- CG (17a.2, 17b.2), over volcanic substrate, rich in palms and tree ferns and abundant epiphytes and bamboos (*Chusquea* spp., *Elytrostachys* spp. and *Rhipidocladus* spp.). A difference is that *Alnus jorullensis* is only found in the Central and Talamanca areas, not in Guanacaste.
IA1b(1)- VG: The association (28.2): *Welfia georgii, Vochysia alenii* (in pure stands), *Bernoullia flamea, Cedrela* spp., *Nectandra* spp., *Ocotea* spp., *Persea* spp., *Cinammomum* spp.

The variant (29.2) of: *Alchornea latifolia, Laplacea grandis, Matayba* spp., *Prockia costaricensis, Vochysia* spp., *Colubrina spinosa, Cornutia grandifolia, Coussarea auste-smithii, Meliosma* spp., *Nectandra panamensis, Nectandra sanguinea, Pouteria stipitata.*

Associated species

Panama: At around 800 m on the path "El Cantar", "cerro Azul", National Park Chagres, with biotemperature between 17 to 26 °C and with 3,500 to 7,000 mm of rain annually, Carrasquilla (1993) identified 244 species in 225 genera of 90 families principally of Angiosperms, and 2 Gymnosperms and 1 *Lycopodium*. The families with the most species were: Rubiaceae (51), Melastomatceae (19), Clusiaceae (17), Leguminosae (16), Lauraceae (16), Moraceae (13), Euphorbiaceae (12), Apocynaceae (12), Sapotaceae (12), Areacaceae (11), Sapindaceae (9),

Annonaceae (8) and Myrtaceae (8). The génera with most species are: *Psychotria*, (16), *Ocotea*, (8) *Inga*, (8). A total of species 44 (18 %) endemic to Panama of which 16 have been registered only in the province of Panama. The habits of the species are: 163 trees, 134 shrubs, 36 herbaceous, 32 vines, 20 epiphytes, 22 hemi-epiphytes, 6 semi-parasites.

In "cerro Jefe" (1,007 m; bio temperature between 18 and 26 °C, annual precipitation between 3,500 and 7,000 mm, Carrasquilla (1987) identified 486 species of which 143 species are endemic to Panama and 80 are only known from this locality. The 8 families with most endemic species are : Araceae (13), Orchidaceae (5), Asteraceae (7), Ericaceae (8), Gesneriaceae (12), Myrsinaceae (8), Rubiaceae (25) and Solanaceae (7). A lot of these species have not developed long range dispersion mechanisms. Los 4 genera with the highest number of endemic species are: *Anthurium* (13), *Ardisia* (4), *Columnea* (7) and *Psychotria* (16) some of these might be food plants for endemic species of birds, with restricted ranges (as in the case of *Anthurium*; Croat, 1986 cited by Carrasquilla, 1897).

TREE STRATUM

Tree hight
Belize, Guatemala and Honduras: 20- 40 m.
Panama: 30- 40 m in height Panama, below which is found a sub-canopy were *Socratea* spp., is found.

Canopy cover
Belize, Guatemala and Honduras: closed.

Canopy morphology
Evergreen ombrophyllous, some sclerophyllous.

Leaf phenology
Evergreen and some seasonal.

Vines
Belize, Guatemala and Honduras: frequent, including Marcgraviaceae.
Nicaragua: climbers such as *Smilax* spp. and *Rubus* sp*p.*

Arboreal palms
Panama: *Welfia regia*, *Socratea exorrhiza*, *Euterpe precatoria,* the last also in Belize, Guatemala and Honduras.

Tree ferns
Belize: some.
Nicaragua: Tree ferns: *Cyathea arborea.*

Drapery epifytes
Nicaragua: *Cavendishia bracteata*, *Columnea rubricaulis,* spp.
Panama epiphytes are abundant, mosses, lichens, ferns and amongst the vascular plants theres: Bromeliads, Orchids, Araceae, Cyclanthaceae, Ericaceae.

Sessile epifytes
Belize: some.
Nicaragua: *Guzmania angustifolia*, Orchids like: *Bulbophyllum* spp., *Elleanthus cynarocephalus*, *Epidendrum lacustre Sobralia* spp.

Climbing epifytes
Climbing epiphytes such as: *Philodendron* spp.

SHRUB STRATUM	En Panama: Rubiaceae, Melastomataceae, Myristicaceae, Euphorbiaceae and Moraceae. In Nicaragua: *Conostegia hirtella* and *C. Oerstediana; Jacobinia umbrosa, Cephaelis* spp., *Palicourea padifolia, Lippia myriocephala, Senecio arborescens.*
Acaule palms	Belize: various species: *Astrocaryum mexicanum, Chamaedorea pinnatifrons, Chamaedorea costaricana,* Guatemala, Izabal: *Chamaedorea castillo-montii.* Nicaragua: *Geonoma* spp., *Chamaedorea* spp. and *Bactris* spp.
Herbaceous cover (herbs considerably taller than 1.5M)	*Hierbas gigantes como: Chusquea simpliciflora, Renealmia mexicana, Heliconia* spp. amongest which *H. Tortuosa.*
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	Belize: Zamia spp., Aechmea spp., Cardulovica spp., Cyclanthus spp., Anthurium spp., Dieffenbachia spp., Calathea spp. and Heliconia spp. Nicaragua: Blechnum ensiforme, Pitcairnia imbricata, Selaginella spp., Begonia spp., Hydrocotile mexicana, Anthurium microspadix, Hoffmannia oreophila, Rondeletia nebulosa, Psychotria uliginosa, P aubletiana P macrophylla, Alloplectus tetragonus, A cucullatus, Besleria solanoides, Mainthemum paniculatum, Peperomia obtusifolia, Piper augustum and Piper obliquum.
Graminoids cover	Centropogon cordifolius.
Cover of inferior cryptogamytes (no ferns)	Herbaceous: *Polystichum muricatum, Campyloneurum angustifolium, Antrophyum cajenense, Asplenium achillaefolium* and *Diplazium cristatum.*
OTHER OBSERVATIONS	Nicaragua: these forests are found in the northern Caribbean side of the country.
LITERATURE	(Wright et al. 1959: 12,12a,12b; Iremonger and Brokaw 1995: I.2.3.3.2.). Iremonger 1997.

CHARACTERISTICS	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1b(1)K / 7-r, 7-s**
NAME	**Tropical evergreen broad-leaved submontane forest on karstic hills (7)** **Bosque tropical siempreverde latifoliado submontano en colinas cársticas (7)**
ECOSYSTEM DYNAMICS	Ancient.
GEOLOGY	Calcareous rock.
CLIMATIC CONDITIONS	Found in the 2500 - 4000 mm annual rainfall areas of southern Belize with a dry season from February through May.
FIRE EXPOSURE	Not resistant to fire but frequently exposed to fire from uncontrolled slash and burn cultivation activities. In hill crests, the following applies: Fires can be devastating. The soil at the base of limestone hills is often quite fertile and sought after for slash and burn agriculture. Wild fires become hotter as they creep up the slopes and often completely destroy the trees on the tops of the hills. Additionally, the soils on these hills are very shallow. Once the forest is destroyed, these soils very quickly erode, and it is very difficult for a forest to re-establish itself.
SPECIAL CONDITIONS	500-1000 m. Since travel through this vegetation type is difficult, there is little information available.
SOIL CHARACTERISTICS	
SOIL TYPE	Clay.
Cover rock	Some rock visible.
WATER REGIME	
Moist regime	Mostly well-drained.
VEGETATION DATA	
Species	
Character species	K-s appears to be the habitat for the Belizean endemic *Zamia prasina.*
Frequent species	*Manilkara* spp. Abundant.
TREE STRATUM	
Tree hight	20 – 40 m.
Canopy cover	Closed.
Canopy morphology	Broad-leaved.
Leaf phenology	Evergreen.
Vines	K-r: The vine *Pasiflora obovata* appears to be restricted to this vegetation type.

Tree ferns	Common.
Sessile epifytes	Common.
SHRUB STRATUM	
Acaule palms	Rich in understory palms.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	There is a rich understory with Ferns, Cyclanthaceae, *Chamaedorea* spp., *Peperomia* spp. *Psychotria* spp.
LITERATURE	K-r: Brokaw & Lloyd-Evans 1987, Iremonger & Sayre 1994, Wright et al. 1959; Iremonger and Brokaw 1995. K-s: Brokaw & Lloyd-Evans 1987, Iremonger & Sayre 1994, Wright et al. 1959; Iremonger and Brokaw 1995.

CHARACTERISTICS	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1b(3) / 8**
NAME	**Tropical evergreen broad-leaved submontane palm forest (8)** **Bosque tropical siempreverde latifoliado submontano de palma (8)**
GEOLOGY	Non-calcareous. Partially over old volcanic rocks.
CLIMATIC CONDITIONS	Found in the 2500 - 4000 mm annual rainfall areas of southern Belize with a dry season from February through May.
FIRE EXPOSURE	Lightning strikes may cause local damage.
SOIL CHARACTERISTICS	
Cover and nature organic matter	A thick layer of organic material is present.
Cover rock	Some degree of emergent rock.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Character species	The palm *Colpothrinax cookii.*
Dominant species	The palms *Colpothrinax cookii* and *Euterpe precatoria* dominate the scene and often extend above the general canopy of the forest.
Co-dominant species	Hemi-epiphytic *Clusia* spp.
Frequent species	Frequent tree species are *Alchornea latifolia, Calophyllum brasiliense, Cojoba arborea, Cyrilla racemiflora, Dendropanax arboreus, Ilex guianensis, Inga* spp., *Magnolia yoroconte, Miconia impetiolaris, Myrcia splendens, Nectandra* spp., *Psychotria elata, Quercus cortesii, Roupala montana,* and *Simarouba* spp.
TREE STRATUM	
Tree hight	15-25 m.
Canopy cover	Broken canopy with palms *Colpothrinax cookii* and *Euterpe precatoria* as conspicuous emergents.
Leaf phenology	Evergreen.
Arboreal palms	*Colpothrinax cookii* and *Euterpe precatoria.*
Tree ferns	Common.
Sessile epifytes	The most noticeable aspect of this vegetation is that many of the plants grow epiphytically. Sessile epiphytes very abundant and diverse.
SHRUB STRATUM	
Canopy cover	*Chamaedorea* spp., *Critonia sexangularis,* Rubiaceae and Melastomataceae form a sparse shrub layer.

Acaule palms	Many palms present in the understory.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	The herb layer is mostly represented by the ferns *Danaea elliptica, Polybotrya* spp. and *Lindsaea* spp.
OTHER OBSERVATIONS	Found in Belize on the peaks of the Little Quartz Ridge and extending along the main divide of the Maya Mountains to Richardson's Peak and possibly beyond.
LITERATURE	Iremonger and Brokaw, 1995.

CHARACTERISTICS	**DESCRIPTION**
CLASSIFICATION-CODE AND MAP-CODE	**IA1c(1) / 9, 9-1, 9-A, 9-ND, 9-CG, 9-VG**
NAME	**Tropical evergreen broad-leaved lower-montane forest (9)** **Bosque tropical siempreverde latifoliado montano inferior (9)**
ECOSYSTEM DYNAMICS	Pristine.
GEOLOGY	Nicaragua: In mountainous areas with steep slopes and escarpments. Substrate of basic tertiary volcanic rock (basalt's, andesites, etc).
CLIMATIC CONDITIONS	In Belize: Annual precipitation 2,500-4,000 mm a year, with frequent lighting strikes. Nicaragua: Mean annual temperature 20-22 °C and mean annual precipitation 1,250-1,500 mm evenly distributed, though though humidity is still greater due to condensation from passing clouds on vegetation and rocks. For this reason this forest is sometimes called low cloud forest. En Panama found from 1,000 to 1,500 m on the Caribbean side and from 1,200 to 1,800 on the pacific side.
FIRE EXPOSURE	Not a frequent factor.
SPECIAL CONDITIONS	A = variant de la Sierra de Agalta, Honduras. ND = variant Sierra Nombre Dios/Sierra La Esperanza, Honduras. 1 = variant intervened in A or in ND, Honduras.
SOIL CHARACTERISTICS	
SOIL TYPE	In Belize, Guatemala and Honduras variable. In Nicaragua: soils Molisols and Alfisols, medium texture with good drainage.
Soil color	Nicaragua: dark.
Cover mineral soil	Nicaragua: very superficial (< 25 cm).
Cover and nature organic matter	Nicaragua: Due to the accumulation of abundant organic

material, its called mountain soil.

Cover rock

Nicaragua: Large rocks on the surface.

WATER REGIME

Moist regime

In general well-drained but soil very humid most of the year, with the exception of the months of Abril and May when there is less precipitation but still mists present.

VEGETATION DATA

Nicaragua: Some amount of seasonality. Dead and fallen trees common. A refuge for species of primitive families such as: Magnoliaceae, Chlorantaceae, Lauraceae, Myrtaceae, Weinmanniaceae, Myrsinaceae, Clusiaceae and Cyatheaceae.

Species

Frequent species

Belize: *Callophylum brasiliense, Colpothrinax cookii, Clusia* spp., *Euterpe precatoria, Magnolia* spp., *Podocarpus guatemalensis, Pourouma bicolor, Psychotria elata, Quercus corrugata, Q. Purulhana, Q. Skinneri. Synechantus fibrosus* and a unnamed Babusoid species.

Guatemala (vertiente Atlantico): *Chaetopelea (Ulmus) mexicana, Trema micrantha, Citharexylum donell-smithii, Heliocarpus donell-smithii, Saurauia* spp., *Rondeletia cordata, Chamadorea costaricana, Clethra* spp.

Honduras
Agalta: *Brunelia mexicana, Hedyosmum mexicanum, Quercus* spp, *Liquidambar stiraciflua, Matayba oppositifolia, Myrica cerifera, Ocotea helicterifolia, Podocarpus* spp., *Eupatorium tuerkheimii,* sometimes in the lower part *Juglans olanchana, Oplismenus setarius, Psychotria elata, Psychotria ulginosa, Arachniodes gesnerioides.*

Nombre de Dios: No records.

In Nicaragua: *Inga* spp., *Cecropia* spp., *Eugenia* spp., *E. acapulcensis, Clusia* spp., *Casimiroa* spp., *Ochroma pyramidale, Oreopanax* spp., *Nectandra reticulata, N. nervosa, Persea schiediana, P. americana, Ficus* spp., *F. Costaricana, F. Involucrata, Inga* spp., *Ardisia guianensis, Clusia rosea, Clusia salvinii, Heliocarpus appendiculatus, Cecropia* spp., *Malpighia glabra, Terminalia* spp., *Dalbergia tucurensis, Mosquitoxylum jamaense, Cordia collococca, Trophis mexicana, Ilex* spp., *Hedyosmum mexicanum, Styrax polyanthus, Guarea brevianthera, Quercus aata., Q. brenesii, Calocarpum* spp., *Carpinus caroliniana*.

In Panama though some elements are similar to the submontane flora such as: *Billia columbianum, Catola costaricensis, Hedyosmum bonplandianum, Siparuna pauciflora, Meliosma glabrata, Oreomunnea mexicana, Citharexylum* spp., some elements are only found here such as: *Quercus corrugata, Alnus acuminata, Quercus oocarpa, Ulmus mexicana, Eugenia* spp., *Podocarpus* spp., *Magnolia* spp., *Cedrela* spp., *Persea* spp. and *Ocotea* spp.

On "Cerro Hoya", Carrasquilla (1998) identified 200 species,102 genera and 55 families. The families with most species are: Orchidaceae (9), Rubiaceae (8), Euphorbiaceae (7), Leguminosae and Melastomataceae (5/each), Annonaceae, Araceae and Asteraceae (4/each). 6 endemic species wer found: *Ceiba rosea, Protium panamense* and *P. inconforme, Clusia cf longipetiolata, Souroubea venosa* and *Passiflora williamsii*. *Oreomunnea mexicana* (Juglandaceae) is new for Panama.

Carrasquilla (1987 and 1993), suggests that the high levels of endemisum on the mountains Jefe, Azul and Hoya is due to that during the cretaceous (70 million years ago) these mountains were volcanic islands of intrusive rock. also the mountains Azuero (the oldest rocks in Panama), San Blas, Bagre, Pirre and Sapo in the Darian. Though lower down Tertiary sedimentary and intrusive rocks are found. Also its considered possible that these mountains were Pleistocene refuges (Carrasquilla, 1987 and 1993 cites Raven & Axelrold, 1975, Destro, 1986 and Atlas National of Panama, 1988).

Panamá has 900 species of Bryophytes (± 600 mosses). In La Fortuna, Chiriquí 225 species have been identified, 175 for the Campana and 88 for Barro Colorado. Salazar (1998) identified in the Hoya Mountains, 69 species of mosses and 48 genera and 18 families, also 18 genera in 12 families of Hepaticas (5 talosas and 7 leafy).

Martínez (1995) in a study of the national Park Volcán Burú (Estern side) from 1,800 to 2,900 m found 156 species (89% Magnoliopsida,) en 125 genera and 67 families. The species rich families were: Asteraceae (25), Ericaceae and Fabaceae (7/each), Rubiaceae and Solanaceae (6/each), Labiatae, Piperaceae, Rosaceae Scrophulariaceae and Poaceae (5 /each), Boraginaceae, Lobeliaceae, Loranthaceae, Melastomataceae and

Onagraceae (3/each). Amaryllidaceae, Liliaceae, Orchidaceae, Apiaceae, Convolvulaceae, Loganiaceae, Passifloraceae, Tiliaceae and Urticaceae (2/each). The genera with most species are: *Solanum, Peperomia* (4/each), *Gnaphalium, Senecio, Verbesina* and *Salvia* (3/each), *Bomarea, Chusquea, Bidens, crotalaria, Lupinus, Phaseolus, Galium, Alchemilla, Rubus, Calceolaria, Castilleja, Centropogon, Fuchsia, Passiflora, Buddleia* (2/each). 10 species have a wide altitudinal range: *Alnus acuminata, Quercus* spp., *Buddleia americana, Monochaetun floribundum, Bocconia frutescens, Monnina xalapensi, Castilleja quirosii, Lycianthes beckeriana, Comarostaphylis arbutoides* and *Gaultheria odorata*. 58% of the species flower in the dry season,17% in the wet season and 25 % in both. *Ageratina herrerae* was reported for the first time for Panama. Out of the total, 72 species are herb, 15 climbers, 15 semi- shrubs, 25 shrubs and 29.

TREE STRATUM

Tree hight

En Belize, Guatemala and Honduras : 20- 35 m.

En Nicaragua with hard bark and no more than 20 m.

In Panama between 30 and 40 the vegetation is dense but consists principally of short and twisted trees.

Canopy cover

En Belize, Guatemala and Honduras: closed.

In Nicaragua, around 75 % because of the fallen branches and trees.

Average basal area

Nicaragua: 7-9 m^2

Canopy morphology

Ombrophyllous with some sclerophyllous plants.

Leaf phenology

Seasonal Evergreen in that some of the species can loose there leaves in the dry season.

Vines

Rare.

Arboreal palms

In Belize: *Colpothrinax cookii* and *Euterpe precatoria*
In Nicaragua: *Socratea exorrhiza.*

In Panama reports of abundant palms but they do not specify.

Tree ferns

En Belize: present.

En Nicaragua: *Cyathea arborea*, *Cyathea* spp., *Alsophila*

	spp.
	In Panama abundant.
Drapery epifytes	In Nicaragua: *Cavendishia* spp. *(C. guatemalensis var chiapensis* and *C. Bracteata), Columnea rubricaulis*.
Sessile epifytes	In Belize present.
	Nicaragua: The crowns, branches and trunks densely covered in epiphytes mostly bryophytes though also Bromeliads: *Guzmania nicaraguensis, G. angustifolia.* Orchids: *Bulbophyllum* spp., *Elleanthus* spp., *Pleurothallis* spp., *Epidendrum* spp.
Climbing epifytes	In Nicaragua: *Philodendron* spp. and *Syngonium* spp.
SHRUB STRATUM	Hrubs: *Conostegia hirtella* and *Conostegia oerstediana, Cephaelis* spp., *Palicourea padifolia, Cledemia setosa.*
Lower height	1.5 m.
Upper height	4.0 m.
Canopy cover	30-40%
Acaule palms	Just seedlings.
Herbaceous cover (herbs considerably taller than 1.5M)	En Belize: common.
	In Nicaragua: *Chusquea simpliciflora, Renealmia mexicana,* various *Heliconia* spp. such as: *Heliconia tortuosa,* palms *Chamaedorea deckeriana, Chamaedorea tepejilote.*
Leaf morphology	Ombrophyllous, some sclerophyllous.
Shrub phenology	Evergreen.
Tall herbs periodicity	Perennial.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	Cover 50%.
	Herbs: *Pseudolmedia spuria, Besleria solanoides, Mollinedia minutiflora, Peperomia obtusifolia, Dennstaedtia dissecta, Scutellaria orichalceae, Begonia* spp., *Selaginella* spp., *Musgos, Blechnum ensiforme, Pitcairnia imbricata, Hydrocotile mexicana, Anthurium microspadix, Centropogon cordifolius, Hoffmannia oreophila, Rondeletia nebulosa, Psychotria panamensis, P uliginosa, P aubletiana* and *P macrophylla; Alloplectus tetragonus, Mainthemum paniculatum, Peperomia*

obtusifolia, Piper augustum, P. biolleyi and *P. obliquum*.

On Hoya Mountain, Correa and Ruíz (1993) identified 112 species of ferns (± 10% the ferns of Panama) in 43 genera; Between 400 and 500 m they found 25 (22%) species of ferns mostly terrestrial and between 1,380 and 1,500 m they found 42 (38%) species, mostly epiphytes; the forest starts at 700 m. The genera *Asplenium* (15), *Elaphoglossum* and *Trichomanes* (7/each) presents more species. The 4 tree species are: *Alsophila erinacea, Cnemidaria mutica, Cyathea delgadii* and *C. Pinnula*. Above 1,380 m, 3 species. No endemic species were found, though some with restricted ranges such as: *Asplenium gomezianum, Sticherus compactus, Pleopeltis macrocarpa* var. *Complanata* (Costa Rica and Panama), and *Lomariopsis maxonii and Terpsichore staheliana* (Nicaragua, Costa Rica and Panama).

The species identified by Correa & Ruíz: *Adiantum tenerum, Adiantum serratodentatum, Arachnioides denticulata, Asplenium radicans, Asplenium cuspidatum* var. *Cuspidatum, Asplenium feei, Asplenium hoffmannii, Asplenium pteropus., Asplenium serra, Blechnum fragile, Blechnum Iherminieri, Blechnum x caudatus, Campyloneurum sphenodes, Cnemidaria mutica, Cochlidium linearifolium, Ctenitis hemsleyana, Cyathea delgadii, Cyathea pinnula, Dannea cuspidata., Diplazium hians, Elaphoglossum revolutum, Elaphoglossum erinaceum, Elaphoglossum latifolium, Huperzia taxifolia, Hymenophyllum fragile, Hymenophyllum polyanthos, Lindsaea cf klotzschiana, Lomariopsis maxonii, Polypodium fraxinifolium, Saccoloma inaequale., Selaginella martensii, Sticherus compactus, Terpsichore asplenifolia, Terpsichore staheliana, Thelypteris concinna, Trichomanes angustifrons., Trichomanes capillaceum* var. *Capillaceum, Trichomanes reptans, Trichomanes rigidum, Vittaria graminifolia, Asplenium cristatum.*

Graminoids cover

5-10%.

Forbes cover (including juvenile trees and acaule palms)

Nicaragua: Chamaephytes abundant: *Polystichum muricatum, Campyloneurum angustifolium, Antrophyum cajenense, Asplenium achillaefolium* and *Diplazium cristatum*.

Cover of inferior cryptogamytes (no ferns)

On, fallen trunks, lower trees 5%.
In Panama abundant mosses lichens and fern allies are reported.
According to Salazar (1998), in Panama: Mosses *Adelothecium bogotense, Calymperes erosum,*

Syrrhopodon circinatus, S. Gardneri, S. Incompletus, S. Leprieurii, S. Lycopodioides, S. Prolifer, Leskeodon andicola, Leucoloma serrulatum, L. tortellum, L. Cruegerianum, Fissidens diplodus, Chryso-hypnum diminutivum, Ctenidium malacodes, Ectropothecium leptochaeton, Herzogiella cylindricarpa, Hypnum cupressiforme, Isopterygium tenerum, Mittenothamnium reptans, Phyllodon truncatulus, Platygyriella densa, Rhacopilopsis trinitensis,: *Leucobryum cf albicans, L. Antillarum, Ochrobryum gardneri,* L*eucomium* spp. *Macromitrium cf fragilicuspis, Meteoridium remotifolium, Orthostichella pentastichia, Pilotrichella rigida, P. flexilis, Squadmidium remotifolium, S. Leucotrichum, Toloxis imponderosa, Zelometeorium patulum, Isodrepanium lentulum, Neckeropsis undulata, Porotrichum* spp. *Phylogonium fulgens, P. viscosum, Actinodontium sprucei, Brymella callicostelloides, B. Cuspidata, Calliscostella depressa, C. Pallida; Cyclodictyon albicans, Lepidopilidium divaricatum, Pilotrichidium callicostatum, P. asperifolium, Thamnoipsis undata, Trachyxiphium cf subfalcatum, Prionodon densus;* Pterobryaceae: *Calyptothecium duplicatum, Jaegerina scariosa, Pireella pohlii, Racopilum intermedium, R. tomentosum,* Rhizogoniaceae: *Pyrrhobryum spiniforme, Sematophyllum cf adnatum, S. Subsimplex, S. Swartzii, Taxithelium planum, Trichosteleum fluviale, T. Microstegium, T. Sentosum; Pilosium chlorophyllum,*: *Cyrtohypnum mexicanum, C. Minutulum, C. Schistocalyx.*

Hepatics: *Riccardia* spp., Metzgeriaceae: *Metzgeria* spp. *Marchantia* spp., *Dumortiera nepalensis (=D. Hirsuta* var *nepalensis), Monoclea gottschei, Riccia* spp. *Lophocolea muricata (L. Connata), Frullania* spp., *Bryopteris fdilicina, Ceratolejeunea* spp., *Lejeunea* spp., *Lepidolejeunea* spp., *Taxilejeunea* spp. Lepidoziaceae: *Bazzania* spp., *Arachniopsis* spp. Plagiochilaceae: *Plagiochila* spp. Radulaceae: *Radula* spp., *Trichocolea* spp.

Acaule palms cover
Just seedlings.

Predominant periodicity of herbaceous cover
Evergreen, perennial.

FAUNISTIC OBSERVATIONS

In Nicaragua, amongst: Racoon, guatuza, chachalaca (*Ortalis cinereiceps*), guardatinaja, Rabbit, pizote, venado puco (*Mazama americanus*), quetzal (*Pharomachrus mocinno*).

CHARACTERISTICS	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1c(1/2) / 10-HCW / 10-RP**
NAME	**Tropical evergreen mixed lower-montane forest (10)** **Bosque tropical siempreverde mixto montano inferior (10)**
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	Unknown.
FIRE EXPOSURE	Probable.
SPECIAL CONDITIONS	HCW = West Central Honduras variant. RP = Entre Rios / El Paraiso variant (Honduras).
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	According to Agudelo (1987) for Honduras: Humid Low Subtropical Montane Forest; bh-MBS; as a continuation of the Humid Subtropical Forest; 900- 1,900 m (mean 1,300 m), irregular topography. Trees up to 25- 30 m height, smooth bark, medium grade of epiphytism (moss, orchids, bromeliads, Araceae), pure pine forest may occur.
Species	
Frequent species	*Pinus oocarpa, Pinus patula var tecunumanii, Arbutus xalapensis, Buddleija americana, Calyptranthes hondurensis, Clethra macrophylla, Conostegia* spp., *Cyclanthera* spp., *Ficus aurea, Ficus ovalis, Heliocarpus appendiculatus, Ilex* spp., *Inga* spp., *Lobelia laxiflora, Miconia* spp., *Myrica cerifera, Persea schiedeana, Piper lacunosum, Psychotria macrophylla, Oreopanax lachnocephalus, Oreopanax xalapensis, Quercus cortesii, Vernonia arborescens*. From Agudelo (1987), Honduras: *Pinus oocarpa, Pinus maximinoi, Liquidambar styraciflua, Arbutus xalapensis, Clethra macrophylla, Leucothoe mexicana, Liquidambar styraciflua, Lippa subtrigosa, Lysiloma multifoliatum, Myrica cerifera, Quercus spp, Rhus striata, Acer negundo var mexicana, Carpinus caroliniana var tropicalis, Cedrela oaxacensis, Cleyera theanoides, Cornus disciflora, Diphysa robinoides, Eupatorium daleoides, Persea donnell- smithii, Perymenium grande, Phoebe acuminatissima, Quercus hondurensis, Quercus oleoides, Quercus peduncularis, Quercus peduncularis var nublanosa, Solanum atitlanum, Viburnum hartwegi,*

Vismia mexicana.

TREE STRATUM

Canopy morphology Broad-leaved.

Leaf phenology Evergreen / Semi-deciduous.

Tree ferns *Lophosoria quadripinnata.*

LITERATURE

Iremonger 1997.

CHARACTERISTICS	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1c(4) / 11**
NAME	**Tropical evergreen broad-leaved lower-montane forest with palms (11)** **Bosque tropical siempreverde latifoliado montano inferior con palmas (11)**
GEOLOGY	Non-calcareous soils, including old volcanic substrate.
CLIMATIC CONDITIONS	Found in the 2500-4000 mm annual rainfall areas of southern Belize with a dry season from February through May.
SPECIAL CONDITIONS	1000 – 1500 m. Found in Belize on the peaks of the Little Quartz Ridge area and on the highest ridges of the Maya Mountains, including the area around "Doyle's Delight".
VEGETATION DATA	Only in Belize.
Species	
Character species	The palm *Colpothrinax cookii.*
Dominant species	The palms *Colpothrinax cookii* and *Euterpe precatoria* dominate the scene and often extend above the canopy of the forest.
Co-dominant species	Hemi-epiphytic *Clusia* spp. are abundant.
Frequent species	Frequent tree species: *Alchornea latifolia, Calophyllum brasiliense, Cojoba arborea, Cyrilla racemiflora, Dendropanax arboreus, Ilex guianensis, Inga* spp., *Magnolia* spp., *Miconia impetiolaris, Myrcia splendens, Nectandra* spp., *Prunus tikalana, Psychotria elata, Quercus cortesii, Roupala Montana,* and *Simarouba* spp.
TREE STRATUM	
Sessile epifytes	The most noticeable aspect of this vegetation is the abundance of epiphytes. Sessile epiphytes common.
SHRUB STRATUM	
Canopy cover	*Chamaedorea* spp., *Critonia sexangularis, Synechantus fibrosus*, Rubiaceae and Melastomataceae form a sparse shrub layer.
Acaule palms	Frequent.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	Herb layer dominated by ferns: *Danaea elliptica, PoIybotrya* spp. and *Lindsaea* spp.
LITERATURE	Allen 1995; Holst 2001; Iremonger and Brokaw 1995: I.2.4.1.

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CHARACTERISTICS	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1d(1) / 12, 12-2, 12-A, 12, 12-CG**
NAME	**Tropical evergreen broad-leaved upper-montane forest (12)** **Bosque tropical siempreverde latifoliado montano superior (12)**
ECOSYSTEM DYNAMICS	Ancient.
SOIL CHARACTERISTICS	
Cover and nature organic matter	Honduras - "la Tigra": Ground covered with accumulated leaves and branches, some fallen trees present.
WATER REGIME	
Moist regime	Honduras - "la Tigra": moist to saturated, abundant running water, streams and brooks.
VEGETATION DATA	
Dominant species	In Costa Rica: according to Gómez (1986): - At 1,500 m a zone of *Alnus* spp. and *Cornus* spp. sometimes associated with *Sapium* spp. and *Billia hippocastanum*. -At ± 1,800 m a zone of *Chusquea longifolia* (at lower elevations *Rhipidocladum* spp. predominates) and a large number of species in the family Melastomataceae. The family Lauraceae is abundant, sometimes found in almost pure stands. -At 2,000 m *Quercus* spp. are more common sometimes dominating the physiology of the forest. Other species at these elevations are: *Escallonia poasana, Garrya laurifolia, Hesperomeles heterophylla, Holodiscus fissus, Podocarpus spp., Magnolia, Clethra gelida, Oreopanax xalapense, Rapanea pittieri, Solanum storkii, Styrax polyneuron, Weinmannia pinnata*. In these forests the distinction between epiphyte and terrestrial plants becomes blurred. -The presence of *Escallonia poasana* in association with *Vaccinium* spp. *Fuchsia arborescens, Bechnum loxense and Puya dasylirioides* mark the nocturnal frost line. -There exists a variant of this forest which contains deciduous elements (Bursera simarouba, Quercus pilarius and Wimmeria spp.) (Gómez, 1986). In Panamá (Berger, 2000) notes the presence of: *Alnus acuminata* and *Buddlea nitida.* Honduras - "la Tigra": A distinct variant is the association "Oak- Avocado" found in "La Tigra" above 2,000 msnm.

Various species of oak are abundant: *Quercus cortesii, Q. Lancifolia, Q. Laurina* and *Q. bumelioides*; amongst the Lauraceae is the wild avocado: *Persea americana var nubigena*. Other arboreal elements are: W*einmannia pinnata, Podocarpus oleifolius, Tetrorchidium molinae (Endemic), Oreopanax xalapensis, O. Capitatus, O. Lachnocephalus*, *Myrsine jurgensenii* and *Simplocos venicosa*.

Honduras, Agudelo (1987) lists for a wider zone between 850 - 2000 m the following species: *Mauria sessiflora, Ilex chiapensis, I. williamsii, Oreopanax xalapensis, Carpinus caroliniana var tropicalis, Calophyllum brasiliensis, Weinmannia balbisina, Befaria guatemalensis, Hieronyma guatemalensis, H. Poasana, Quercus eugeniaefolia, Q. Peduncularis var sublanosa, Q. Sapotaefolia, Q. Tomentocaulis, Homalium racemosum; Olmediella betschieriana, Catola laevigata; C. Mollis, Nectandra heydeana, Ocotea veraguensis, Phoebe helicterifolia, Magnolia hondurensis, Miconia argentea, Cedrela oaxacensis, Guarea kunthiana, Guarea pittieri, Trophis chorizantha, Ardisia paschalis, Parathesis vulgata, Synardisia venosa, Pinus maximinoi, P. pseudostrobus, Podocarpus guatemalensis, P. oleifolius, Roupala borealis; Psychotria oregenes, P. persearum, Saurauia selerorum, Phyllonoma laticuspis, Solanum nudum, Turpinia paniculata, Styrax glabrescens, Laplacea fruticosa, L. Grandis, Ternstroemia tepezapote, Citharexylum caudatum.*

Co-dominant species

Frequent species

Honduras Agalta: A: *Ardisia* sp., *Chamaedorea pinnatifrons, Clusia rosea, Columnea rubricaulis, Comarostaphylis arbutoides, Cyathea divergens, Eugenia capuli, Magnolia* sp., *Miconia glaberrima, Nectandra* sp., *Psychotria aubletiana, Quercus acutifolia, Weinmannia pinnata.*

Associated species

In Panama: *Castilleja quirosii, Cirsium subcoriaceum, Rubus praecipus, R. glaucus, Smilax subpubescens, Monochaetum floribundum, Lycianthes beckneriana, Monnina xalapensis, Clethra coloradensis,*and *Quercus* spp.
En Costa Rica : *Ardisia* spp., *Blakea* spp., *Brunelia costaricensis, Catola costaricensis, Chione costaricensis, Clethra lanata, Cleyera theaoides, Clusia* spp., *Conostegia* spp., *Dichapetalum axillare, Didymopanax pittieri, Drymis granatensis, Eugenia* spp., *Eurya seemanniana, Fuchsia arborescens, Gaiadendron punctatum, Hedyosum mexicanum, Hieronyma poasana,*

Ilex lamprophylla, I. Pallida, Leandra costaricensis, Lippia torresii, Magnolia poasana, Miconia spp., *Micotropis occidentalis, Mollinedia* spp., *Ocotea* spp., *Oreopanax* spp., *Persea schiediana, prunus annularis, Quercus* spp., *Rapanea ferruginea, Sapia spp, Saurauria costarricensis, Siparuna* spp., *Symplocos* spp., *Viburnum* spp., *Weinmannia pinnata, Zinowiewia integerrima*.

TREE STRATUM

Tree hight

In Panamá: 25 m.
In Costa Rica in the oak forests, the emergents reach heights of up to de 30 m.
Honduras: 25-30 m.

Canopy cover

Honduras 70%.

Canopy morphology

Sclerophyllous dominant with some ombrophyllous species present.

Leaf phenology

Predominantly evergreen but some seasonal elements present.

Vines

Honduras - "la Tigra": the lianas S*milax espinosa* and *S. Subpubescens*; frequent also *Boemeria* spp., and *Souruba* spp., present.

Arboreal palms

Tree ferns

Honduras - "la Tigra": *Lophosoria quadripinnata, Cyathea mexicana*.

Drapery epifytes

Honduras - "la Tigra": Ericaceae and Melastomataceae

Sessile epifytes

- Bromeliaceae, Orquídaceae
Honduras - "la Tigra": *Encyclia* spp. and *Arpophyllum spicata* and possibly 6 species of Bromeliads
Honduras "Agalta": *Encyclia brassavola, Epidendrum lacustre, Sobralia* spp.

Climbing epifytes

- Bryophytes, ferns, Araceae.
Honduras – "la Tigra": *Hymenophyllum* spp. And *Elaphoglossus peltata,* impresive amounts of moss on the tree trunks, one Aráceae, *Monstera* aff. *Oblicua.*

SHRUB STRATUM

Canopy cover

In Panama: *Monochaetum floribundum, Lycianthes beckneriana, Monnina xalapensis, Clethra coloradensis*
Honduras - "la Tigra": *Phyllonoma laticuspis* (Saxifragácea) with white fruits, born strangely on the ends of the leaves, *Conostegia vucanalis, Hedyosmum mexicanum; Cestrum anaggris, Lyciantes hortulana, Rondeletia nubulosa*, (endemic to Honduras and the north of Nicaragua, *Vaccinium poasanum, Fuchsia paniculata, Saurauia* spp, *S. kegeliana* and *S. Scrabida, Zanthophyllum* spp.

Acaule palms

Palmas Geonomoides

Honduras - la "Tigra": Amongst the palms were seen: *Chaemadorea* spp., *C. costaricana* and *Geonoma* spp.

GROUND STRATUM

Overall herbaceous cover of the ground stratum

Honduras - "la Tigra": 10% herbaceous. Between sub-shrubs and herbs in open sites: *Mikania* spp., *Calea* spp., *Vernonia* spp., *Solanum nudum, Salvia cinabarina, Salvia tilaeifolia, Eupatorium turckheimii, E. williamsii* (endémic), *E. semialatum, E. sexangularis, Senecio petascioides*, and *Passiflora* spp., *P. sexflora, P. biflora, Rubus* spp., *Heterocentron subtriplinervium, Cirsium mexicanum, Psychotria sp, Polygala* spp. In the undergrowth: 3-4 species of terrestrial ferns, as well as *Habenaria* spp., *Monotropa* spp., *Pitcairnia* spp., very few Piperaceae, no members of the genus *Begonia* seen.

Forbes cover (including juvenile trees and acaule palms)

Panama: Ferns reported by Correa & Ruíz (1998) in this type of ecosystem in Panama are: *Adiantum tenerum Adiantum serratodentatum, Arachnioides denticulata, Asplenium radicans, Asplenium cuspidatum* var. *cuspidatum, Asplenium feei, Asplenium hoffmannii, Asplenium pteropus, Asplenium serra, Blechnum fragile, Blechnum Iherminieri, Blechnum x caudatus, Campyloneurum sphenodes, Cnemidaria mutica, Cochlidium linearifolium, Ctenitis hemsleyana, Cyathea delgadii, Cyathea pinnula, Dannea cuspidata, Diplazium hians, Elaphoglossum revolutum, Elaphoglossum erinaceum, Elaphoglossum latifolium, Huperzia taxifolia, Hymenophyllum fragile, Hymenophyllum polyanthos, Lindsaea klotzschiana, Lomariopsis maxonii, Polypodium fraxinifolium, Saccoloma inaequale., Selaginella martensii, Sticherus compactus, Terpsichore asplenifolia, Terpsichore staheliana, Thelypteris concinna, Trichomanes angustifrons, Trichomanes capillaceum var capillaceum, Trichomanes reptans, Trichomanes rigidum., Vittaria graminifolia, Asplenium cristatum, Arachnoides denticulata, Asplenium cuspidatum, Blechnum sessilifoilium, Campyloneurum angustifolium, Campyloneurum angustifolium var amphostenom, Culcita coniifolia, Dryopteris paralellogramma, Polypodium macrolepis, Ctenitis hemsleyana, Pteris altissima, Pteris altissima Poir., Trichomanes capillaceum, Vittaria filifolia, Vittaria lineata.*

FAUNISTIC OBSERVATIONS

Taking into account seasonal movements up and down the mountain. These forests are the home of the Quetzal in the region.
Amongst the fauna: Pecarí Cuello blanco, Ardilla,

Trogones and Quetzales.

CHARACTERISTICS	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1d(1/2) / 14-HCW, 14-RP, 14-ND**
NAME	**Tropical evergreen mixed upper-montane forest (14)** **Bosque tropical siempreverde mixto montano superior (14)**
SPECIAL CONDITIONS	HCW = Central West Honduras variant. RP = Entre Rios /El Paraiso variant. ND = Nombre Dios
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Co-dominant species	*Pinus pseudostrobus, Pinus patula var tecunumanii, Quercus* spp.
Frequent species	HCW: *Quercus bumelioides, Quercus cortesii, Quercus rugosa, Quercus sapotifolia, Arbutus xalapensis, Ardisia* spp., *Begonia oaxacana, Bernoullia flammea, Brunellia mexicana, Clusia* spp., *Columnea rubricaulis, Cornus discifolia, Cyrilla racemiflora, Dendropanax arboreus, Dendropanax hondurensis, Eupatorium semialatum, Eupatorium sexangulare, Hedyosmum mexicanum, Hoffmannia gesnerioides, Liquidambar styraciflua, Lycianthes hortulana, Miconia aeruginosa, Miconia glaberrima, Miconia hyperprasina, Myrica cerifera, Myrsine* spp., *Ocotea* spp., *Oreopanax capitatus, Oreopanax xalapensis, Oreopanax lachnocephalus, Picramnia teapensis, Piper psilorachis, Piper scalirispicum, Psychotria panamensis, Psychotria poeppigiana, Satyria meiantha, Symplocos vernicosa, Toxicodendron striatum, Vaccinium poasanum, Vismia baccifera.* RP: No data. ND: *Liquidambar styraciflua, Quercus* spp., *Alchornea latifolia, Ardisia* spp., *Begonia* spp., *Calliandra arborea, Casearia* spp., *Catopsis* spp., *Chamaedorea* spp., *Clusia* spp., *Cupressus lusitanica, Dendropanax* spp., *Psychotria elata, Pentagonia donnell-smithii*. In Honduras on high mountains there are valleys protected from the wind with particular vegetation not dominated by *Quercus* spp., among the species: *Alfaroa hondurensis, Celastrus vulcanicolus, Cornus disciflora, Hydrangea*

	steyermarkii, Passiflora prolata, Prunus salasii, Prunus brachybotrya, Phyllonoma laticuspis (P.R.House pers. com.).
TREE STRATUM	
Tree hight	15 – 40 m.
Canopy cover	Closed.
Canopy morphology	Mixed broad-leaved with occasional needle leaf
Leaf phenology	Semi-evergreen
Arboreal palms	None reported.
Tree ferns	HCW: *Cyathea* spp.
Drapery epifytes	HCW: *Phyllogonium fulgens.*
Sessile epifytes	ND: Many.
Climbing epifytes	Several.
SHRUB STRATUM	
Acaule palms	ND: *Chamaedorea* sp.
LITERATURE	Iremonger 1997.

CHARACTERISTICS	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1e(1) / 15, 15-A, 15-ND**
NAME	**Tropical evergreen broad-leaved altimontane forest (15)** **Bosque tropical siempreverde latifoliado, altimontano (15)**
GEOLOGY	Variable.
CLIMATIC CONDITIONS	Above 2,000 m, Caribbean side. Above 2,300 m, Pacific side.
SOIL CHARACTERISTICS	
SOIL TYPE	In Costa Rica and Panama, Gómez (1986) mentions that generally the soils are Inceptisols sometimes Andosols with an irregular topography and slopes between 30- 60%.
VEGETATION DATA	The cloud forest vegetation has a physiognomy which is determined by climatic factors: clouds and wind, as well as soils. The elevation is not fundamental as these vegetation types are found at lower elevations when the climatic conditions are favorable. These high mountain ecosystems experience drastic reduction in precipitation during the dry season but the relative humidity never drops to levels which might cause serious stress or at least not for any significant period. (Gómez, 1986).
Species	
Dominant species	En Costa Rica IA1e(1)- CG High mountain cloud forests (altimontane); Typical trees: Talamanca: *Quercus, Magnolia, Podocarpus montanus* and *P. oleifolia*), undergrowth with many Bryophytes, Asteraceae and Ericaceae. Central Highlands: *Quercus*, Lauráceas and *Podocarpus* spp. but no *Magnolia*. Guanacaste: no *Podocarpus* spp. but many *Quercus* spp., Lauraceae, *Myrcianthes* spp., Sapotaceae, Theaceae (*Gordonia*) and palms (*Euterpes* and *Geonoma*). Gómez (1986) also mentions that Lawton & Dryer studied the Costa Rican Monteverde cloud forest, identifying 6 sub-types of cloud forest based on wind exposure, topography, drainage and flora, the exact distribution of the subtypes were not mapped.: 1. Protected: Canopy dominants: *Ficus tuerckheimii, Sapium oligoneuron, S. Pachystachyum, Cedrela tonduzii, Quararibea plaatyphylla, Citharexylon caudatum, Mortoniodendron guatemalense*, Lauraceae, Sapotaceae; rich in bryophytes and epiphytic ferns, with a undergrowth variable but not dense. 2. Windward: *Pouteria viridis, Sloanea megaphylla, Persea americana, Lonchocarpus* spp. and *Dussia* spp.;

undergrowth denser than the previous type with a predominance of Acanthaceae, Rubiaceae, palms *Geonoma* spp. and *Calyptrogynes* spp., *Heliconia* spp. and *Costus* spp.

3. Oak: (differs very little from the description of, IA1d(1)), characterized in Monteverde, by *Quercus corrugata, Q. seemanii, Weinmannia wercklei, Cecropia polyphlebia, Centronia phlomoides*; undergrowth of *Geonoma* spp., *Chamaedorea* spp., Acanthaceae, Melastomataceae and ferns, The acualescent tree ferns are particularly noteworthy: *Lophosoria quadripinata* and *Cnemidaria mutica*.

4. Leeward: similar to the windward but with more epiphytes and a richer and denser undergrowth.

5. Saturated: With badly drained soils, similar oak forest but with more abundance of *Tetrorchidium* spp., *Hedyosum montanum, Symplococarpus brenesii, Tovomita nicaraguensis* and *Myrica phanerodonta*, this is the habitat of *Burmannia wercklei* a rare and beautiful endemic plant of the Burmaniacee, a family closely related to the Orchidaceae.

6. Dwarf forest (Elfin Forest): Found at al elevations exposed to the wind; dwarf (below 10 m), xeromorphic (hydrolic stress caused by drainage and desiccation), microphyllous and sclerophyllous, the species that adapt to these conditions are shrubs such as: *Weinmannia* spp., *Myrica* spp., *Conostegia* spp., *Oreopanax* spp., *Clusia* spp., *Podocarpus* spp., Ericaceae, but not easy to characterize by floristic composition alone, because of the special environmental conditions and extreme isolation, creating distinct floras with high levels of endemisum (Gómez, 1986).

CHARACTERISTICS#	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1e(1/2) / 16-HCW**
NAME	**Tropical evergreen mixed altimontane forest (16)** **Bosque tropical siempreverde mixto, altimontano (16)**
ECOSYSTEM DYNAMICS	Pristine.
WATER REGIME **Moist regime**	Well-drained, with cloud influence.
VEGETATION DATA **Species** **Frequent species**	En Honduras, Pacific variant above 2,300 m, Trees: *Abies guatemalensis, Taxus globosa, Cupressus lusitanica, Pinus ayacahuite, Pinus hartwegii, Pinus maximinoi, Pinus patula, Pinus pseudostrobus, Podocarpus oleifolius, Quercus cortesii, Quercus lancifolia, Quercus laurina, Alnus jorulensis, Ternstroemeria megaloptycha, Weinmannia pinnata, Weinmannia tuerckheimii, Cleyera theaeoides, and Drimys grandiflora.* Herbs and Shrubs: *Acalypha firmula, Begonia convallardiodora, Begonia fusca, Begonia oaxacana, Bocconia glaucifolia, Daphnophis strigillosa, Fuchsia paniculata, Fuchsia splendens, Hedyosmum mexicanum, Hoffmannia lineolata, Miconia glaberrima, Peperomia* spp. *Rondeletia buddleioides, Rondalettia laniflora, Rubus eriocarpus, Saurauia kegeliana, Saurauia scabrida, Senecio jurgensenii, Smilax spinosa.* No data exists for the Atlantic variant en Honduras. In Guatemala: *Taxus globosa, Podocarpus oleifolius, Cupressus lusitanica var benthamii, Abies guatemalensis, Pinus ayacahuite, P. donnell- smithsii, P. pseudostrobus, P. maximinoii, P. tecunumani, P. hartwegii, Quercus* spp. (Rosito, Medinillas & Vargas). According to Perry (1984) other species of Pine can de expected at these elevations, probably: *P. rudis, P. michoacana, P. oaxacana,* and *P. chiapensis*. At elevations these *Juglans guatemalensis* can be expected. Among the *Podocarpus* spp. that have been reported are *P. oleifolius: P. maturai, P. montana, and P. guatemalensis.*

TREE STRATUM	
Tree hight	To 40 m.
Canopy cover	Variable.
Canopy morphology	Mixed.
Leaf phenology	Evergreen.
Arboreal palms	No reports.
Sessile epifytes	Many.
LITERATURE	Iremonger, 1997: 49; Perry, J.P. The pines of Mexico and Central America. Timber Press. Portland, Oregon. 231 p.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1f(2) / 17, 17-2, 17-PR, 17-K**
NAME	**Tropical evergreen broad-leaved alluvial forest, occasionally flooded (17)** **Bosque tropical siempreverde latifoliado aluvial, ocasionalmente inundado (17)**
ECOSYSTEM DYNAMICS	Ancient to pristine.
GEOLOGY	Substrate sedimentary, from 5 to 500 m, relief imperceptible, subject to periodic inundation's.
CLIMATIC CONDITIONS	In south Belize average precipitation from 2,500 to 4,000 mm a year, with a dry season from February to May. Atlantic slope (Nicaragua, Costa Rica and Panama) the average precipitation 2,750-6,000 mm a year, average temperatures 22-24 °C and relative humidity of 90%.
FIRE EXPOSURE	In Belize and El Salvador: exposed to fire from the savanna but the vegetation is resistant.
SPECIAL CONDITIONS	K: Limited to agricultural areas with shifting cultivation. In Belize, from 0 to 500 m. A scrubby forest in depressions formed by streams that seasonally inundate the short grass savanna:VA2b(2). K: Commonly on river banks in the south of Belize were the occasional inundation's supply new alluvial material.
SOIL CHARACTERISTICS	
SOIL TYPE	In Belize the soils are deep and poor in calcium. K: The soils are deep and rich in calcium, fertile and well-drained, the fertility is maintained by the seasonal depositing of silt. In Nicaragua, Costa Rica and Panama: Soils alluvial rich in organic material, black in color.

In El Salvador (Pacific slope): deposits of fine silt in the A horizon (Ventura *et al*, 2,000).

Soil color

Belize: Brown to grayish brown, on the surface but lower horizons mottled.

WATER REGIME

Moist regime

In Belize occasionally inundated.

In Nicaragua, inundated periodically during 8-9 months of the year (draining continually but slowly leaving the soils wet).

Water characteristics

Fresh water, riverine.

VEGETATION DATA

Similar in growth and composition to the moderately drained evergreen lowland forest but much richer in palms and giant herbaceous plants such as *Heliconia* spp. and *Maranta* spp., the trees frequently with buttresses.

In the southeast of Nicaragua, Costa Rica y Panama, exists a special association dominated by *Prioria copaifera*, IA1f2-Pr. Growing at low altitudes, on saturated or inundated soils. At higher altitudes *Peltogyne purpurea* is more common. (ANAM- CBMAP- L. Berger Int. Inc. 2,000). On the periphery *Pachira aquatica, Tabebuia spp.* and *Symphonia globulifera,* can be found. etc (Gómez,1986).

Species

Frequent species

In Belize, common woody species include: *Acacia* spp., *Coccoloba* spp., *Guazuma ulmifolia, Guettarda combsii, Hirtella racemosa, Miconia* spp., *Mouriri excelsa, Sabal mauritiiformis, Simarouba glauca, Vochysia hondurensis* and *Xylopia frutescens.* In areas with poor drainage, a dense herbaceous layer forms, consisting of *Scleria bracteata* and other Cyperaceae.

K: The frequent species include: *Acosmium panamense, Attalea cohune, Brosimum* spp., *Calophyllum brasiliense, Carapa guianensis, Castilla elastica, Ceiba pentandra, Celtis schippii, Dendropanax arboreus, Dialium guianense, Ficus guajavoides, Ficus* spp., *Grias cauliflora, Guarea glabra, Guarea grandifolia, Inga affinis, Licania platypus, Nectandra* spp., *Ochroma lagopus, Poulsenia armata, Pouteria durlandii, Pouteria mammosa, Protium schippii, Pseudolmedia* spp., *Pterocarpus rohrii, Quararibea funebris, Rheedia* spp., *Sabal mauritiiformis, Schizolobium parahybum, Simira salvadorensis, Symphonia globulifera, Vochysia hondurensis.* When the river washes away parts of the

forest *Guadua longifolia* and *Dieffenbachia seguine* enter.

In Nicaragua, amongst the most common species are: *Lecythis ampla, Cecropia obtusifolia, Dypterix panamensis, Dialium guianensis, Carapa guianensis, Hyeronima* spp., *Lacmellea panamensis,Prioria copaifera, Enterolobium shomburkii, Achras* spp., *Guettarda* spp., *Inga* spp., *Xylopia* spp., *Ormosia* spp., *Tetragastris panamensis, Swetenia macrophylla, Zuelania guidonia, Vismia* spp.

In El Salvador (Ventura *et al*, 2,000): Numerous species quick growing trees to 35 m in height, with soft bark and buttresses such as: *Ceiba pentandra, Sterculia apetala Spodias* spp., *Annona* spp., *Bixa orellana, Carica cauliflora, Terminalia oblonga, Xilosma* spp., *Gyrocarpus americanus.* The shrub layer is dominated by *Bactris major*. Understory dominated by *Heliconia latispatha, Marantha macrosephala* and seedlings of forest trees.

TREE STRATUM

Tree hight

Belize: Short and scrubby.
K: high.

Canopy cover

Belize: open.
K: the canopy can be open, in areas destroyed by inundations.

SHRUB STRATUM

Lower height

K: 3 m.

Upper height

K: 4 m.

Canopy cover

Quassia amara, Carica pennatula, Heliconia spp.,

Acaule palms

In Belize, the palms are a significant feature of the understory: *Astrocaryum mexicanum, Bactris* spp., *Calyptrogyne ghiesbreghtiana*
and *Desmoncus orthocanthus.*

In general the palms can that can be found are: *Astrocaryum alatum, Bactris hondurensis, Reihardtia latisecta, Prestoea decurrens.*

Herbaceous cover (herbs considerably taller than 1.5M)

Renealmia cernua.

GROUND STRATUM

Overall herbaceous cover of the ground stratum

Herbs: *Cyclanthus bipartitus, Bauhinia guianensis, Zamia spp., Passiflora quadrangularis, Passiflora vitifolia, Psychotria aubletiana, Aechmea spp., Philodendrum spp., Maranta spp.*

FAUNISTIC OBSERVATIONS

In Belize, K: this type of vegetation appears to be a favorable habitat for the Howler Monkey of Yucatan

Alouatta pigra.

Some amphibians that Villa (1972) considers to be present in this ecosystem in Nicaragua are: *Agalychnis saltator*, *Bufo coniferus*, *Bufo haetmatiticus*, *Bufo marinus*, *Dendrobates auratus*, *Gastrophryne pictiventris*, *Hyla boulengeri*, *Hyla elaeochroa*, *Hyla rufitela*, *Leptodactylus melanonotus*, *Rana palmipes*, *Smilisca baudinii*.

OTHER OBSERVATIONS

The soils are fertile and susceptible to being converted into agricultural land. (ANAM- CBMAP- L. Berger Int. Inc. 2,000).

In El Salvador found in: Santa Clara, Escuintla, La Paz; Chaguantique, Nancuchiname, Escuintla, Normandia, El Tercio and San Felipe in Usulután.

LITERATURE

Belize: Wright et al. 1959: 11f; Iremonger and Brokaw 1995: I.2.1.3. K: Brokaw & Lloyd-Evans 1987, Brokaw et al. 1997, Iremonger & Sayer 1994, Wright et al. 1959: 5, 5a, 6, 6a, Iremonger and Brokaw 1995: I.2.1.2.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1g(1)(b) / 20**
NAME	**Tropical evergreen broad-leaved permanently inundated lowland swamp forest (20)** **Bosque tropical siempreverde latifoliado pantanoso permanentemente inundado (20)**
CLIMATIC CONDITIONS	Found in the 2500 - 4000 mm annual rainfall areas of southern Belize with a dry season from February through May.
SPECIAL CONDITIONS	0-500 m. This forest reaches up to 30 m in height. The soil water table is more or less permanent at least within a few cm of the soil surface, if not above it. These are confined to the Toledo District.
SOIL CHARACTERISTICS	
SOIL TYPE	Soils range from gray clays to loam and sandy loam.
Cover and nature organic matter	Some places have a surface mat of fibrous peat, which has a high live root content.
WATER REGIME	
Moist regime	Badly drained, waterlogged for most of the year.
VEGETATION DATA	
Species	
Frequent species	Frequently encountered species include: *Acacia* spp., *Acosmium panamense, Acrostichum aureum, Astrocaryum mexicanum, Attalea cohune, Bactris* spp., *Bucida buceras, Calophyllum brasiliense, Calyptranthes karlingii, Calyptrogyne ghiesbreghtiana, Carapa guianensis, Cassipourea guianensis, Chrysobalanus icaco, Coccoloba belizensis, Crysophila stauracantha, Dalbergia stevensonii, Dendropanax arboreus, Desmoncus orthacanthos, Erythroxylum guatemalense, Euterpe precatoria, Grias cauliflora, Guettarda combsii, Hirtella racemosa, Inga affinis, Lindsaea lancea, Lonchocarpus rugosus, Manilkara zapota, Manicaria saccifera, Maytenus schippii, Montricardia arborescens, Mouriri exilis, Pachira aquatica, Pterocarpus officinalis, Randia* sp., *Rhabdadenia paludosa, Rhizophora mangle, Rinorea hummelii, Sabal mauritiformis, Strychnos panamensis, Symphonia globulifera, Terminalia amazonia, Virola koschnyi, Vitex kuylenii, Vochysia hondurensis* and *Xylopia frutescens.*
TREE STRATUM	

Tree hight	15-20 m.
Canopy cover	Canopy broken.
Canopy morphology	Broad-leaved.
Leaf phenology	Evergreen.
Arboreal palms	*Attalea cohune, Sabal mauritiformis* and *Manicaria saccifera* are the principal emergent palms. *Euterpe precatoria* is common but usually remains relatively small.
Sessile epifytes	Sessile epiphytes common.
SHRUB STRATUM	
Acaule palms	*Astrocaryum mexicanum, Bactris* spp. and *Crysophila stauracantha* are distinctive understory palms.
LITERATURE	Meerman 1999a, Wright et al. 1959: 26, 27, Iremonger and Brokaw 1995: I.1.1.2.1.

CHARACTERISTICS	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1g(1)(b)-C / 20-C**
NAME	**Tropical evergreen broad-leaved lowland swamp forest, permanently inundated, Campnosperma panamensis variant (20-C)** **Bosque tropical siempreverde latifoliado pantanoso de tierras bajas, permanentemente inundado, variante Campnosperma panamensis (20-C)**
GEOLOGY	Substrate sedimentary, plains from 0 to 10 m.
SPECIAL CONDITIONS	This vegetation type is a special variant of the broad-leaved evergreen swamp forest IA1g(1)(b), permanently inundated that is found only in southeast Costa Rica and northeast Panama.
WATER REGIME	
Moist regime	Saturated to inundated.
VEGETATION DATA	
Species	
Character species	The vegetation reflects the physiognomic and floristic structure typical of the marine coastal associations such as mangroves. Orey, *Campnosperma panamensis* in densities from 20% when the freatic level is lower due to the elevation of the terrain to 90% or in almost pure stands in permanently inundated areas. The stands have variable densities with Orey, *Campnosperma panamensis* alternating with the palm, *Raphia taedigera.*
Frequent species	Shrubs and herbs such in the Melastomataceae and Rubiaceae.
TREE STRATUM	
Arboreal palms	Orey is found with *Raphia taedigera.* and *Euterpe precatoria*
GROUND STRATUM	
Graminoids cover	Cyperaceae.
Forbes cover (including juvenile trees and acaule palms)	The regeneration of Orey is abundant and aggressive in the light gaps formed by fallen trees.
OTHER OBSERVATIONS	- The almost pure stands are found dispersed and separated across an area of approximately 140 Km^2. From the River Sixaola to 3 Km southeast of the River San Pedro, Bocas del Toro. - The densest stands are found in the "El Almirante" Bay, in front of the Island of Colon, in the area of

Pondsok Point. Continuing south east to the west of the Chiriquí lagoon, next to the mouth of the Rivers Ahuyama and Róbalo, is found small patch of Orey forest. The third patch extends from the River Guarumo to the south western edge of the Valiente Peninsula east of the River Cricamola. This area is large and extensive with various patches of Orey of high and low densities.

- The forth and most eastern of the areas of Orey, is found from the south east coast of the Valiente Península, to the mouth of the River Cañaveral and on to west of the River San Pedro. The patches have variable densities of Orey mixed with *Raphia taedigera.*
- An important discovery was the locating of Orey on the Pacific side of the Darien Province.

CHARACTERISTICS	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA1g(2)(b) / 21-HC-2, 21-MA**
NAME	**Tropical evergreen broad-leaved lowland swamp forest with palm, permanently inundated (21)** **Bosque tropical siempreverde latifoliado pantanoso de tierras bajas con palmas, permanentemente inundado (21)**
PHYSICAL CONDITIONS	Plains from 0 to 100 m.
ECOSYSTEM DYNAMICS	Pristine.
GEOLOGY	Alluvial sediment.
CLIMATIC CONDITIONS	Average precipitation 2,500-4000 mm a year, average temperatures around 27°C.
SOIL CHARACTERISTICS	
SOIL TYPE	Soils Entisols and Inceptisols hydromorphic, clay, with restricted drainage, sometimes with large quantities of organic material.
Soil color	Ochre to dark depending on the amount of organic material.
Cover and nature organic matter	Considerable amounts of organic material can accumulate but do not form peat.
Cover rock	Non observed.
WATER REGIME	
Moist regime	Inundated 8 months or permanently.
VEGETATION DATA	HC = Central Honduras MA= *Manicaria* variant from Belize North Nicaragua similar to Honduras and south

	Nicaragua similar to Costa Rica and Panama
Species	Vegetation broad-leaved species dominated by Palms and sprouting broad-leaved trees. Similar to IA1g(1) but with more palms to the point that they come to dominate.
Character species	M: characterized by *Manicaria saccifera* HC characterized by *Roystonea dunlapiana, R. regia* and *Acoelorraphe wrigthii*
Dominant species	Dominant in different areas is: Yolillo, *Raphia taedigera*, called Matomba in Panamá (ANAM- CBMAP- L.Berger Int.Inc., 2,000), in Nicaragua nematophores have been observed. Gómez mentions that *Raphia* is found from Colombia to NE Nicaragua, a little to the north of the Perlas Lagoon.
Frequent species	M (Belize): Common species include: *Astrocaryum mexicanum, Bucida buceras, Calophyllum brasiliense, Ceratozamia robusta, Connarus lambertii, Euterpe precatoria, Mouriri exilis, Mouriri myrtilloides, Pachira aquatica, Pterocarpus officinalis* and *Symphonia globulifera.* HC (Honduras): *Castilla elastica, Coccoloba* spp.*, Combretum cacoucia, Desmoncus* spp.*, Erithrina glauca, Grias cauliflora, Pachira aquatica, Pterocarpus officinalis, Symphonia globulifera,* and *Vochysia guatemalensis*. In Nicaragua, Costa Rica and Panama, mentions Gómez (1986), Broad-leaved species are found on the periphery of the stands of *Raphia taedigera* as isolated individuals or as small patches: *Pterocarpus officinalis, Carapa guianensis*, *Pentaclethra macrolba, Grias fendleri, Prioria copaifera, Luhea seemanii, Crudia acuminata*. In Panama a understory seedlings of *Raphia taedigera,* and *Grias cauliflora*, with some vines and epiphytes.
Associated species	Associations of *Raphia- Inga*, *Raphia- Rhizophora* are found. In Nicaragua and Costa Rica, *Manicaria saccifera* is found in high densities in areas saturated with brackish water (Gómez, 1986), sometimes with palms such as *Astrocaryum alatum, Euterpe* spp., *Raphia taedigera* and broad-leaved species such as: *Calophyllum brasiliense, Symphonia globulifera, Carapa guianensis, Dialium guianensis* and *Pterocarpus officinalis*.
TREE STRATUM	
Tree hight	In Belize and Honduras from 10 to 30 m, in the south 15 to 20 m, in Panama reported from 10-15 m.
Canopy cover	Including the palms from 70-75%. In Belize more open.
Canopy morphology	Ombrophyllous and palms.
Leaf phenology	Evergreen.
Vines	Abundant at forest margins and over shrubs.
Arboreal palms	In different proportions, other species of palms:

	Manicaria saccifera (brackish water), *Acoelorrhaphe wrightii* (Papta), *Socratea exorrhiza, Elaeis oleifera, Asterogyne martiniana, Astrocaryum alatum, Prestoea decurrens, Desmoncus orthocanthos, Euterpe macrospadix, Welfia georgii*. In Honduras: *Roystonea dunlapiana, Roystonea regia. Attalea cohune* is common in areas with history of disturbance.
Tree ferns	In Nicaragua, sometimes *Cyathea arborea*
Sessile epifytes	Some.
Climbing epifytes	*Philodendron* spp. and *Syngonium* spp.
SHRUB STRATUM	
Lower height	1.5 m.
Upper height	2.5 m.
Canopy cover	20%.
Acaule palms	Only when there is a closed canaopy: *Geonoma congesta* and *G. procumbens*, *Bactris hondurensis* and pseudo-palms such as *Cyclanthus palmata* and *Cardulovica palmata*, and the climbing palm *Desmoncus orthocanthos.*
Herbaceous cover (herbs considerably taller than 1.5M)	
Leaf morphology	Ombrophyllous and tropical delta (palms).
Shrub phenology	Evergreen.
Tall herbs periodicity	Biennials and perennials.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	5-10%. Frequently Marantaceae, *Costus* spp. and *Heliconia* spp.
Graminoids cover	Some Cyperaceae.
Forbes cover (including juvenile trees and acaule palms)	Herbaceous terrestrial such as: *Polystichum muricatum* and *Campyloneurum angustifolium*.
Cover of inferior cryptogamytes (no ferns)	Algae and lichens on tree trunks.
Acaule palms cover	Variable but no more than 5%.
Predominant periodicity of herbaceous cover	Evergreen.
LITERATURE	(Meerman 1999a, Wright et al. 1959: 28, Iremonger and Brokaw 1995: I.1.1.2.2.), Iremonger 1997: 1,2.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2a(1)(a) / 22, 22-A, 22-P, 22-M, 22M-2, 22-ST, 22-PN, 22-VR, 22-VIT**
NAME	**Tropical evergreen seasonal broad-leaved lowland forest, well-drained (22)** **Bosque tropical siempreverde estacional latifoliado de tierras bajas, bien drenado (22)**
ECOSYSTEM DYNAMICS	Ancient - Pristine.
GEOLOGY	Nicaragua: A broad-leaved forest on undulating or rugged terrain, therefore with good drainage from 100-400 m. Substrate metamorphic at higher altitudes, at lower altitudes sedimentary.
CLIMATIC CONDITIONS	Belize: Average precipitation 2,000- 2,500 mm a year. Nicaragua: Average precipitation 1,800-2,000 mm a year and average temperatures 24-25°C. Relative humidity 80%. Costa Rica, VRGT: Dry period, 3-4 months.
FIRE EXPOSURE	Belize: Sensitive to fire damage. The ST variant is very sensitive to fire damage and repeated burning leads to the vegetation being replaced by *Dicranopteris* spp. and *Pinus caribaea*.
SPECIAL CONDITIONS	A= variant de Sierra Agalta Honduras P= variant cordillera Entre Ríos/ El Paraíso, Honduras M= variant Mosquitia, Honduras with a M- 2= intervened, ST= variant Simarouba/Terminalia on acid soils, Belize. VIT= variant Virola/Terminalia on quartzite hills, Belize. Variant Nicaragua. PN= The Nicoya Peninsula, Costa Rica. VRGT = Costa Rica.
SOIL CHARACTERISTICS	
SOIL TYPE	VT: soils superficial, brownish gray ash and rocky ST: soils reddish brown or gray clay sand with stones and quartzite on low hills. Nicaragua: Soils clay Mollisols and Alfisols well-drained undulating or rugged, Ultisols lower down. PN: Substrate of marine sediments almost flat. VRGT: Substrate tectonic and erosive producing acid red clay Ultisols in the foothills, badly drained in the depressions, dry season 3-4 months. Marine sediments, rugged or flat with, rocky Inceptisols, with little humus.
Soil color	Nicaragua: Brown and ochre Costa Rica: Reddish
Cover and nature organic matter	Nicaragua: Regular
Cover rock	Nicaragua: Noticeable on hills and rugged terrain.

WATER REGIME

Moist regime

Well-drained.
Nicaragua: Between mesic and very humid.

VEGETATION DATA

Species

Frequent species

Guatemala in the karstic region: *Ampelocera hotlei, Aspidosperma megalocarpon, Alseis yucatenensis, Astrocaryum mexicanum, Brosimum alicastrum, Brosimum panamense, Bursera simaruba, Callophyllum brasiliense, Crysophila stauracantha, Cupania prisca, Dialium guianense, Guarea excelsa, Lonchocarpus castilloi, Malmea depressa, Manilkara* spp., *Pimenta dioica, Piscidia piscipula, Protium copal, Pseudobombax ellipticum, Poulsenia armata, Pouteria* spp., *Quararibea funebris, Sabal mauritiiformis, Sebastiania longicuspis, Simaruba glauca, Simira salvadorensis, Spondias mombin, Swartzia cubensis, Terminalia amazonia, Trophis racemosa. Vatairea lundelli, Vochysia hondurensis, Zuleania guidonia*.

VT: *Cyathea* spp., *Euterpe precatoria, Guettarda combsii, Miconia* sp., *Mouriri myrtilloides, Podocarpus guatemalensis, Schippia concolor, Symphonia globulifera, Terminalia amazonia, Virola brachycarpa, Vismia ferruginea, Vochysia hondurensis* and *Xylopia frutescens* are frecuente.

ST: *Attalea cohune, Bactris* spp., *Calophyllum brasiliense, Castilla elastica, Clidemia* spp., *Combretum farinosum, Dendropanax arboreus, Desmoncus orthacanthos, Dialium guianense, Dicranopteris* spp., *Euterpe precatoria, Ficus* spp., *Geonoma* spp., *Guarea* spp., *Heliconia vaginalis, Hirtella racemosa, Inga* spp., *Licania platypus, Licania hypoleuca, Miconia* spp., *Mimosa pigra, Mimosa watsoni, Mouriri myrtilloides, Nectandra* spp., *Ochroma lagopus, Passiflora ambigua, Podocarpus guatemalensis, Pourouma aspera, Protium schippii, Psychotria poeppigiana, Pterocarpus rohrii, Quararibea* spp., *Rheedia* spp., *Schefflera morototoni, Schippia concolor, Schizolobium parahybum, Scleria bracteata, Simarouba glauca, Sloanea tuerckheimii, Souroubea* spp., *Spondias mornbin, Stemmadenia donnell-smithii, Swietenia macrophylla, Symphonia globulifera, Terminalia amazonia, Tococca* spp., *Trichospermum grewiifolium., Virola brachycarpa, Virola koschnyi, Vismia ferruginea, Vochysia hondurensis, Xylopia frutescens* and *Zanthoxylum* spp. with *Astrocaryum mexicanum* and Melastomataceae in the

understory. At higher altitudes tree ferns *Cyathea* spp. and terrestrial ferns.

A (Honduras): *Alchornea latifolia, Arundinella deppeana, Chamaedorea pinnatifrons, Euonymus acuminata, Ficus* spp., *Garcinia intermedia, Guettarda macrosperma, Persea americana, Picramnia antidesma, Quercus* spp., *Liquidambar stryraciflua, Miconia laevigata, Ocotea* spp., *Odentonema callistachyum, Palicourea crocea, Piper* spp., *Psychotria aggregata, Swietenia macrophylla.*

M (Honduras): *Apeiba membranaceae, Brosimum* spp., *Bursera simaruba, Calophylum brasiliense, Casearia* spp., *Castilla elastica, Castilla tuno, Ceiba pentandra, Cupania* spp., *Dialium guianense, Guarea grandifolia, Hirtella americana, Luhea seemannii, Manilkara* spp., *Pouruma aspera, Pouteria mammosa, Shizolobium parahybum, Spondias mombin, Virola koschnii, Vochysia ferruginea, Vochysia guatemalensis, Xylopia frutescens*.

P (Honduras): From the air Iremonger identified : *Calycophyllum candissimum, Liquidambar styraciflua* and *Symphonia globulifera.*

Nicaragua: Amongst the mostly frequent trees: *Luhea seemanii, Terminalia amazonica, Guarea guidonea, Necandra globosa, Swetenia macrophylla, Licania platypus, Dialium guianense, varios Ficus* spp., and *Inga* spp., *Xylopia frutescens, Calophyllum brasiliense, Guatteria sp, Bauhinia guianensis, Tetragastris panamensis, Virola koschnyi, Virola* spp., *Vochysia* spp.

In Costa Rica the species in the Pacific variations are considered semideciduos in the rest of Centroamerica (though they appear here to be more seasonal evergreen in form) and are different from the species on the Atlantic side of Costa Rica.

PN: *Andira inermis, Alophyllus occidentalis, Apeiba tibourbou, Bursera spp, Byrsonima crassifolia, B. densa, Capparis sp, Castilla elastica, Chlorophora tinctorea, Cochlospermum vitifolium, Acrocomia vinifera, Ficus spp, Godmania aesculifolia, Triplaris sp, Spondia mombin, Spondia purpurea.*

VRGT: *Albizia adinocephala, Astronium graveolens, Guaiacum sactum, Byrsonima crassifolia, Calycophyllum candidissimum, Castilla sp, Cordia sp, Guatteria amplifolia, Lafoensia punicifolia, Licania arborea,*

	Platymiscium pinnatum, Sloanea terniflora, Attalea butyracea, Swartzia simplex, A variant with many vines and few epiphytes *Aristoloquia* spp. and *Dioscorea* spp., rich in *Heliconia* spp. and Cyclanthaceae. Trees: *Byrsonima crassifolia, Xilopia frutescens, Ximenia americana, Genipa caruto, Sapindus saponaria, Enterolobium shomburgkii, Hernandia* spp., *Jacaranda lasiogyne, Guazuma ulmifolia.*
Associated species	Nicaragua: *Bursera simarouba, Tabebuia neocrysantha, Croton glabellus, Cochlospermum vutifolium, Cecropia peltata, Ocroma lagopus, Heliocarpus* spp.
TREE STRATUM	
Tree hight	Belize: 13 – 35 m. A: 35 m. VT: low: 13-20 m. Nicaragua: 20– 30 m.
Canopy cover	75 – 80%.
Average basal area	Nicaragua: 10-12 m^2/Ha.
Canopy morphology	High proportion (80-90%) ombrophyllous, the rest are sclerophyllous.
Leaf phenology	Nicaragua: Predominantly evergreen trees with some bud protection. The reduction in foliage in the dry season is noticeable, as is the partial defoliation. Some shed all there leaves. Transitional forests between the seasonal evergreen and the semi-deciduous exist might and be extensive in some areas. PN: No more than 30% deciduous, generally 10- 15%.
Vines	Nicaragua: Some woody vines such as, *Passiflora coriaceae*.
Arboreal palms	Belize: On limestone *Sabal mauritiiformis,* ST/VT: *Attalea cohune.* Nicaragua: Exist but not frequent.
Tree ferns	Nicaragua: Rare to find *Alsophila myosuroides*.
Drapery epifytes	Nicaragua: *Pleurothallis* spp., *Scaphyglottis graminifolia.*
Sessile epifytes	Not common.
Climbing epifytes	Nicaragua: *Philodendron guttiferum and P inequilaterum.*
SHRUB STRATUM	Nicaragua: Amongst the most frequent shrubs: *Psychotria capitata, Acalypha diversifolia, Bactris* spp., *Chamaedorea tepejilote, Desmopsis schippii, Geonoma* spp., *Malvaviscus arboreus, Macgravia brownei, Piper marginatum, Quassia amara, Reinhartdtia gracilis, Rinorea squamata, Sorocea* spp., *Tibouchina longifolia, Wissandula excelsior*.
Lower height	Nicaragua: 1.5 m.
Upper height	Nicaragua: 3.0 m.
Canopy cover	Nicaragua: 20 –30 %.

Acaule palms	Belice: *Chamaedorea oblongata, C. Ernesti-augusti, C. elegans, tepejilote, Geonoma interrupta*. Nicaragua: *Bactris* spp., *Chamaedorea tepejilote, Geonoma* spp.
Herbaceous cover (herbs considerably taller than 1.5M)	Nicaragua: *Chusquea simpliciflora, 5%.*
Leaf morphology	Nicaragua: Ombrophyllous some sclerophyllous.
Shrub phenology	Nicaragua: Evergreen.
Tall herbs periodicity	Nicaragua: Perennial.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	Nicaragua: *Costus* spp., *Adiantum latifolium, Dieffenbachia* spp. and *Bromelia* spp. *20-30%*.
Graminoids cover	Nicaragua: Exist, but not significant.
Forbes cover (including juvenile trees and acaule palms)	Nicaragua: 5 – 7%.
Cover of inferior cryptogamytes (no ferns)	Nicaragua: On rocks, fallen trunks.
Acaule palms cover	Nicaragua: Just seedlings.
Predominant periodicity of herbaceous cover	Nicaragua: Evergreen.
LITERATURE	Guatemala: Martinez-Tuna (1999); Belice: Stevenson 1942; Brokaw 1991; Meerman 1999a; Wright et al. 1959;; Iremonger & Brokaw 1995; Iremonger 1997

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2a(1)(a)K / 23-r, 23-s, 23-s-M**
NAME	**Tropical evergreen seasonal broad-leaved lowland forest, well-drained, on steep karstic hills (23)** **Bosque tropical siempreverde estacional latifoliado de tierras bajas, bien drenado (23)**
ECOSYSTEM DYNAMICS	Ancient.
GEOLOGY	Karstic.
CLIMATIC CONDITIONS	Less than 2,500 mm of rainfall per year.
FIRE EXPOSURE	The soil at the base of limestone hills is often quite fertile and sought after for slash and burn agriculture. Wild fires become hotter as they creep up the slopes and often completely destroy the trees on the tops of the hills. Additionally, the soils on these hills are very shallow. Once the forest is destroyed, these soils very quickly erode, and it is very difficult for a forest to re-establish itself.
SPECIAL CONDITIONS	K-r: On rolling hills. K-s: On steep hills. K-s-M: On steep hills in Mosquitia, Honduras.
SOIL CHARACTERISTICS	
SOIL TYPE	Over calcareous rock. Soils may be extremely organic due to the leaching of the mineral soil and the build-up of organic matter in the limestone cracks and fissures. Usually very shallow on the slopes and susceptible to erosion.
Cover rock	Variable. Most noticeable in K-s.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Frequent species	K-r: *Acacia dolychostachya, Alseis yucatenensis, Ampelocera hottlei, Annona primigenia, Aspidosperma cruenta, Attalea cohune, Bourreria oxyphylla, Brosimum alicastrum, Calophyllum brasiliense, Casearia bartlettii, Cedrela odorata, Cordia gerescanthus, Crysophila stauracantha, Cupania belizensis, Cymbopetalum mayanum, Exothea paniculata, Guarea glabra, Hirtella americana, Licaria peckii, Lysiloma acapulcense, Manilkara zapota, Sideroxylon foetidissimum, Matayba oppositifolia, Ouratea lucens, Pimenta dioica, Pouteria amygdalina, Pouteria durlandii, Protium copal, Pseudolmedia oxyphyllaria, Rehdera penninervia, Sabal*

mauritiiformis, Sebastiana tuerckheimiana, Simira salvadorensis, Spondias mombin, Stemmadenia donnell-smithii, Tabebuia guayacan, Trichilia havanensis, Trichilia moschata, Trophis racemosa, Vatairea lundellii, Vitex gaumeri, Wimmeria concolor, Zanthoxyulum procerum, Zuleania guidonia and Myrtaceae. Palms and Rubiaceae are abundant in the shrub layer and lianas are frequent.

K-s: The usually more extreme conditions generate a different vegetation with: *Acalypha* sp., *Achimenes erecta, Alseis yucatenensis, Aphelandra scabra, Astronium graveolens, Bauhinia divaricata, Bernoullia flammea, Brosimum* spp., *Bursera simaruba, Cedrela odorata, Ceiba aesculifolia, Clusia* sp., *Coccoloba acapulcensis, Costus pictus, Crysophila stauracantha, Cupania belizensis, Cymbopetalum mayanum, Dendropanax arboreus, Desmoncus orthacanthos, Dracaena americana, Deherainia smaragdina, Drypetes laterifolia, Gausia maya, Heliconia spissa, Louteridium chartaceum, Louteridium donnell-smithii, Manilkara zapota, Malmea depressa, Metopium brownei, Oreopanax obtusifolius, Passiflora cobanensis, Passiflora xiikzodz, Pimenta dioica, Piper psilorrhachis, Piper* spp., *Pithecellobium arboreum, Plumeria rubra, Pouteria campechiana, Pouteria reticulata, Protium copal, Pseudobombax ellipticum, Rhus* spp., *Sapindus saponaria, Sebastiania tuerckheimiana, Swartzia cubensis, Talisia oliviformis, Thouinia paucidentata, Trichilia havanensis, Trichilia minutiflora, Vitex gaumeri and Zanthoxylum* sp. Epipetric herbs are locally abundant, e.g. *Anthurium slechtendahlii, Anthurium verapazense, Tradescantia discolor,* and *Begonia sericoneura*. The vegetation of burned hilltops is replaced by vines such as *Bidens squarrosa* and *Calea* spp. or more commonly with the fern *Pteridium aquilinum*.

K-s-M: *Anthurium bombacifolium, Anthurium ochranthum, Anthurium schlechtendalii, Ardisia pelludida, Astrocaryum mexicanum, Begonia* spp., *Bucida buceras, Byrsonima crassifolia, Grias fendleri, Guadua maclurei, Heliconia wagneriana, Monstera adansonii, Piper arboreum, Sabicea villosa, Sideroxylon tempisque, Stromanthe jacquinii, Syngonium macrophyllum.*

TREE STRATUM

Tree hight 20-40 m.

Canopy cover Closed, canopy often uneven in K-s.

Canopy morphology	Broad-leaved.
Leaf phenology	Evergreen with a distinctive semi-deciduous element.
Vines	Present.
Arboreal palms	Generally restricted to K-r: *Attalea cohune*, *Sabal mauritiiformis*.
Tree ferns	Generally none, but reported from Parque Nacional Laguna Lachua (Alta Verapaz, Guatemala).
Sessile epifytes	Some in K-r but abundant on K-s and K-s-M.
SHRUB STRATUM	
Acaule palms	Various, including: *Chamaedorea elegans*, *Chamaedorea oblongata*, *Chamaedorea ernesti-augusti*, *Chamaedorea pinnatifrons*.
OTHER OBSERVATIONS	The hill tops of variant K-r often have a vegetation very similar to variant K-s but these differences are not mapable.
LITERATURE	Castaneda Cerna, 1997., Brokaw & Lloyd-Evans 1987, Iremonger & Sayre 1994, Meerman 1998b, 1999a, 1999c, Schultze and Whitacre 1999, Wright et al. 1959; Iremonger and Brokaw 1995; Iremonger 1997.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2a(1/2)(a) / 24**
NAME	**Tropical evergreen seasonal mixed lowland forest, well-drained (24)** **Bosque tropical siempreverde estacional mixto de tierras bajas, bien drenado (24)**
GEOLOGY	0-700 m; over non-calcareous rocks.
CLIMATIC CONDITIONS	Average rainfall less than 2,500 mm a year with a pronounced dry season from February through May.
FIRE EXPOSURE	This ecosystem is the result of frequent fires.
SOIL CHARACTERISTICS	
Cover mineral soil	Generally mineral soil visible.
Cover and nature organic matter	Organic layer very limited.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Dominant species	*Pinus caribaea* is the dominant species.
Frequent species	Typical broad-leaved species include *Agarista* spp., *Byrsonima crassifolia, Clethra occidentalis, Clusia massoniana, Curatella americana, Schippia concolor, Terminalia amazonia* and various *Quercus* spp.
TREE STRATUM	
Arboreal palms	None.
Tree ferns	Common.
Sessile epifytes	Frequent.
GROUND STRATUM	
Graminoids cover	The herbaceous understory is often dominated by *Dicranopteris* spp., sedges and grasses including *Tripsacum latifolium.*
LITERATURE	Means, 1997, Wright et al. 1959; Iremonger and Brokaw 1995.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2a(1/2)(a)-K / 25**
NAME	**Tropical evergreen seasonal mixed, well-drained forest, on calcareous soils (25)** **Bosques tropical siempreverde estacional mixto, bien drenado, en suelos calcáreos (25)**
ECOSYSTEM DYNAMICS	Low.
GEOLOGY	Kárstic, flat bottomed valleys.
CLIMATIC CONDITIONS	Less than 3,000 mm of rain a year.
FIRE EXPOSURE	Occurs.
SOIL CHARACTERISTICS	
SOIL TYPE	Clay.
Soil color	Gray, dark.
Cover rock	Variable.
VEGETATION DATA	
Species	
Frequent species	*Pinus caribaea* and broad-leaved shrubs.
TREE STRATUM	
Tree hight	15 – 25 m.
Canopy cover	Very open.
Canopy morphology	Needle leaved.
Leaf phenology	Evergreen.
Arboreal palms	No.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2a(1)(b) / 26, 26-2**
NAME	**Tropical evergreen seasonal broad-leaved lowland forest, moderately drained (26)** **Bosque tropical siempreverde estacional latifoliado de tierras bajas, moderadamente drenado (26)**
GEOLOGY	Forest found between 0 and 100 m on alluvial plains.
CLIMATIC CONDITIONS	Average precipitation 2,500-3,000 mm a year, the average temperatures 26-28 °C, relative humidity 80%.
SOIL CHARACTERISTICS	
SOIL TYPE	Soils clay Ultisols.
Soil color	Reddish.
Cover and nature organic matter	Reddish black when organic material is abundant.
WATER REGIME	
Moist regime	As this type of forest is found on flat terrain, drainage is moderate to poor but can not be considered marshy, even though standing water can be found in depressions during the rainy season.
VEGETATION DATA	
Species	
Frequent species	*Manilkara chicle, Lycania hypoleuca, Crysophyllum mexicanum, Calophyllum brasiliense* var. *rekoi, Vochysia hondurensis, Xylopia aromatica, X. Frutescens, Symphonia globulifera, Didymopanax morotoni.*
Associated species	*Luhea seemanii, Terminalia amazonica, Guarea guidonea, Necandra globosa, Swetenia macrophylla, Licania platypus, Dialium guianense, Ficus* spp., *Inga* spp., *Cortón glabellus, Cecropia peltata, Ocroma lagopus, Guatteria* spp., *Bauhinia guianensis, Bursera simarouba, Tabebuia* spp., *Tetragastris panamensis, Virola koschnyi, Virola* spp., *Heliocarpus* spp.
TREE STRATUM	
Tree hight	20 – 30 m.
Canopy cover	80%.
Average basal area	12-14 m^2/Ha.
Canopy morphology	Ombrophyllous.
Leaf phenology	Evergreen with some semi-deciduous elements.
Vines	Some such as: *Passiflora coriacea* and *Macgravia brownei*
Arboreal palms	Some such as: *Elaeis oleifera* and in wetter parts *Acoelorraphe wrigthii*
Drapery epifytes	Orchíds: *Brassavola nodosa, Polystachya spp.,*

	Shomburkia spp., *Epidendrum* spp., *Scaphyglottis graminifolia, Pleurothallis* spp.
Sessile epifytes	Bromeliads: *Tillandsia* spp., *Bromelia* spp.
Climbing epifytes	Araceae: *Philodendron guttiferum, P. inequilaterum*
SHRUB STRATUM	Amongst the shrubs are found: *Miconia albicans, Miconia lundelliana, M. Miconia ciliata, Acisanthera bivalvis, Tococa guianensis, Mauletia guatemalensis, Mesechites trifida, Psychotria. erecta, P capitata and P. oaxacana*. *Acalypha diversifolia, Desmopsis schippii, Geonoma* spp., *Piper marginatum, Quassia amara, Reinhartdtia gracilis, Rinorea squamata, Tibouchina longifolia, Wissandula excelsior*.
Herbaceous cover (herbs considerably taller than 1.5M)	*Heliconia* spp., *Bactris tepejilote, B. hondurensis, Chamaedorea* spp., *Desmoncus orthocanthos, Chusquea simpliciflora.*
GROUND STRATUM	*Dieffenbachia* spp., *Passiflora coriaceae, Costus* spp.,
Overall herbaceous cover of the ground stratum	30 – 40%.
Graminoids cover	Insignificant.
Forbes cover (including juvenile trees and acaule palms)	Terrestrial ferns: *Adiantum latifolium, Lyndsea strycta, Trichomanes pinnatum.*
Cover of inferior cryptogamytes (no ferns)	Insignificant.
Acaule palms cover	None, just seedlings.
Predominant periodicity of herbaceous cover	Evergreen.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2a(1)(b)K / 28, 28-NE, 28-NW, 28-CE, 28- CW, 28-BR**
NAME	**Tropical evergreen seasonal broad-leaved lowland forest on calcareous soils (28)** **Bosque tropical siempreverde estacional latifoliado de tierras bajas en suelos calcáreos (28)**
ECOSYSTEM DYNAMICS	Ancient.
GEOLOGY	Calcareous.
CLIMATIC CONDITIONS	Average rainfall less than 2,000 mm per year with a pronounced dry season from February through May.
FIRE EXPOSURE	Belize: Limited to areas with slash and burn cultivation.
SPECIAL CONDITIONS	No suffix: Over calcium rich alluvium. This very mixed assemblage is found on the middle terraces of many rivers and streams draining from the Maya Mountains. BR: Belize River Variant: These forests are found along the Belize River on recent alluvial deposits over limestone. CE: Central Eastern Belize variant CW: Central Western Belize variant TP: Tehuantepec-Peten variant: These are forests in lowland or low hilly areas (to about 200 m) on shallow limestone soils. Y: Yucatan variant: These are forests in lowland or low hilly areas (to about 200 m) on shallow limestone soils in the north and west of the country, but also near to the coast in the Stann Creek area. Note: see separated description below for IA1a(3)(b)K from Guatemala.
SOIL CHARACTERISTICS	
SOIL TYPE	No suffix: Soils are deep, calcium rich and usually sandy. BR: Soils are either deep gray clays, dark brown sandy loam or sandy clay loam over limestone at 50-75 cm. Generally there is a distinctive “hog wallow” relief with standing water in the cracks. CE: On limestone based soils. TP: Soils are well-drained gray or brown clays, variably stony over calcareous rock.
Soil color	TP: Gray or brown.
Cover rock	Variable.
WATER REGIME	
Moist regime	Mostly well-drained. BR: Badly drained.

VEGETATION DATA

Species
Character species
Frequent species

Y: Characterized by the scarcity of the palms *Attalea cohune* and *Crysophila stauracantha* which are so common in similar forests elsewhere in Belize.

Alluvial variant: *Acoelorrhaphe wrightii, Atalea cohune, Bactris major, Bactris mexicana, Belotia campbellii, Calathea lutea, Calophylum brasiliense, Ceiba pentandra, Chrysophyllum oliviforme, Coccoloba belizensis, Coccoloba schiedeana, Costus guanaiensis, Cupania belizensis, Desmoncus orthacanthos, Ficus* spp.*, Guarea* spp.*, Hampea trilobata, Heliconia latispatha, Luhea speciosa, Lysiloma bahamense, Manilkara* spp.*, Maranta arundinaceae, Pimenta dioica, Pouteria* spp.*, Pterocarpus rohrii, Sabal mauritiiformis, Samanea saman, Schizolobium parahybum, Simarouba glauca, Spondias mombin, Stemmadenia donnell-smithii, Swietenia macrophylla, Tabebuia rosea, Tabernaemontana arborea, Virola koschnyi, Vitex gaumeri, Vochysia hondurensis, Zanthoxylum* spp.*, Zuleania guidonia*. The species are a mixture of lowland, moist dependent and somewhat more drought tolerant species.

BR: Some tree species present are *Ampelocera hottlei, Attalea cohune, Bactris mexicana, Bucida buceras, Calophyllum brasiliense, Cedrella odorata, Ceiba pentandra, Cojoba arborea, Davilla kunthii, Enterolobium cyclocarpum, Ficus insipida, Guazuma ulmifolia, Pachira aquatica, Pouteria campechiana, Roystonea regia, Schizolobium parahybum, Scleria bracteata, Spondias mombin, Swartzia cubensis, Swietenia macrophylla, Terminalia amazonia, Vatairea lundellii, Vochysia hondurensis, Xylopia frutescens, Zanthoxylum* sp. and occasional Melastomataceae. Small epiphytic orchids are frequent.

CE: Frequently encountered species include *Acacia* spp.*, Bursera simaruba, Coccoloba* spp.*, Crysophila stauracantha, Cupania* spp.*, Guettarda combsii, Lonchocarpus castilloi, Manilkara zapota, Pouteria* spp.*, Sabal mauritiiformis, Simarouba glauca, Swietenia macrophylla* and *Vitex gaumeri.*

CW: Common species in the section of this forest near Lamanai include *Allophylus campostachys, Aspidosperma megalocarpon, Attalea cohune, Brosimum alicastrum, Bucida buceras, Bursera simaruba, Capparis frondosa, Castilla elastica, Cedrela odorata, Ceiba pentandra, Chamaeodorea pinnatifrons, Crysophila stauracantha,*

Coccoloba belizensis, Cojoba arborea, Crataeva tapia, Cupania belizensis, Dendropanax arboreus, Desmoncus orthacanthos, Enterolobium cyclocarpum, Forchhammeria trifoliate, Guarea glabra, Guazuma ulmifolia, Hirtella americana, Licaria peckii, Lonchocarpus castilloi, Lonchocarpus guatemalensis, Maranta arundinaceae, Metopium brownei, Pimenta dioica, Piper amalgo, Piscidia piscipula, Protium copal, Sabal mauritiiformis, Sapindus saponaria, Schizolobium parahybum, Spondias mombin, Swartzia cubensis, Talisia oliviformis, Trichilia havanensis and *Vitex gaumeri*.

TP: Common trees are *Alseis yucatanensis, Ampelocera hottlei, Aspidosperma cruenta, Astronium graveolens, Attalea cohune, Brosimum alicastrum, Bursera simaruba, Calophyllum brasiliense, Cedrela odorata, Ceiba pentandra, Clusia salvinii, Cordia dodecandra, Cupania belizensis, Cupania prisca, Crysophila stauracantha, Dendropanax arboreus, Drypetes laterifolia, Drypetes brownei, Eugenia capuli, Ficus spp., Hirtella americana, Laetia thamnia, Lonchocarpus castilloi, Manilkara zapota, Matayba oppositifolia, Metopium brownei, Passiflora mayarum, Pimenta dioica, Pouteria amygdalina, Pouteria campechiana, Pouteria reticulata, Protium copal, Pseudobombax ellipticum, Pseudolmedia spuria, Sabal mauritiiformis, Schizolobium parahybum, Sebastiana longicuspis, Simira salvadorensis, Spondias mombin, Stemmadenia donnell-smithii, Swietenia macrophylla, Talisia olivaeformis Terminalia amazonia, Trichilia minutiflora, Trophis racemosa, Vatairea lundelli, Vitex gaumeri,* and *Zuleania guidonia*. The understory has species such as *Adiantum pulverulatum, Malvaviscus arboreus, Piper jacquemontianum, Psychotria pubescens, Pteris longifolia and Tectaria heracleifolia.* A freqently found graminoid is *Ichnanthus lanceolatus.*

Y: Characterized by the scarcity of the palms *Attalea cohune* and *Crysophila stauracantha* which are so common in similar forests elsewhere in Belize. A distinctive tree is the chicle or chicosapote *Manilkara zapota.* Some other common species include, *Brosimum alicastrum, Bursera simaruba, Caesalpina gaumeri, Cordia dodecandra, Desmoncus orthacanthos, Gymnanthes lucida, Pouteria campechiana, Sabal mauritiiformis, Simarouba glauca, Swartzia cubensis, Swietenia macrophylla, Talisia oliviformis* and *Vitex gaumeri.*

TREE STRATUM

Tree hight

Alluvial variant: 15-30 m.
BR: below 20 m
CE: 15-20 m.
CW: to 25 m.
TP: 15-30 m.
Y: 15 – 20 m.

Canopy cover

Closed.

Canopy morphology

Broad-leaved.

Leaf phenology

Semi-evergreen.

Arboreal palms

Alluvial variant: *Sabal mauritiiformis, Attalea cohune.*
BR: *Roystonea regia.*
CE: *Sabal mauritiiformis, Attalea cohune.*
TP: *Sabal mauritiiformis, Attalea cohune, Gausia maya.*
Y: *Sabal mauritiiformis, Sabal yapa.*

Tree ferns

None.

Sessile epifytes

Not abundant.

SHRUB STRATUM

Acaule palms

Alluvial variant: Rare.
BR: Rare.
TP: *Chamaedorea elegans, C. oblongata.*
Y: *Chamaedorea seifrizzii.*

GROUND STRATUM

Overall herbaceous cover of the ground stratum

BR: In some patches there is enough light on the forest floor to allow the development of a fairly dense herb layer in which *Scleria bracteata* can proliferate.

FAUNISTIC OBSERVATIONS

Alluvial variant: Appears to be a favored habitat for the Yucatan Black Howler Monkey *Alouatta pigra*.
TP: Central American Spider Monkey *Ateles geoffroyi* habitat.
BR: In Belice, this habitat type appears to be a favored habitat for *Tapirus bairdii*.

LITERATURE

- Alluvial variant: Meerman 1999c, Wright et al. 1959; Iremonger and Brokaw 1995.
- BR: Smith 1945a, 1945b, Furley & Newey 1979, Wright et al. 1959: 10, 10a, Iremonger and Brokaw 1995.
- CE: Wright et al. 1959: 1, 1a, Iremonger and Brokaw 1995.
- CW: Lundell 1940, Lambert and Arnason 1978, Brokaw 1992, Wright et al. 1959; Iremonger and Brokaw 1995;
- TP: Brokaw and Mallory 1992, Wright et al. 1959; Iremonger and Brokaw 1995; Cabrera and Sanchez, 1994.
-Y: Meerman 1993, Bijleveld 1998, Wright et al.;

Iremonger and Brokaw 1995.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2a(3)(g)k / 29** **This ecosystem was originally mis-codified on the map as IA2a(1)(b)k**
NAME	**Tropical evergreen seasonal broad-leaved lowland forest dominated with bamboo on calcareous soils (29)** **Bosque siempreverde estacional latifoliado de tierras bajas dominado por bambú, en suelos calcáreos (29)**
GEOLOGY	Karstic
CLIMATIC CONDITIONS	It is localized in an area with 2,500 mm of annual rainfall with a well defined dry season
FIRE EXPOSURE	Guatemala: Increasing burning pressure in most of the Peten. The actual effect of fire on this ecosystem is not known.
WATER REGIME	
Moist regime	Inundated most of the year.
VEGETATION DATA	It is a type of vegetation sometimes denominated "carrizal".
Species	
Character species	*Phragmites australis ? / Guadua longifolia*?.
TREE STRATUM	
Tree hight	3 - 7 m.
Canopy cover	Dense.
Canopy morphology	Bambusoid.
GENERAL OBSERVATIONS	The description is made from information obtained on an overflight.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2a(1/2)(b) / 30, 30-M, 30-HC-2**
NAME	**Tropical evergreen seasonal mixed lowland forest, moderately drained (30)** **Bosque tropical siempreverde estacional mixto de tierras bajas, moderadamente drenado (30)**
GEOLOGY	In Nicaragua: From 0 to 60 m, sedimentary plains.
CLIMATIC CONDITIONS	Average temperatures between 24 and 32°C, Average annual precipitation 3000 mm relative humidity of 90%.
FIRE EXPOSURE	In nicaragua: fire is one of the principal threats to this ecosystem, affecting more the broad-leaved species than the pine, according to taylor (1962), its one of the factor that maintain the pine.
SOIL CHARACTERISTICS	
SOIL TYPE	Nicaragua: Silty and Sandy.
WATER REGIME	
Moist regime	Soils moderately drained, sometimes well-drained.
VEGETATION DATA	In Nicaragua: A mixture of broad-leaved evergreen alluvial forest [IA2a(1)(b)] and Pine [IA2a(2)]. It occurs especially on alluvial terraces close to the rivers edge. In the northeast of Nicaragua broad-leaved seasonal evergreen forests mixed with dense pine forest or savannas. [Va2d and/or Va2e].
Species	
Frequent species	In Nicaragua: An association between *Pinus caribea, Byrsonima crassifolia, Xylopia frutescens, X. aromatica, Calophyllum brasiliense, Symphonia globulifera, Vochysia hondurensis, Cochlospermum vitifolium, Quercus oleoides, Lycania hypoleuca, Crysophyllum mexicanum, Pera arborea* and *Zygia longifolia*, C*hrysobalanus icaco*, is found. Mejía (2,000) describes the following species for a similar ecosystem in the Mosquitia of Honduras: *Pinus caribaea* var. *Hondurensis, Byrsonima crassifolia, Xylopia aromatica, Curatella americana, Conostegia icosandra, Symplocos chiriquensis, Hyronima alchoreoides, Mimosa schomburgkii, Pera arborea, Vismia macrophylla, Cordia* spp., *Miconia* spp., *Malouetia guatemalensis*.
Associated species	In saturated lower laying areas, dense patches of the palm

	Acoelorraphe wrightii can be found.
SHRUB STRATUM	In Nicaragua: *Crysobalanus icaco, Eugenia acapulcensis, E. monticola, Guettarda combsii, Helycteres guazumifolia, Manilkara* spp., *Tibouchina aspera, Amanoa guianensis, Myrsine coriaceae, M. floridiana, Amaioua corymbosa, Cojoba donnell- smithii, Croton trinitatis, Erytroxylum guatemalense, Alibertia edulis* and *Cordia curassavica*.
Herbaceous cover (herbs considerably taller than 1.5M)	*Heliconia* spp.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	The Melastomataceae: *Miconia albicans, M lundelliana, M ciliata, Acisanthera bivalvis* and *Tococa guianensis*; also: *Mauletia guatemalensis, Mesechites trifida, Lantana camara, Buchnera pusilla, Lyndsea strycta, Trichomanes pinnatum; Psychotria erecta, P capitata and P. oaxacana.*
Graminoids cover	Amongst the Cyperaceae: *Scleria bracteata and Cladium jamaicense.*
OTHER OBSERVATIONS	The importance of this ecosystem is its high genetic value as the populations of *Pinus caribea* are subjected to continuos competition from the broad-leaved vegetation, that grows more quickly than the Pine, creating therefore a germplasum of very rapid growth.
LITERATURE	

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2a(2)(b) / 31, 31-1, 31-2**
NAME	**Tropical evergreen seasonal needle-leaved lowland forest, moderately drained (31)** **Bosque tropical siempreverde estacional aciculifolia de tierras bajas, moderadamente drenado (31)**
PHYSICAL CONDITIONS	Sedimentary plains with some slight undulations and small escarpments. from 0 to 500 m.
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	The highest part of the sedimentary plain, along the edge of the alluvial plains.
CLIMATIC CONDITIONS	Average precipitation between 1,800 and 2,800 mm, a year. Relative humidity 80 %, with an average temperature of 26 °C though temperatures between 22 and 24 °C are mentioned.
FIRE EXPOSURE	This ecosystem is subjected to frequent burning during agricultural clearance, that sometimes develops into forest fires. These fires impede regeneration of both the Pine (brinzals and latizals) and broad-leaved species. The impact of timber extraction is less damaging.
SOIL CHARACTERISTICS	
SOIL TYPE	Variable. Generally on acid Ultisols, sometimes on Inceptisols, sandy clay, with regular drainage but saturated in lower lying areas for 9 months of the year.
Soil color	Color reddish-brown.
Cover rock	In some areas, quartz gravel is found on the surface.
WATER REGIME	
Moist regime	From saturated to mesic, to badly drained.
VEGETATION DATA	Generally classified as needle-leaved because of the canopy being dominated by 80% or more of pine, but some broad-leaved species always present.
Species	
Dominant species	The dominant tree species is Pine (*Pinus caribaea*),
Co-dominant species	
Frequent species	Belize: *Acoelorraphe wrightii, Aspidosperma cruenta, Byrsonima crassifolia, Cassia emarginata, Chrysophyllum oliviforme, Pithecellobium* spp., *Quercus oleoides, Vitex gaumeri, Vochysia hondurensis, Xylopia frutescens,* a number of species of Melastomataceae are found. Patches of the fern *Dicranopteris* spp. and the sedge *Scleria bracteata* are frequent.
Associated species	Nicaragua: accompanied by some trees or shrubs such as: *Byrsonima crassifolia, Curatella americana* and rarely *Quercus oleoides.*

TREE STRATUM

Tree hight	20-25 m, in mature populations sometimes reaching 40 m
Canopy cover	In many cases canopy cover can drop below 65% and therefore would fall into the class IIA, "woodland", but it was not generally classified as such by the specialists. This might be justification to eliminate the woodland class between 65% and 30% canopy cover.
	1: *Pinus caribaea* dense form (that between 40 to 50% of the area) in better drained areas (undulating or rolling); though still with abundant light reaching the forest floor. 2: Woodland or Savanna.
Average basal area	5-12 m^2/Ha.
Canopy morphology	Needle-leaved, sclerophyllous.
Leaf phenology	Seasonal Evergreen.
Vines	*Cassytha filiformis* is a parasitic vine on *Byrsonima crassifolia.*
Arboreal palms	Only on the wettest edges, is found *Acoelorraphe wrightii.*
Tree ferns	Nicaragua and Honduras: in some places the tree fern, *Alsophila myosuroides* is found.
Drapery epifytes	*Brassavola nodosa*.
Sessile epifytes	In Belize *Tillandsia* spp., are frequent.
Climbing epifytes	*Philodendrum* spp. as an epiphyte on Pine.

SHRUB STRATUM

The understory is ocupaied by 10% of shrubby species such as: *Miconia lundelliana, M. albicans, M. ciliata, Tococa guianensis* and the herbaceous ferns, *Pteridium aquilinum* and *Blechnum serrulatum*.

Lower height	1.
Upper height	3.
Canopy cover	20%.
Acaule palms	No.
Leaf morphology	Broad-leaved the majority sclerophyllous, some ombrophyllous.
Shrub phenology	Evergreen.

GROUND STRATUM

Graminoids cover	Grass cover dense, (70% of the underestory): *Schizachrium sanguineum, Trachypogon angustifolius, Andropogon leucostachyus, Axonopus aureus, Setaria geniculata, Paspalum* spp. and *Rynchospora cephalotes*.
Forbes cover (including juvenile trees and acaule palms)	Herbaceous species (10% of the inderstory): *Psidium guianensis, Chomelia protracta, Morinda rojoc, Chiococca* spp., *Psycotria capitata, Appunia guatemalensis, Diodia rigida, Chamaecrista diphylla, Centrosema angustifolium, Senna undulata, Desmodium*

	barbatum, Hyptis savannarum, Polygala hygrophylla, Cotubea spicata, Mesechites trifida
Acaule palms cover	
Predominant periodicity of herbaceous cover	Predominantly hemi-cryptophytes.
FAUNISTIC OBSERVATIONS	Deer graze the sabanas, guatuzas y teplesquintles in the gallery forests. River tortoises and fish in the streams and rivers.
OTHER OBSERVATIONS	The vegetation seems natural in structure with only moderate intervention, due to the extraction of selective individuals of pine from some areas. Generally this ecosystem is productive and can sustain considerable human activity. But it is questionable if it can be considered of equal value for biodiversity conservation.
LITERATURE	Wright et al. 1959: 16, 16a, 16b, 17, Iremonger and Brokaw 1995: I.2.2.6., Iremonger 1997: 24, 25, 26, 27.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2a(1)(b)S**
NAME	**Tropical evergreen seasonal broad-leaved lowland forest on poor or sandy soils (27)** **Bosque tropical siempreverde estacional latifoliado de tierras bajas, en suelos infértiles o arenosos (27)**
CLIMATIC CONDITIONS	Average rainfall less than 2,500 mm per year with a pronounced dry season from February through May.
FIRE EXPOSURE	Fire is of at least occasional occurrence in this ecosystem. Wild fires become hotter as they creep up the slopes and often completely destroy the trees on the tops of the hills. Additionally, the soils on these hills are very shallow. Once the forest is destroyed, these soils very quickly erode, and it is very difficult for a forest to re-establish itself.
SPECIAL CONDITIONS	
SOIL CHARACTERISTICS	
SOIL TYPE	Nutrient poor, acidic soils.
WATER REGIME	
Moist regime	Moderately well-drained.
VEGETATION DATA	
Species	
Frequent species	Characterized by low plants: *Attalea cohune, Acosmium panamense Calophyllum brasiliense, Miconia* spp., *Terminalia amazonia, Virola koschnyi, Vochysia hondurensis* and *Xylopia frutescens.* Other, frequently encountered species include: *Aspidosperma* spp., *Bactris major, Bactris mexicana, Belotia campbellii, Bucida buceras, Byrsonima crassifolia, Chrysobalanus icaco, Chrysophyllum mexicanum, Clidemia* spp., *Coccoloba* spp., *Desmoncus orthacanthos, Guettarda combsii, Hampea trilobata, Hirtella racemosa, Licania hypoleuca, Luhea speciosa, Metopium brownei, Miconia* spp., *Mouriri exilis, Ouratea* spp., *Pachira aquatica, Pinus caribaea, Pouteria* spp., *Psychotria poeppigiana, Roupala montana, Scleria bracteata, Simarouba glauca, Spondias mombin, Tabernaemontana arborea, Tetracera volubilis* and *Trichospermum campbellii.*
LITERATURE	(Meerman 1999c, Wright et al. 1959: 1, 11a, 11c, 11d, 11e, 11g, Iremonger and Brokaw 1995: I.2.2.4.)

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2a(2)(a) / 32**
NAME	**Tropical evergreen seasonal needle-leaved lowland forest (32)** **Bosque tropical siempreverde estacional aciculifoliado de bajura (32)**
PHYSICAL CONDITIONS	
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	Alluvial plain, 0-500 m.
CLIMATIC CONDITIONS	Average rainfall less than 2500 mm a year with a pronounced dry season from February through May.
FIRE EXPOSURE	Although much of this vegetation type is being managed for timber production, it is created and maintained by fires. Occasionally, small patches with old pine are encountered in broadleaf forest along the Maya Mountain divide and these probably indicate patches of this forest type that have regenerated to broadleaf in the absence of fire.
SOIL CHARACTERISTICS	
SOIL TYPE	Soils are pale reddish or pinkish brown over sandy clay.
WATER REGIME	
Moist regime	Well-drained and drought in the dry season is an important stress factor.
VEGETATION DATA	Generally classified as needle leaved as 80% of the canopy is Pine, but some broad-leaved species always present.
Species	
Dominant species	*Pinus caribaea* forms a distinctive element.
Frequent species	Typical broad-leaved trees found as a subdued stratum in this vegetation type include: *Agarista* spp., *Byrsonima crassifolia, Clethra occidentalis, Clusia massoniana, Schippia concolor, Terminalia amazonia* and various *Quercus* spp. The herbaceous understory is often dominated by sedges and grasses including *Tripsacum latifolium*. Often the fern *Dicranopteris* spp. is abundant.
TREE STRATUM	
Arboreal palms	Occasionally *Acrocomia aculeata.*
Tree ferns	Present.
Sessile epifytes	Present.
SHRUB STRATUM	
Acaule palms	*Schippia concolor*.

GROUND STRATUM

Overall herbaceous cover of the ground stratum	Grasses and/or *Dicranopteris* fern.
OTHER OBSERVATIONS	It occurs in two main localities, the uplands of the Pine Ridge Mountains and one patch further south in the Chiquebull area. Small isolated patches occur in the foothills of the Maya Mountain. Generally this ecosystem is productive and can sustain considerable human activity. It is questionable though if it has the same level of importance in the conservation of biodiversity in Belize.
LITERATURE	Means, 1997, Wright et al. 1959: 18, 18a; Iremonger and Brokaw 1995: I.2.3.4.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2a(2)(a)K-s / 33-s**
NAME	**Tropical evergreen seasonal needle-leaved forest, well-drained, on steep karstic hills (33)** **Bosque tropical siempreverde estacional aciculifoliado, en colinas cársticas escarpadas (33)**
ECOSYSTEM DYNAMICS	Low.
GEOLOGY	Karstic.
CLIMATIC CONDITIONS	Average precipitation less than 3,000 mm a year.
FIRE EXPOSURE	Occurs.
SPECIAL CONDITIONS	0-700 m. On low hills.
SOIL CHARACTERISTICS	
SOIL TYPE	Clay.
Soil color	Dark gray.
Cover rock	Variable.
VEGETATION DATA	
Species	
Dominant species	*Pinus caribaea.*
TREE STRATUM	
Tree hight	10 – 15 m.
Canopy cover	Very open.
Canopy morphology	Needle-leaved.
Leaf phenology	Evergreen.
OTHER OBSERVATIONS	Only seen from the air.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2b(1) / 34, 34-VR, 34-VT, 34-ST, 34-l**
NAME	**Tropical evergreen seasonal broad-leaved submontane forest (34)** **Bosque tropical siempreverde estacional latifoliado, submontano (34)**
GEOLOGY	Non-calcareous. Nicaragua: Central mountain region, Tertiary in origin, in some parts of the south of the country on the Pacific side Quaternary in origin.
CLIMATIC CONDITIONS	Belize and Guatemala: Average precipitation less than 2,500 mm a year. Nicaragua: Average precipitacion 1,200-1,800 mm a year, wet season from May to December, average temperature 21-24 °C.
FIRE EXPOSURE	Belize: L: The herbaceous cover dominated by *Rhyncospora exaltata y Dicranopteris flexuosa,* due to fire stress. ST and VT: Occasionally exposed to fire caused by lighting strikes, though effect is minimal. Isolated pines might be a sign of previous fire damage.
SPECIAL CONDITIONS	L = variant low. ST = variant *simarouba-terminalia* extends across large areas of the Maya mountains. VT = variant *Virola-Terminalia* Variant Nicaragua: 700 and 1,200m Variant El Salvador
SOIL CHARACTERISTICS	
SOIL TYPE	Belize: L: Sandy Loam. ST: Reddish brown clay or gray with stones, over quartzite on low hills. VT: On non-calcareous rocks. Soils shallow Grayish brown, stony, terrain broken to rugged. Nicaragua: The soils are Mollisols of basic volcanic origin (basalts, andesites), with a soft texture, superficial (± 25 cm), good drainage.
Soil color	Nicaragua: Dark.
Cover and nature organic matter	Nicaragua: Rich in organic material.
WATER REGIME	
Moist regime	Nicaragua: Seasonally humid to mesic.
VEGETATION DATA	

Species

Frequent species

L: *Ilex guianensis, Myrcia leptoclada, Ormosia velutina, Pinus caribaea, Purdiaea belizensis, Quercus sapotifolia,* y *Roupala montana.*

ST: *Castilla elastica, Chrysophyllum cainito, Dendropanax arboreus, Dialium guianense, Euterpe precatoria, Ficus* spp., *Guarea* spp., *Licania platypus, Nectandra* spp., *Attalea cohune, Podocarpus guatemalensis, Protium schippii, Pterocarpus rohrii, Quararibea* spp., *Pourouma aspera, Rheedia* spp., *Schizolobium parahybum, Simarouba glauca, Stemmadenia donnell-smithii, Swietenia macrophylla, Terminalia amazonia, Virola brachycarpa, Vismia ferruginea, Vochysia hondurensis, Xylopia frutescens, Zanthoxylum* spp., *Astrocaryum mexicanum* Melastomataceae common in the understory, the tree fern C*yathea* is present as well as some terrestrial ferns.

VT: *Cyathea* spp., *Euterpe precatoria, Podocarpus guatemalensis, Schippia concolor, Symphonia globulifera, Terminalia amazonia* and *Virola brachycarpa*.

Nicaragua: Open canopy: *Quercus aata, Q. brenesi, Croton panamensis, Persea* spp., *Nectandra* spp., *Inga* spp., *Ardisia guianensis, Clusia salvinii, Heliocarpus appendiculatus, Cecropia* spp., *Terminalia* spp., *Chaeptoptelea mexicana, Ficus glabrata, Mastichodendron capiri* var. *tempisque, Juglan olanchanum.*

El Salvador reported as evergreen but latter reclassified as seasonal: *Quercus* spp., *Saurauia kegeliana, Styrax argenteus, Hirtella racemosa, Sapranthus violaceus, Matayba glaberrima.*

TREE STRATUM

Tree hight

L: Crown: 5-10 m.
VT: 13-20 m.

Canopy cover

Closed.

Canopy morphology

Broad-leaved with sclerophyllous elements.

Leaf phenology

Nicaragua: Evergreen with some seasonal elements.

Tree ferns

Nicaragua: *Cyathea arborea* is occasional.

Drapery epifytes

El Salvador: Epiphytes: Orchids, bromeliads, cactus amongst others.

Sessile epifytes

Nicaragua: *Aechmea* spp., *Bulbophyllum* spp.

Climbing epifytes

Nicaragua: *Philodendron* spp.,

SHRUB STRATUM

Upper height
L: 1.5 – 2m.

Canopy cover
Nicaragua: *Senecio panamensis, Lippia myriocephala, Picramnia antidesma, Malpighia glabra.*

Acaule palms
Belize:
ST: *Astrocaryum mexicanum*
VT: *Schippia concolor*
Nicaragua: *Chamaedorea* spp. such as *C. tepejilote;*

Herbaceous cover (herbs considerably taller than 1.5M)
Nicaragua: *Heliconia* spp.

GROUND STRATUM

Overall herbaceous cover of the ground stratum
Nicaragua: herbaceous: *Selaginella* spp., *Begonia* spp., *Costus spp., Tradescantia zanoni, Hoffmannia oreophila, Psychotria. panamensis, Piper spp., Asplenium achillaefolium.*

FAUNISTIC OBSERVATIONS
Nicaragua: A rodent *Oryzmis dimidiatus*, is endémic to this formacion; source UZCH/ MARENA (1998).

Nicaragua: Villa (1982) considers the following amphibians to be found in this ecosystem: *Agalychnis callidryas, Bolitoglossa striatula, Bufo coccifer, Bufo luetkenii, Bufo marinus, Centrolenella fleischmanni, Centrolenella granulosa, Centrolenella proseblepon, Dendrobates pumilio, Eleutherodactylus bransfordii, Eleutherodactylus cerasinus, Eleutherodactylus fitzingeri, Eleutherodactylus gollineri, Eleutherodactylus noblei, Eleutherodactylus rugulosus, Eleutherodactylus talamancae, Eteutherodactylus mimus, Eteutherodactylus rugosus, Hyla loquax, Hyla miliaria, Hyla staufferi, Hypopachus variolosus, Leptodactylus melanonotus, Oedipina pseudouniformis, Phrynohyas venulosa, Ptychohyla spinipollex, Rana maculata, Smilisca baudinii, Smilisca phaeota.*

OTHER OBSERVATIONS
El Salvador: Remnants of this forest are found on Mount Campana, around the National Park "El Imposible", Ahuachapán, intermediate altitudes of Mount "Verde" in Santa Ana, Forest over skri near lake Coatepeque, Mount "El Mono" in Usulután and relics near the industrial complex of "Plan de la Laguna" in La Libertad.

LITERATURE
L: Wright et al. 1959; Iremonger and Brokaw 1995.
VT: Wright et al. 1959; Iremonger and Brokaw 1995.
ST: Stevenson 1942, Brokaw 1991, Wright et al. 1959; Iremonger and Brokaw 1995.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2b(1)K / 35-r, 35-s**
NAME	**Tropical evergreen seasonal broad-leaved submontane forest on karstic hills (35)** **Bosque tropical siempreverde estacional latifoliado submontano en colinas cársticas (35)**
ECOSYSTEM DYNAMICS	Ancient.
GEOLOGY	500-1,000 m, calcareous rock.
CLIMATIC CONDITIONS	Average rainfall less than 2,500 mm a year, with a pronounced dry season from February through May.
FIRE EXPOSURE	Wild fires become hotter as they creep up the slopes and often completely destroy the trees on the tops of the hills. Additionally, the soils on these hills are very shallow. Once the forest is destroyed, these soils very quickly erode, and it is very difficult for the forest to re-establish itself.
SPECIAL CONDITIONS	K-r = On rolling hills. K-s = On steep hills.
SOIL CHARACTERISTICS	
SOIL TYPE	Clay.
Soil color	Dark.
Cover and nature organic matter	Usually a distinctive layer of organic matter.
Cover rock	Some rock protruding.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Frequent species	Little information is available on this forest type but since it is restricted to southern Belize, there will be more species that require high humidity.
TREE STRATUM	
Tree hight	K-r: 20-30 m. K-s: 15-25 m.
Canopy cover	Closed canopy.
Canopy morphology	Broad-leaved.
Leaf phenology	Semi-evergreen.
Vines	Frequent.
Arboreal palms	K-r: *Attalea cohune* and *Sabal mauritiiformis* are common emergent palms. K-s: *Sabal mauritiiformis* is the common emergent palm.
Tree ferns	None.
Sessile epifytes	K-r: Uncommon.

K-s: Frequent.

SHRUB STRATUM

Acaule palms

Frequent.

LITERATURE

K-r: Brokaw & Lloyd-Evans 1987, Iremonger & Sayre 1994, Wright et al. 1959; Iremonger and Brokaw 1995.

K-s: Brokaw & Lloyd-Evans 1987, Iremonger & Sayre 1994, Wright et al. 1959; Iremonger and Brokaw 1995.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2b(2) / 37, 37-2**
NAME	**Tropical evergreen seasonal needle-leaved submontane forest (37)** **Bosque tropical siempreverde estacional aciculifolia, submontano (37)**
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	Nicaragua: Hillsides, mountains and small plains at altitudes from 700 to 1,500 m. Geological substrate of granite, metamorphic rock, tertiary volcanic rock and lava flows.
CLIMATIC CONDITIONS	Belize: average precipitation less than 2,500 mm a year with a pronounced dry season from February to May. In Honduras Agudelo (1987) called this formation Humid Subtropical forest; bh- S, (divided into 3 zones: sub-humid, per-humid and tropical) which he describes in the following manner from 1,000 to 1,600 m; average precipitation 1,000- 2,200 mm a year; average temperatures 18- 24 °C; with 2 1/2 to 5 1/2 month dry season. Nicaragua: Average precipitation 1,000-1,400 mm a year and average temperatures 21-24 °C.
FIRE EXPOSURE	This ecosystem is subjected to frequent burning, associated with agricultural activity that can develop into full fledged forest fires. The burning impedes regeneration of the Pine (brinzales y latizales) and broad-leaved species. The impact of timber extraction is less damaging. Belize: Occasionally small patches of mature Pine is found in broad-leaved forest on the ridges of the Maya mountains Mayas that could be the result of the regeneration of broad- leaved forest.
SOIL CHARACTERISTICS	
SOIL TYPE	Belize: Clay-sandy. Nicaragua: Soils Entisols, good drainage.
Soil color	Belize: Reddish brown or pale pink. Nicaragua: Yellow, brown and to black.
Cover and nature organic matter	Generally the accumulation of organic material is minimal because of the brush fires. Nicaragua: Occasionally an accumulation of 20 to 30 cm of pine needles in decomposition in sites were fires have been absent for some time.

Cover rock

Belize: variable.
Nicaragua: Stones (small and medium) and gravel in the soil and subsoil.

WATER REGIME
Moist regime

Nicaragua: Mesic to xeric.
Well-drained.

VEGETATION DATA

Generally classified as needle leaved in that the canopy is more than 80% Pine, but always with some broad-leaved species.

Species
Character species

Belize: characterized by the dominance of Pine *Pinus caribaea.*

Nicaragua: An evergreen forest with seasonality, in submontane areas especially on hillsides, a forest consisting of 3 species Pine is found: *Pinus oocarpa* and to a lesser extent *P. patula* spp. *tecunumani* and *P. maximinoii*, that can be dense, moderately dense or moderately open. The first is more frequent at 900 to 1,200 m, the second at intermediate areas 1,000 to 1,300 m and the third at higher altitudes1,200 to 1,700 m; (small patches are found on the peaks of Mount Musun), it is possible however that hybrid populations exist
El Salvador: This vegetation class does not exist in the pure state rather as a mixed forest with *Quercus* spp. and *Terstroemia tepezapote*, among others. Generally grases are abundante, *Hypharrhenia rufa*.

Associated species

Honduras, dominant species: *Pinus oocarpa* or *Pinus caribaea* var. *hondurensis* (Agudelo, 1987).
Belize: Some broad-leaved trees accompany this vegetation class dispersed in a form of subcanopy: *Agarista* spp., *Byrsonima crassifolia, Clethra occidentalis, Clusia massoniana, Schippia concolor, Terminalia amazonia* and various *Quercus* spp. The herbaceous understory is often dominated by sedges and grasses including *Tripsacum latifolium*. *Dicranoteris* spp. is very common.

Nicaragua: Some broad-leaved trees accompany this vegetation class dispersed in a form of subcanopy: *Byrsonima crassifolia, Sapium* spp., *Piscidia grandifolia, Myrica cerifera, Acacia pennatula, Ardisia revoluta, Cecropia peltata, Guazuma ulmifolia, Lysiloma multifoliolatum, Casimiroa edulis, Cassia sp, Tecoma stan, Sabal* spp., *Zanthophyllum* spp., *Psidium guajaba, Psidium guianensis*.At higher altitudes, relatively small patches of Pine are accompanied by *Quercus* spp. and

Liquidambar styraciflua.

Honduras (Agudelo, 1987): reports associated species as: *Quercus peduncularis, Quercus oleoides, Quercus hondurensis, Byrsonima crassifolia, Psidium* spp., *Dodonea viscosa, Lysiloma seemannii, Piscidia grandifolia, Luehea candida* and *Acacia farnesiana.* Less frequent are: *Acrocomia mexicana* var. *vinifera, Cedrela odorata, Genipa carotu, Ceiba pentandra, Enterolobium cyclocarpum, Platymiscium dimorphandrum.*

Occasional species: *Mastichodendron capiri* var. *Tempisque, Tabebuia rosea, Tabebuia donnell- smithii, Andira inermis, Alchornea latifolia, Arbutus xalapensis, Astronium graveolens, Cupania dentata, Leucothoe mexicana, Paurotis cookii.*

TREE STRATUM

Tree hight

10 – 20 m.
Honduras: according to Agudelo (1987) to 30 m

Canopy cover

In many cases the canopy cover can fall below 65% and therefore should be in the class IIA, "woodland", but generally it was not classified as such by the specialists. This could be the justification to eliminate the class between 65% and 30%.
Nicaragua only from 40 to 60% is Pine.

Canopy morphology

Needle-leaved and broad-leaved both in general sclerophyllous.
Agudelo (1987) describes this vegetation in Honduras as Pine (needle-leaved) canopy with broad-leaved species in lower strata.

Leaf phenology

Evergreen (pine) and seasonal (some broad-leaved in lower strata)

Tree ferns

Present in Belize.

Sessile epifytes

Present in Belize.
Nicaragua: Orchids, Bromeliads, *Tillandsia usneoides*, ferns and fern allies though not very frequent.
Agudelo (1987) In Honduras epiphytes are rare.

SHRUB STRATUM

Canopy cover

Nicaragua: Amongest the most frequent shrubs are: *Mimosa albida, Calliandra houstoniana, Montanoa* spp., *Hyptis suaveolens, Calea urticifolia, Galphimia glauca, Lantana* spp.

Agudelo (1987) describes for this vegetation in Honduras, a understory of Oak, spiny leguminosae and grass.

GROUND STRATUM

Overall herbaceous cover of the ground stratum	Nicaragua: *Pteridium aquilinum, Stachytarpheta jamaensis, Ageratum conyzoides, Gnaphalium attenuatum, Pectis* spp., *Vernonia* spp., *Desmodium canum, D. sericophyllum, D. Barbatum, D. cajanifolium, Eriosema* spp., *Zornia diphylla, Senna tajera, S. deamii, Paspalum notatum, Sporobolus sp, Agave americana, Agave* spp.
Graminoids cover	Belize; A distinctive layer of grasses and sedges are found.
FAUNISTIC OBSERVATIONS	Nicaragua: Amongst the animals found are: Raccoon, white tailed deer, rabbit, Chacalaca, Guatuza, Guardatinaja, Pizote.
OTHER OBSERVATIONS	Nicaragua: The intervened clases [IA2b(2)-2] have dispersed Pine with natural grass dominated pasture: *Hyparrhenia rufa* (naturalized) and *Andropogon* spp. (native), accompanied by herbs and shrubs, if the area is not burnt in between 15 and 20 years it returns to Pine forest. Belize: from 500 to 1,000 m. characterized by the dominance of *Pinus caribaea* and the presence of broad-leaved species. Found on the Pine Ridge and Maya mountains, on the last in small patches. El Salvador, The sites for this vegetation class are close to the Honduran frontier: Mount El Ahorcado; La Montañona, Chalatenango and Perquín, Morazán. Generally this ecosystem is productive and can sustain considerable human activity. But it is questionable that it has the same value in biodiversity conservation.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2c(1) / 38**
NAME	**Tropical evergreen seasonal broad-leaved montane forest (38)** **Bosque tropical siempreverde estacional latifoliado montano inferior (38)**
PHYSICAL CONDITIONS	
ECOSYSTEM DYNAMICS	Nicaragua: Pristine. Honduras: Pristine. Belize: Old secondary growth. The vegetation stunted (dwarf forest) probably caused by Hurricane damage (Hurricane Hattie, 1961) followed by fire.
GEOLOGY	Belize: non-calcareous. Nicaragua: Mountain Zone steep slopes and escarpments, volcanic rock (basalts, andesites, etc.)
CLIMATIC CONDITIONS	Belize: Beaten by the wind and frequently covered in clouds. Nicaragua: Average temperatures 20–22 °C and average precipitation 1,250–1,500 mm a year, evenly distributed, though the humidity is higher due to condensation on rocks, plants and soil, from the near permanent cloud cover. At higher elevations very exposed and beaten by the wind.
FIRE EXPOSURE	Belize: Probably occasional fires due to lightning.
SOIL CHARACTERISTICS	
SOIL TYPE	Nicaragua: Mollisols y Alfisols, very superficial (< 25 cm), medium texture, dark in color, well-drained.
WATER REGIME	
Moist regime	Humidity influenced by cloud cover.
VEGETATION DATA	Nicaragua: A refuge for species from the families: Magnoliaceae, Chlorantaceae, Lauraceae, Weinmanniaceae, Myrsinaceae, Myrtaceae, Clusiaceae and Cyatheaceae. A evergreen broad-leaved forest with some seasonal elements. The crowns, branches and trunks of the trees, as well as the vines, are densely covered in epiphytes, predominantly bryophytes, also the soil is covered in herbaceous chamaephytes, *Selaginella* spp. and ferns. Trees with hard bark and rarely exceeding 20 m in height. Various species of tree ferns present. Climbing towards the peaks and ridges, the increased exposure to high winds, causes a decrease in the tree ferns and epiphytes, and an increase in evergreen shrubs and lichens, the forest

here looks more like a dry sclerophyllous evergreen forest with stunted trees and very little undergrowth.

Species

Frequent species

Belize: *Clusia* spp. and *Myrica cerifera* form dense thickets of 1- 2 m in height. These shrubs are covered in "lichens" *Phyllogonium* spp., Orchids and Bromeliads; this is the only place in Belize were the orange flowered *Epidendrum ibaguense* is found. This would probably better classify as **IIIB1b, Semi-deciduous Tufttree shrubland.**

Nicaragua: Amongst the trees: *Persea schiediana, P. americana, Ficus costaricana, F. Involucrata, Nectandra reticulata, N. nervosa, Inga* spp., *Ardisia guianensis, Clusia rosea, Clusia salvinii, Heliocarpus appendiculatus, Cecropia* spp., *Malpighia glabra, Terminalia* spp., *Calophyllum brasiliense, Dalbergia tucurensis, Mosquitoxylum jamaense, Cordia collococca, Trophis mexicana, Heliocarpus appendiculatus, Ilex spp, Hedyosmum mexicana, Styrax polyanthus, Guarea brevianthera, Quercus aata, Q. brenesii, Calocarpum* spp., *Carpinus caroliniana*.

In El Salvador the vegetation is classified as evergreen, the trees reach heights of 30 m or more. The most representative being: *Magnolia hondurensis, Quercus* spp., *Myrica cerifea, Hedyosmum mexicana, Podocarpus oleifolius, Litsea glaucescens, Brunellia mexicana, Prunus lundelliana, Saurauia selerorum, Cornus disciflora*.

TREE STRATUM

Tree hight

Belize: 5m.

Canopy cover

Belize: Open.
Nicaragua: generally closed, open only in places exposed to the wind.
El Salvador: Closed.
Honduras: Closed.

Canopy morphology

Broad-leaved many sclerophyllous elements, especially in places exposed to the wind.

Leaf phenology

Evergreen seasonal.

Vines

Belize: No.
Nicaragua and El Salvador: Some.

Arboreal palms

No.

Tree ferns

Nicaragua: Tree ferns: *Cyathea arborea* and other species.

Drapery epifytes

Nicaragua: *Cavendishia* spp. like *Cavendishia aff. guatemalensis* var. *chiapensis* and *Cavendishia bracteata, Columnea rubricaulis*.

	El Salvador: In general on trunks, branches and crowns of the trees, the vines as well are densely covered in epiphytes principally Bryophytes.
Sessile epifytes	Belize: Many. Nicaragua: Bromeliads: *Guzmania nicaraguensis, G angustifolia* Orchids such as: *Bulbophyllum* spp., *Elleanthus* spp., *Epidendrum* spp.
Climbing epifytes	
SHRUB STRATUM	
Canopy cover	Nicaragua: Shrubs: *Conostegia hirtella* and *Conostegia oerstediana, Cephaelis* spp., *Palicourea padifolia*.
Acaule palms	Belize: None. Nicaragua: *Chamaedorea* spp.
Herbaceous cover (herbs considerably taller than 1.5M)	Nicaragua: *Chusquea simpliciflora, Renealmia mexicana*., different *Heliconia* amongst which is found: *Heliconia tortuosa*.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	Nicaragua: Herbs such as: *Blechnum ensiforme, Pitcairnia imbricata, Selaginella* spp., *Begonia* spp., *Hydrocotile mexicana, Anthurium microspadix, Centropogon cordifolius,* Rubiaceae such as *Hoffmannia oreophila* and *Rondeletia nebulosa,* as well as different *Psychotria* like: *P. panamensis, P uliginosa, P. aubletiana* and *P. macrophylla, Alloplectus tetragonus, Mainthemum paniculatum*; Piperáceas like: *Peperomia obtusifolia, Piper augustum, Piper biolleyi* and *Piper obliquum*.
Cover of inferior cryptogamytes (no ferns)	Nicaragua: Herbaceous ferns: *Polystichum muricatum, Campyloneurum angustifolium, Antrophyum cajenense, Asplenium achillaefolium* and *Diplazium cristatum.* El Salvador: the soil covered with Chamaephytes such as *Selaginella* spp. Also large number of herbaceous ferns and tree ferns.
FAUNISTIC OBSERVATIONS	Nicaragua: Wild animals: Racoon, guatuza, Chachalaca (*Ortalis cinereiceps*), guardatinaja, Rabbit, pizote, venado puco (*Masama americanus*), Quetzal (*Pharomachrus mocinno*). Villa (1972) mentions 4 species of amphibians for this ecosystem in Nicaragua: *Hyla miliaria, Ptychohyla spinipollex, Centrolenella fleischmanni, Eleutherodactylus noblei*.

OTHER OBSERVATIONS	Belize this type of vegetation has only been identified on the peaks of cockscomb mountains including victoria peak (1,120 m). El salvador, sites with this vegetation are: Montecristo, Metapán), Cerro verde and Los andes, Volcán de Santa Ana, the peak of Volcán Chinchontepec, San Vicente. In honduras only reported form the National Park Patuca close to the frontier with Nicaragua.
LITERATURE	Kamstra et. Al. [1996]

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2c(1/2) / 39**
NAME	**Tropical evergreen seasonal mixed montane forest (39)** **Bosque tropical siempreverde estacional mixto montano inferior (39)**
ECOSYSTEM DYNAMICS	Ancient.
GEOLOGY	Non-calcareous.
CLIMATIC CONDITIONS	Average rainfall less than 2500 mm per year with a pronounced dry season from February through May.
FIRE EXPOSURE	This ecosystem is the result of frequent fires.
SOIL CHARACTERISTICS	
Cover rock	High.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Dominant species	*Pinus oocarpa* and *Quercus peduncularis*.
Frequent species	*Agarista mexicana, Arbutus xalapensis, Agave oppascidens, Brahea dulcis, Byrsinoma crassifolia, Comocladia guatemalensis, Desmodium angustifolium, Dyphisa floribunda, Inga leptaloba, Juniperus comitana, Liquidámbar styraciflua, Myrica cerifera, Pachyrrizus erosus, Pinus maxoninoii, Pinus oocarpa, Pinus tecunumanii, Rhus vestita, Saurauia* spp., *Senecio deppeanus, Stillingia sanguinolenta, Quercus pedunculatus, Quercus sapotifolia, Quercus tristis.*
TREE STRATUM	
Tree hight	8 - 30 m.
Canopy cover	Rugged to open.
Canopy morphology	Mixed.
Leaf phenology	Evergreen.
Arboreal palms	*Brahea dulcis*
LITERATURE	Medinilla-Sanchez, 1999.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2c(2) / 40**
NAME	**Tropical evergreen seasonal needle-leaved montane forest (40)** **Bosque tropical siempreverde estacional aciculifolia montano inferior (40)**
PHYSICAL CONDITIONS	
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	1,000-1,500 m. Sloping terrain.
CLIMATIC CONDITIONS	Somewhat dry average precipitation less than 2,000 mm a year.
FIRE EXPOSURE	Frequent.
SOIL CHARACTERISTICS	
SOIL TYPE	Clay.
Soil color	Reddish.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Dominant species	*Pinus* spp.
Co-dominant species	In small watersheds are found *Quercus* spp.
Frequent species	*Byrsonima crassifolia, Psidium* spp., *Eupatorium* spp. *Rondeletia* spp., *Calea* spp.
TREE STRATUM	
Tree hight	10 –20 m.
Canopy cover	Very open due to human intervention.
Canopy morphology	Needle-leaved.
Leaf phenology	Evergreen.
Arboreal palms	No.
Tree ferns	No.
Sessile epifytes	Some.
OTHER OBSERVATIONS	Flying over the area, it was possible to identify a Pine dominated forest. In the small valleys there was some *Quercus* spp. This polygon should probably be considered a mixed Pine-Oak forest. Generally this ecosystem is productive and can sustain a considerable amount of human activity. It is questionable though if it has the same importance in Biodeversity conservation. Flights, 15.46 / 91.35; 15.46 / 91.40.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2d(1) / 41**
NAME	**Tropical evergreen seasonal broad-leaved upper-montane forest (41)** **Bosque tropical siempreverde estacional latifoliado montano superior (41)**
ECOSYSTEM DYNAMICS	Low.
CLIMATIC CONDITIONS	Guatemala: precipitation variable, regularly more than 2,000 mm, annually, also influenced by condensation from passing clouds.
SPECIAL CONDITIONS	Guatemala: 1,800 – 2,300 m. Terrain steep. The majority of the polygons are found in the middle of the volcanic region facing the Pacific Ocean.
SOIL CHARACTERISTICS	
SOIL TYPE	Guatemala: Sandy loam.
Cover rock	Slight.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Frequent species	*Alnus* spp., *Citharexylum donnell-smithii, Parathesis tartaria, Buddleia skutchii, Oreopanax xalapensis, Hedyosmum mexicanum, Ehretia luxiana, Saurauia* spp., *Gunnera killipiana, Chaetoptelea mexicana.*
Associated species	
TREE STRATUM	
Tree hight	20-30 m.
Canopy cover	Closed.
Canopy morphology	Broad-leaved.
Leaf phenology	Evergreen or Seasonal Evergreen.
Tree ferns	Present.
OTHER OBSERVATIONS	Guatemala muestreo N °202 Nicaragua: Seasonal ecosystems have been deforested at these altitudes.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2d(1/2) / 42**
NAME	**Tropical evergreen seasonal mixed upper-montane forest (42)** **Bosque tropical siempreverde estacional mixto montano superior (42)**
ECOSYSTEM DYNAMICS	Ancient.
GEOLOGY	Non-calcareous.
FIRE EXPOSURE	Some fire influence.
SPECIAL CONDITIONS	1,500-2,000 m on the Atlantic side, 1,800-2,300 m on the pacific side. In very inclined areas.
SOIL CHARACTERISTICS	
SOIL TYPE	Sandy to Silty.
Cover rock	Some.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Dominant species	*Pinus* spp.
Co-dominant species	*Quercus* spp.
Frequent species	*Pinus maximinoi, P.pseudostrobus, Quercus brachystachys, Ostrya virginiana, Arbutus xalapensis, Stipa* spp., *Eupatorium* spp., *Rhamnus pringlei, Acacia pennatula, Lantana híspida, Indigofera miniata, Senecio deppeanus, Vernonia* spp., *Rapanea myricoides, Clethra* spp., *Liquidambar styraciflua, Magnolia guatemalensis, Saurauia* spp., *Viburnum* spp., *Myrica cerifera.*
TREE STRATUM	
Tree hight	10 – 25 m.
Canopy cover	40 – 80%.
Canopy morphology	Broad-leaved and needle leaved.
Leaf phenology	Semi-deciduous.
Vines	No.
Arboreal palms	No.
Tree ferns	No.
Sessile epifytes	Abundance of *Tillandsia* spp.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2d(2) / 43**
NAME	**Tropical evergreen seasonal needle-leaved upper-montane forest (43)** **Bosque tropical siempreverde estacional aciculifolia montano superior (43)**
SPECIAL CONDITIONS	1,800- 2,300 m.
VEGETATION DATA	
Species	
Frequent species	Transition from IA2c(2) to IA2e(2)
OTHER OBSERVATIONS	Just one polygon. No area was sampled.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2e(1) / 44**
NAME	**Tropical evergreen seasonal broad-leaved altimontane forest (44)** **Bosque tropical siempreverde estacional latifoliado altimontano (44)**
PHYSICAL CONDITIONS	
ECOSYSTEM DYNAMICS	Pristine.
GEOLOGY	Variable.
CLIMATIC CONDITIONS	Precipitation more than 2000 mm, annually, humidity maintained by condensation from clouds. Cold (Cloud forest). Rainy season from May to October.
FIRE EXPOSURE	Human intervention present.
SPECIAL CONDITIONS	Above 2300 m.
SOIL CHARACTERISTICS	
SOIL TYPE	Clayey, Sandy Loam.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Frequent species	*Alnus jurullensis, Arbutus xalapensis, Dodonea viscosa, Dendropanax arboreus, Quercus* spp.*, Litsea glauscescens, Fuchia arborescens, Coriaria thymifolia, Clethra suaveolens, Monnina xalapensis, Zanthoxylum aguilari, Cestrum aurantiacum, Smilax* spp.*, Lycianthes* spp.*, Chiranthodendron pentadactylus, Buddleia nitida, Baccharis vaccioniodes, Eupatorium semilatum, Stillingia acutifolia, Ceanothus coeruleus, Passiflora membranaceae, Ilex brandegeana, Parathesis leptopa, Rapanea juerguensenii, Prunus capulí, Lantana híspida, Symplocos hartwegii, Ilex belizensis, Weinmania pinnata, Rhamnus discolor, Rhamnus Nelson, Cleyera theaeoides, Billia hippocastanum, Drimys granadensis, Persea americana.*
TREE STRATUM	
Tree hight	8 – 25 m.
Canopy cover	Variable, Open-Closed.
Canopy morphology	Broad-leaved.
Leaf phenology	Evergreen.
Arboreal palms	No.
Tree ferns	No.

Sessile epifytes	Various families.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2e(1/2) / 45**
NAME	**Tropical evergreen seasonal mixed altimontane forest (45)** **Bosque tropical siempreverde estacional mixto altimontano (45)**
ECOSYSTEM DYNAMICS	Dynamic because of human intervention.
CLIMATIC CONDITIONS	Precipitaion more than 2,000 mm a year, humidity maintained by the clouds, cold. Rainy season May to October.
FIRE EXPOSURE	Because of human intervention.
SPECIAL CONDITIONS	On the Atlantic side above 2,000 m, and on the Pacific side above 2,300 m.
SOIL CHARACTERISTICS	
Soil type	Clay, Silty Sand.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Dominant species	*Pinus* spp.
Frequent species	A typical mixed forest at these altitudes consists of: *Abies guatemalensis, Acaena elongata, Alnus jurullensis, Arbutus xalapensis, Dodonea viscosa, Dendropanax arboreus, Pinus ayacahuite, Pinus hartwegi, Pinus pseudostrobus, Gregia steyermaerkii, Alsophila salvinii, Cyathea divergens, Dicksonia sellowiana, Cavendishia guatemalensis, Quercus crispifolia, Quercus sapataefolia, Quercus acatenangensis, Litsea glauscescens, Fuchia arborescens, Coriaria thymifolia, Clethra suaveolens, Monnina xalapensis, Stipa* spp., *Zanthoxylum aguilari, Cestrum aurantiacum, Smilax* spp., *Lycianthes* spp., *Chiranthodendron pentadactylus, Buddleia nitida, Baccharis vaccioniodes, Eupatorium semilatum, Stillingia acutifolia, Ceanothus coeruleus, Pasiflora membranaceae, Taxus globosa, Ilex brandegeana, Parathesis leptopa, Rapanea juerguensenii, Prunus capuli, Viburnum jucundum, Cuphea cyanea, Vaccinium leucanthum, Arctostaphylos pyrifolia, Gimnosperma glutinosa, Lantana híspida, Symplocos hartwegii, Ilex belizensis, Weinmania pinnata, Rhamnus discolor, Rhamnus nelsonii, Cleyera theaeoides, Billia hippocastanum, Drimys granadensis, Persea americana.* At these altitudes *Juglans guatemalensis* could be expected as it is found at higher altitudes than *J.*

olanchana generally in the submontane level. Several species of *Podocarpu*s are common: *Podocarpus oleifolius, P. maturai, P. montana, P. guatemalensis*.

In Guatemala some species of conifers are found at higher altitude: *Taxus globosa, Podocarpus oleifolius, Cupressus lusitanica (var benthamii), Abies guatemalensis, Pinus ayacahuite, P. donnell- smithsii, P. pseudostrobus, P. maximinoii, P. tecunumani, P. hartwegii* sometimes mixed with *Quercus* spp. (Rosito, Medinillas & Vargas). Based on reports of Perry (1984), other species of Pine can be expected, probably: *P. rudis, P. michoacana, P. oaxacana, P. chiapensis*.

Pinus and *Abies* can be found in almost pure patches. On the tops of the mountains open stands of *Pinus hartwegii*, looking very similar to a savanna.

TREE STRATUM

Tree hight	8 – 45 m.
Canopy cover	Variable, open – closed. the Pines are emergents.
Canopy morphology	Mixed.
Leaf phenology	Evergreen.
Arboreal palms	No.
Tree ferns	*Cyathea divergens, Dicksonia sellowiana.*
Sessile epifytes	Various families.

GROUND STRATUM

Overall herbaceous cover of the ground stratum	The Bromeliaceae *Gregia steyermaerkii* forms the herb understory.

OTHER OBSERVATIONS	In this category is found "La Sierra de Las Minas", a protected area.
LITERATURE	Rosito-Monzon, 1999; Vargas Ponce, 1999; Medinilla-Sanchez, 1999.

CHARACTERISTIC	DESCRIPCION
CLASSIFICATION-CODE AND MAP-CODE	**IA2e(2) / 46**
NAME	**Tropical evergreen seasonal needle-leaved altimontane forest (46) Bosque tropical siempreverde estacional aciculifolia altimontano (46)**
ECOSYSTEM DYNAMICS	Human intervention present.
GEOLOGY	Variable.
CLIMATIC CONDITIONS	Cold. Humidity maintained by condensation from clouds.
SPECIAL CONDITIONS	Atlantic side above 2,000 m Pacific side above 2,300 m.
SOIL CHARACTERISTICS	
Soil type	Variable.
Cover rock	Considerable.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Dominant species	*Pinus* spp.
Frequent species	*Pinus hartwegii, Juniperus standleyi, Abies guatemalensis, Cupressus lusitanica (var benthamii).*
Associated species	Other conifers expected at these altitudes are: *Taxus globosa, Podocarpus oleifolius, Pinus ayacahuite. Chiranthodendron pentadactylon, Cestrum* sp., *Salvia* sp., *Stipa* sp., *Mahonia volcanicola, Ranunculus geoides, Fuchia michoacanensis, Valeriana prionophylla, Dalia australis, Ribes ciliatum, Baccharis vaccinioides, Gimnosperma glutinosa, Tigridia pavonia, Halenia shannonii, Alnus jurulensis, Rhamnus serrata, Symphoricarpus microphyllus, Eupatorium semialatum.*
TREE STRATUM	
Tree hight	10 –25 m.
Canopy cover	Open.
Canopy morphology	Mixed.
Vines	No.
Arboreal palms	No.
Tree ferns	No.
Sessile epifytes	No.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2f(2)(a) / 47**
NAME	**Tropical evergreen seasonal broad-leaved alluvial forest, occasionally inundated (47)** **Bosque tropical siempreverde estacional latifoliado aluvial de tierras bajas, ocasionalmente inundado (47)**
PHYSICAL CONDITIONS	In Nicaragua, from 0 to 60 m, Flat or undulating sedimentary plains, close to large rivers. In Belize found from 0 to 200 m, along rivers and the edges of lagoons.
ECOSYSTEM DYNAMICS	
GEOLOGY	In Nicaragua, sedimentary with (Quartzite) materials washed down the rivers and eroded by the sea.
CLIMATIC CONDITIONS	En Belize, average precipitation less than 2,500 mm a year, with a pronounced dry season from February to May. In Nicaragua, average precipitation from 2,000 to 2,500 mm a year, with relative humidity 80% and average temperatures from 23 to 26°C.
FIRE EXPOSURE	In Nicaragua, the fires on the Pine savannas affect the edges of this ecosystem. In Belize the fires are limited to the areas where slash and burn agriculture is practiced.
SOIL CHARACTERISTICS	
SOIL TYPE	In Nicaragua, the soils are Clay Ultisols. In Belize the soils are heavy in texture and gray in color. Micro-relief and cracks develop in certain areas.
Soil color	In Nicaragua, the soils are reddish and black when rich in organic material.
Cover and nature organic matter	Nicaragua, regular amounts of organic material.
Cover rock	Nicaragua, small rocks or Quartzite gravel are found.
WATER REGIME	
Moist regime	In Belize, inundation's from the river occur every year.
VEGETATION DATA	
Species	
Dominant species	Nicaragua, trees: *Xylopia frutescens, X. aromatica, Calophyllum brasiliense, Symphonia globulifera, Vochysia hondurensis,*
Frequent species	Nicaragua, *Cochlospermum vitifolium, Quercus oleoides, Lycania hypoleuca, Crysophyllum mexicanum, Pera arborea* and *Zygia longifolia*. Amongst the most frequent species in Belize are:

	Aristolochia grandiflora, Bactris major, Bactris mexicana, Belotia campbellii, Bucida buceras, Cassia grandis, Cecropia peltata, Cordia gerescanthus, Balizia leucocalyx, Costus pulverulentus, Enterolobium cyclocarpum, Ficus insipida, Guazuma ulmifolia, Heliconia latispatha, Inga vera, Licania platypus, Lonchocarpus guatemalensis, Mutingia calabura, Ouratea nitida, Pachira aquatica, Pterocarpus officinalis, Pterocarpus rohrii, Rinorea sp, Roystonea regia, Samanea saman, Schizolobium parahybum, Tabebuia rosea, Trophis racemosa and *Zygia peckii. Attalea cohune, Guadua longifolia* and the introduced bamboo: *Bambusa vulgaris* which forms dense patches, and *Inga affinis* frequently dominate higher up the banks. del agua. The tall aroid *Montricardia arborescens* is locally abundant. Towards the sea the riverine vegetation gives way to mangrove, including *Avicennia germinans* and *Rhizophora mangle.*
TREE STRATUM	In Nicaragua, the tropical seasonal evergreen broad-leaved alluvial does not form a gallery as the terrain is almost flat.
Tree hight	Nicaragua: from 10 to 20 m Belize from 20 to 25 m
Canopy cover	Nicaragua: 75%. In Belize the canopy is closed.
Average basal area	Nicaragua: 8-9 m^2
Canopy morphology	Ombrophyllous with the presence of some sclerophyllous species. In Belize broad-leaved.
Leaf phenology	Evergreen with a dry season where some elements behave in a semi-deciduous or deciduous manner. In Belize evergreen.
Vines	Nicaragua: few
Arboreal palms	Nicaragua: In the lower saturated areas dense stands of the palm *Acoelorraphe wrightii* can be found. In Belize *Roystonea regia* close is found close to the mouth of the rivers, also *Cocos nucifera* can be found invading these areas.
Drapery epifytes	Nicaragua: Orchids: *Brassavola nodosa, Polystachya* spp., *Shomburkia* spp., *Epidendrum* spp.
Sessile epifytes	Nicaragua: Bromeliads: *Tillandsia* spp. In Belize are not common.
SHRUB STRATUM	Nicaragua: shrubs: *Crysobalanus icaco, Eugenia acapulcensis, E. monticola, Guettarda combsii, Helycteres guazumifolia, Manilkara spp., Tibouchina aspera, Amanoa guianensis, Myrsine coriaceae, M. floridiana, Amaioua corymbosa, Cojoba donnell- smithii, Croton trinitatis, Erytroxylum guatemalense, Alibertia*

	edulis and *Cordia curassavica*.
Lower height	Nicaragua: 1.5 m.
Upper height	Nicaragua: 4.0 m.
Canopy cover	Nicaragua: 40%.
Acaule palms	Nicaragua: 5% just along the edges. In Belize *Bactris* spp are mentioned.
Herbaceous cover (herbs considerably taller than 1.5M)	Nicaragua: 5% generally along the edge.
Leaf morphology	Nicaragua: Ombrophyllous with some sclerophyllous species present.
Shrub phenology	Nicaragua: Evergreen.
Tall herbs periodicity	Nicaragua: Biennials.
GROUND STRATUM	Nicaragua: Herbs: Las Melastomataceae: *Miconia albicans, M lundelliana, M ciliata, Acisanthera bivalvis* and *Tococa guianensis*; also: *Mauletia guatemalensis, Mesechites trifida, Lantana camara, Heliconia spp., Buchnera pusilla, Lyndsea strycta*; amongst the *Psychotria* are*: P. erecta, P capitata* and *P. oaxacana.*
Overall herbaceous cover of the ground stratum	Nicaragua: 50-60%.
Graminoids cover	Nicaragua: Amongst the Cyperaceae: *Scleria bracteata* and *Cladium jamaicense.*10-20%.
Forbes cover (including juvenile trees and acaule palms)	*Trichomanes pinnatum*, 1-2%.
Cover of inferior cryptogamytes (no ferns)	Nicaragua: very few.
Acaule palms cover	Nicaragua: Just saplings.
Predominant periodicity of herbaceous cover	Nicaragua: Deciduous and perennial.
AQUATIC (SEMI-) SESSILE LIFE FORMS	
Emerged vegetation	Nicaragua: At the waters edge are found: *Motricardia arborescens*, *Spatiphyllum* spp.
Submerged vegetation	Nicaragua: Submerged in the water: *Mayaca fluviatilis, Eichornia diversifolia* and 2 more undetermined species possibly *Potamogeton* spp. (Potamogetonaceae) and *Halodule* spp. *(*Cymodoceaceae).
FAUNISTIC OBSERVATIONS	In Nicaragua, these sites are refuges for animals that feed on, or roam the savanna: Tepezcuintle, Guatuza, White tailed deer, Armadillo, various wild mice and the Jaguar are mentioned by the population. The river has, Guapote, Mojarras and various River Tortoises. Villa (1972) mentions 3 species of amphibians for this ecosystem: *Dendrobates pumilio, Phrynohyas venulosa, Bufo coccifer*.
OTHER OBSERVATIONS	In Nicaragua, the importance of these forests is centered

on there role as corridors between between different ecosystems. Physically they play a vital role in the conservation of watersheds. They also help to conserve local community water resources. The threats are form migratory agriculture, using slash and burn techniques and the resulting sedimentation from such practices.

LITERATURE

For Belize: Brokaw and Mallory 1993, Meerman 1999a, 1999c, Wright et al. 1959: 20, Iremonger and Brokaw 1995: I.1.1.1.3.; Cabrera and Sanchez, 1994.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2f(3)(a) / 48, 48-M**
NAME	**Tropical evergreen seasonal broad-leaved alluvial forest, seasonally inundated (48)** **Bosque tropical siempreverde estacional latifoliado aluvial de tierras bajas, estacionalmente inundado (48)**
ECOSYSTEM DYNAMICS	Ancient – pristine.
GEOLOGY	In Guatemala calcareous. 0-500 m. In Nicaragua, from 5 to 10 m, flat.
CLIMATIC CONDITIONS	Less than 1800 mm of rain a year (Peten). In Nicaragua, average precipitation 2,000-2,500 mm a year, average temperatures 22-25 °C and a relative humidity of 80%.
FIRE EXPOSURE	Exist in areas with nearby agriculture and fires can spread from here into the forest particularly in the dry season (Lundell, 1937).
SPECIAL CONDITIONS	In Nicaragua and Honduras, the trees are short almost shrub like.
SOIL CHARACTERISTICS	
SOIL TYPE	Clay.
Soil color	Gray.
Cover mineral soil	low– medium.
Cover and nature organic matter	Medium– high.
Cover rock	Low.
WATER REGIME	
Moist regime	Inundated in the rainy season.
Water cover	Variable, inundated most of the year, in the rainy season it can be intermediate between inundated and saturated.
Water characteristics	Sweet.
Water bottom composition	Organic material.
VEGETATION DATA	
Species	
Frequent species	Guatemala: *Attalea cohune, Bucida buceras, Lysiloma bahamense, Haematoxylon campechianum, Allophylus cominia, Dyospyrus cuneata, Byrsonimia bucidaefolia, Licaria peckii, Bursera simaruba, Croton glabellus, Matayba opositifolia, Caesalpinia velutina, Simarouba glauca, Cupania belizensis, Simira salvadorensis, Manikara spp., Lonchocarpus sp. Metopium brownei, Coccoloba* spp*., Terminalia amazonia, Tabebuia rosea, Borreria oxyphylla, Cordia dodecandra, Vitex gaumeri, Guettarda combsii, Trophis racemosa, Swietenia*

	macrophylla, Eugenia rufidula.
	En Honduras and Nicaragua entre las especies más frecuentes están: *Calophyllum brasiliense var. rekoi, Vochysia hondurensis, Xylopia aromatica, X. frutescens, Symphonia globulifera, Didymopanax morotoni, Alchornea latifolia.*
Associated species	In Honduras species associated with this vegetation class are: *Andropogon bicornis, Apeiba membranaceae, Aspasia epidendroides, Bactris gasipaes, Bellucia costaricensis, Casearia sylvestris, Cedrela macrophylla, Clusia* spp., *Cupania americana, Dendropanax arboreus, Garcinia* sp., *Geonoma* spp., *Guadua macclurei, Miconia oinochrophylla, Piper* spp., *Quassia amara, Reinhardtia gracilis, Syngonium macrophyllum,Vismia macrophylla, Xiphidium caeruleum, Xylopia frutescens.*
	In Nicaragua in areas influenced by brackish water: *Myrica cerifera, Acoelorraphe wrigthii y Conocarpus erecta*.
TREE STRATUM	
Tree hight	In Nicaragua and Honduras: Generally between 5 and 12 m, sometimes with trees to 15 a 20 m. In Guatemala 10 - 15 m.
Canopy cover	From 80% to open.
Average basal area	In Nicaragua: 6 m^2/Ha.
Canopy morphology	Broad-leaved, ombrophyllous, some species sclerophyllous.
Leaf phenology	Predominantly evergreen with some species shedding their leaves.
Arboreal palms	*Attalea cohune*. In Nicaragua and Honduras *Acoelorraphe wrigthii*
Tree ferns	No.
Sessile epifytes	Some.
SHRUB STRATUM	
Canopy cover	Guatemala: Few shrubs. In Nicaragua and Honduras shrub like trees.
Acaule palms	Not common.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	Almost none, though in some areas vines are found.
AQUATIC (SEMI-) SESSILE LIFE FORMS	
Emerged vegetation	In areas influenced by brackish water the following dominate: *Myrica cerifera, Acoelorraphe wrigthii y*

Conocarpus erecta.

LITERATURE

Honduras: Iremonger 1997: 4.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**1A2f(3)(c) / 49**
NAME	**Tropical evergreen seasonal alluvial forest dominated by bamboo, seasonally inundated (49)** **Bosque tropical siempreverde aluvial de tierras bajas estacional, dominado por bambú, estacionalmente inundado (49)**
SOIL CHARACTERISTICS	
SOIL TYPE	The soils are Ultisols, silty clay.
Soil color	Reddish blackish when high in organic matter.
WATER REGIME	
Moist regime	Seasonally saturated.
VEGETATION DATA	
Species	
Character species	The predominant and most characteristic species is *Bambusa aculeata* (American bamboo; previously called *Guadua*). The bamboo replacing the palms as the dominate life form covering from 60 to 80% of the area.
Associated species	Amongst the accompanying tree species are found: *Terminalia* spp., *Ceiba pentandra, Hymenaea courbaril, Dialium guianense, Carapa guianensis, Calophyllum brasiliense* var. *rekoi, Sapium* spp., *Xylopia* spp., *Ficus* spp. and *Cecropia* spp. with crowns 15 to 25 m with or above the bamboo also *Spondia* spp., *Inga* spp. and *Zygia latifolia*.
TREE STRATUM	
Tree hight	15-20 m.
Canopy cover	70-80%
Canopy morphology	Graminoide (bamboo) and broad-leaved sclerophyllous, some ombrophyllous.
Leaf phenology	From evergreen to semi-deciduous.
Sessile epifytes	Bromeliads epiphytes like *Tillandsia bulbosa*.
Climbing epifytes	Epiphytes such as *Philodendron inequilaterum, P. scandens* and *Syngonium* spp. are frequents on trunks and branches.
SHRUB STRATUM	
Canopy cover	20%, in the understory various palms and shrubs such as: *Ardisia* spp., *Miconia* spp., *Malvaviscus arborea, Lythrum acinifolium, Urera* spp.
Acaule palms	*Asterogyne martiana, Chamaerodera tepejilote,*
Herbaceous cover (herbs considerably	*Chusquea* spp., *Heliconia* spp.

taller than 1.5M)	
Leaf morphology	Broad-leaved and palms, evergreen.
Shrub phenology	Evergreen.
Tall herbs periodicity	Biennials and perennial.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	10%.
Forbes cover (including juvenile trees and acaule palms)	Herbs:*Dieffenbachia* spp., *Anthurium flexile, Maranta* spp., *Achmea magdalenae, Begonia sericoneura*.
Predominant periodicity of herbaceous cover	Perennial.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**1A2f(4)(a) / 50**
NAME	**Tropical evergreen seasonal broad-leaved alluvial gallery forest (50)** **Bosque tropical siempreverde estacional latifoliado aluvial de galería de tierras bajas (50)**
GEOLOGY	From 0 to 60 m, flat or undulating sedimentary plains, dissected by numerous rivers and streams.
CLIMATIC CONDITIONS	Average precipitation 2,000 -2,500 mm a year, relative humidity 80% and average temperatures from 23 to 26°C.
FIRE EXPOSURE	This vegetation class is surrounded by pine savanna, in which occur large numbers of fires, that depending on the local conditions can invade the forest up to the water course.
SOIL CHARACTERISTICS	
SOIL TYPE	Generally with clay Ultisols.
Soil color	Reddish; black when rich in organic material.
Cover rock	Some areas are stony.
WATER REGIME	
Moist regime	Depending on the amount of rain falling higher up the watershed the gallery forests are inundated for periods (though in some dry seasons the streams dry up completely), the amount of time that these areas remain inundated varies, though it can be for some months.
VEGETATION DATA	
Species	
Frequent species	*Xylopia frutescens, X. aromatica, Calophyllum brasiliense, Symphonia globulifera, Vochysia hondurensis,*
Associated species	*Cochlospermum vitifolium, Quercus oleoides, Lycania hypoleuca, Crysophyllum mexicanum, Pera arborea* and *Zygia longifolia.*
TREE STRATUM	
Tree hight	12 m.
Canopy cover	60%.
Average basal area	7 m^2/Ha.
Canopy morphology	Mostly sclerophyllous though some ombrophyllous.
Leaf phenology	Predominantly evergreen though some species shed their leaves.
Vines	*Mesechites trifida.*
Arboreal palms	In lower more saturated areas dense patches of the palm *Acoelorraphe wrightii*, can be found.
Sessile epifytes	Orchids: *Brassavola nodosa, Polystachya* spp.,

	Shomburkia spp., *Epidendrum* spp. and the bromeliad: *Tillandsia* spp.
SHRUB STRATUM	Shrubs: *Crysobalanus icaco, Eugenia acapulcensis, E. monticola, Guettarda combsii, Helycteres guazumifolia, Manilkara sp, Tibouchina aspera, Amanoa guianensis, Myrsine coriaceae, M. floridiana, Amaioua corymbosa, Cojoba donnell- smithii, Croton trinitatis, Erytroxylum guatemalense, Alibertia edulis* and *Cordia curassavica*.
Lower height	1.5 m.
Upper height	4 m.
Canopy cover	70%.
Acaule palms	Bactris spp.
Herbaceous cover (herbs considerably taller than 1.5M)	*Heliconia* spp.
Leaf morphology	Sclerophyllous some ombrophyllous.
Shrub phenology	Evergreen, some semi-deciduous.
Tall herbs periodicity	Perennial.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	40 % Melastomataceae: *Miconia albicans, M lundelliana, M ciliata, Acisanthera bivalvis y Tococa guianensis*; also: *Mauletia guatemalensis, Lantana camara, Buchnera pusilla, Psychotria erecta, P. capitata* and *P. oaxacana.*
Graminoids cover	10% amongst which the Cyperaceae: *Scleria bracteata* and *Cladium jamaicense.*
Forbes cover (including juvenile trees and acaule palms)	20%
Cover of inferior cryptogamytes (no ferns)	Insignificant: *Lyndsea strycta, Trichomanes pinnatum*
Acaule palms cover	
Predominant periodicity of herbaceous cover	Perennial though considerable annuals might be present
AQUATIC (SEMI-) SESSILE LIFE FORMS	
Emerged vegetation	On the rivers edge is found: *Motricardia arborescens,* and *Spatiphyllum* spp.
Submerged vegetation	Submerged in the water: *Mayaca fluviatilis, Eichornia diversifolia* and *Potamogeton* spp., *Halodule* spp.
FAUNISTIC OBSERVATIONS	Many animals use the gallery forest as a refuge and for reproduction, venturing out on to the savanna to find food. The gallery forest are always are accompanied by rivers and streams, and even though in species composition they can appear similar to other closed forests, they are very different ecologically, they also form a function as natural pathways and corridors across the savanna.
OTHER OBSERVATIONS	The gallery forest are very distinct because of the sharp

contrast with the surrounding savannas, gallery forests also exist in closed forests, but here they are less easy to identify and therefore harder to define.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2g(2)(a) / 51, 53-M, 53-M-2**
NAME	**Tropical evergreen seasonal lowland broad-leaved palm swamp forest (51, 53)** **Bosque tropical siempreverde estacional latifoliado pantanoso de tierras bajas, dominado por palmas (51, 53)**
GEOLOGY	From 0 to 100 m, lowland plains, little influence from the sea.
CLIMATIC CONDITIONS	Average temperatures between 26 and 30°C, Average rainfall between 2,300 and 3,500 mm a year.
FIRE EXPOSURE	This vegetation class is surrounded by Pine Savanna, that is prone to fire, which during the dry season can extend into the swamp.
SOIL CHARACTERISTICS	
SOIL TYPE	Soils Hydromorphic, restricted drainage.
Soil color	Reddish brown turning black when organic material is abundant.
Cover and nature organic matter	Peat can accumulate
WATER REGIME	
Moist regime	6-7 months of inundation.
VEGETATION DATA	
Species	
Frequent species	In Nicaragua: Amongst the trees are found: *Terminalia amazonica, Vochysia ferruginea, V. Hondurensis, Machaerium* spp., *Annona* spp., *Xylopia frutescens, Inga spp, Quercus oleoides, Hyeronima alchornoides*; some deciduous or semi-deciduous such as *Apeiba aspera, Tabebuia rosea* and *Cochlospermum vitifolium.* In Honduras: *Carapa guianensis*, *Erythrina fusca*, *Pterocarpus officinalis*. When this forest is intervened, it takes on a shrubby appearance with species such as *Psidium guajava*.
TREE STRATUM	
Tree hight	12 m; Iremonger (1997) cites Clewell (1986) who indicates that canopy is about 15 m, considerable lower than the surrounding alluvial forests.
Canopy cover	40 – 50 %.
Canopy morphology	Predominantly sclerophyllous, with some ombrophyllous elements in tropical deltas.
Leaf phenology	Evergreen with some seasonality, some trees partially shed their leaves.
Vines	*Lygodium* spp. and *Cissus* spp.

Arboreal palms	Amongst the palms: *Elaeis oleifera, Acoelorraphe wrigthii, Bactris tepejilote, B. Hondurensis, Desmoncus orthocanthos*, in open areas up to 40-50%. The borders of this ecosystem can be dominated by *Acoelorraphe wrigthii*.
Sessile epifytes	*Epidendrum* spp., *Oncidium spp*.
Climbing epifytes	*Philodendron* spp., *Anthurium* spp. and *Syngonium* spp.
SHRUB STRATUM	Shrubs: *Alchornea latifolia, Tabernamontana* spp., *Posoqueria latifolia, Mabea* spp., *Alibertia edulis, Psychotria aubletiana, Clidemia* spp., *Miconia* spp., *Nexea* spp.
Lower height	1.5 m.
Upper height	2.5 m.
Canopy cover	5 – 10 %.
Herbaceous cover (herbs considerably taller than 1.5M)	*Maranta* spp., *Costus* spp., *Heliconia* spp., less than 1.5 m in height.
Leaf morphology	Evergreen.
Shrub phenology	Perennial.
Tall herbs periodicity	Evergreen.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	
Graminoids cover	Very rare.
Forbes cover (including juvenile trees and acaule palms)	*Geophila* spp., *Passiflora* spp., *Hibiscus* spp., *Abutilon* spp. and replacement seedlings.
Acaule palms cover	Replacement seedlings.
Predominant periodicity of herbaceous cover	Annuals, biennials and perennial.
OTHER OBSERVATIONS	

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2g(1)(a) / 52-T, 52-Sh, 52-SC, 52-AC, 54**
NAME	**Tropical evergreen seasonal broad-leaved lowland swamp forest (52, 54)** **Bosque tropical siempreverde estacional latifoliado pantanoso de tierras bajas (52, 54)**
ECOSYSTEM DYNAMICS	Medium.
GEOLOGY	Calcareous rock.
CLIMATIC CONDITIONS	T, Sh, SC: Average rainfall less than 2,000 mm per year, with a pronounced dry season from February through May. AC: High average rainfall of near 4,000 mm per year with a dry season from February through May.
SPECIAL CONDITIONS	0-500 m. AC: Aguacaliente variant. T = Tall variant. Sh = Short variant: Swampy stands of low, thin stemmed trees and shrubs without emergents. Usually associated with 1A2g(1)(a)T and closely related to IIIA1b(a)L. SC: Stann Creek variant: Swampy stands of thin stemmed, partly deciduous trees and shrubs without emergents in the Stann Creek district.
SOIL CHARACTERISTICS	
SOIL TYPE	Clay. Some hog-wallow micro-relief exists as a result of repeated wetting and drying of the soil. SC: Mostly over calcium-poor soils. Some hog-wallow micro-relief exists.
Cover rock	Frequent protruding limestone rocks.
WATER REGIME	
Moist regime	Badly drained, often waterlogged for part of the year. AC: Seasonally inundated.
VEGETATION DATA	
Species	
Frequent species	AC: Dominated by the *Eugenia aeruginea*. Other species include *Acoelorrhaphe wrightii, Alibertia edulis, Bactris sp., Calyptranthes chytraculia, Chrysobalanus icaco, Clidemia sp., Connarus lambertii, Guadua longifolia, Lonchocarpus castilloi, Lonchocarpus rugosus, Pachira aquatica, Randia* spp. and *Zygia* spp. The field layer is mainly composed of graminoids and sedges including *Scleria* spp. Epiphytes such as *Aechmea tillandsioides, Anthurium scandens, Epidendrum nocturnum, Epiphyllum sp., Tillandsia balbisiana, T. limbata, T.*

streptophylla, T. utriculata, Vittaria spp. and *Vriesea* spp. are abundant.

T: Frequently encountered trees include *Amyris elemifera, Bactris* spp., *Bucida buceras, Calophyllum brasiliense, Croton pyramidalis, Croton reflexiflora, Dracaena americana, Metopium brownei, Coccoloba reflexiflora, Coccoloba acapulcensis, Coccoloba cozumelensis, Manilkara zapota, Gliricidia sepium, Ouratea nitida, Sabal mauritiiformis, Simarouba glauca, Swietenia macrophylla and Zygia* sp. Thick woody vines are sometimes present. Includes some areas that are locally called "bajos". Logwood *Haematoxylon campechianum,* typically occurs in the wetter, more open sections.

Sh: *Acacia* sp., *Acoelorraphe wrightii* (usually occurring in dense clumps), *Bucida buceras, Calliandra* spp., *Calyptranthes* spp., *Cameraria latifolia, Chrysobalanus icaco, Clidemia* spp., *Crescentia cujete, Erythroxylum guatemalense, Haematoxylon campechianum, Hampea trilobata, Helicteres guazumifolia, Hirtella racemosa, Hymenocalis littoralis, Licania hypoleuca, Miconia* spp., *Mimosa hemendieta, Mouriri exilis, Rinorea* spp., *Xylopia frutescens* and *Zygia* spp.

SC: Frequently encountered plants in these forests are *Acosmium panamense, Aspidosperma cruenta, Astrocaryum mexicanum, Attalea cohune, Bactris* spp., *Bucida buceras, Calyptranthes chytraculia, Clidemia* spp., *Coccoloba* sp., *Crysophila stauracantha, Dialium guianense, Dracaena americana, Guettarda combsii, Heliconia vaginalis, Hirtella racemosa, Inga* sp., *Jacquinia paludicola, Miconia* spp., *Mouriri exilis, Mouriri myrtilloides, Pachira aquatica, Psychotria glomerulata, Psychotria poeppigiana, Scleria bracteata, Swietenia macrophylla, Symphonia globulifera, Tabebuia chrysantha, Terminalia amazonia, Virola koschnyi, Vismia ferruginea, Vochysia hondurensis and Xylopia frutescens.* On richer soils *Pterocarpus officinalis is found;* on poorer soils more Melastomataceae and *Acoelorraphe wrightii.* Where this vegetation type comes close to the coast, *Anacaridum officinale* and *Byrsonyma crassifolia* can be found.

TREE STRATUM

Tree hight
T: 10 – 15 m.
Sh: 5 – 10 m.

Canopy cover
Broken canopy.

Canopy morphology
Broad-leaved and sclerophyllous.

Leaf phenology	This forest type has a distinctive deciduous element.
Vines	Frequent.
Arboreal palms	T: *Sabal mauritiiformis* is the principal emergent palm.
Tree ferns	None.
Sessile epifytes	Frequent, especially abundant in AC.
SHRUB STRATUM	
Acaule palms	*Bactris* spp.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	Where the canopy is open there is a distinctive herbaceous layer dominated by sedges sometimes including *Scleria bracteata*.
LITERATURE	AC: Meerman 1999a, Iremonger and Brokaw 1995: I.1.1.1.2.2. T: Schultze & Whitacre 1999, Wright et al. 1959: 21, 21a, 22, Iremonger and Brokaw 1995: I,1,1,1,1,1 Sh: Meerman 1999c, Wright et al. 1959: 15, 23; Iremonger and Brokaw 1995: I.1.1.1.1.2. SC: Meerman 1999a, Wright et al. 1959: 14,14a,14b,14c; Iremonger and Brokaw 1995: I.1.1.1.2.1.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA2g(3)(a) / 55**
NAME	**Tropical evergreen seasonal broad-leaved lowland swamp forest, seasonally inundated (55)** **Bosque tropical siempreverde estacional latifoliado pantanoso de tierras bajas, estacionalmente inundado 55)**
ECOSYSTEM DYNAMICS	Stress from flooding.
GEOLOGY	Calcareous.
CLIMATIC CONDITIONS	Less than 2,000 mm of annual rainfall.
FIRE EXPOSURE	Rare.
SPECIAL CONDITIONS	Lowland, 0-200 m.
SOIL CHARACTERISTICS	
SOIL TYPE	Clay.
Soil color	Gray.
WATER REGIME	
Moist regime	Badly drained.
Water characteristics	Fresh water.
VEGETATION DATA	
Species	
Frequent species	Frequently encountered trees include *Acacia* spp., *Acoelorraphe wrightii* (usually occurring in dense clumps), *Bucida buceras, Calliandra* sp., *Calyptranthes* spp., *Cameraria latifolia, Chrysobalanus icaco, Clidemia* spp., *Crescentia cujete, Erythroxylum guatemalense, Haematoxylon campechianum, Hampea trilobata, Helicteres guazumifolia, Hirtella racemosa, Hymenocalis littoralis, Licania hypoleuca, Miconia* spp., *Mimosa hemendieta, Mouriri exilis, Rinorea* spp., *Xylopia frutescens* and *Zygia* spp.
TREE STRATUM	
Tree hight	6-12 m.
Canopy cover	Dense.
Canopy morphology	Broad-leaved many species are sclerophyllous.
Leaf phenology	Seasonally evergreen.
Vines	No.
Arboreal palms	No.
Tree ferns	No.
Sessile epifytes	Frequent.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA3a(1)(a) / 56, 56-2, 56-HCW, 56-PNVC, 56-CAR, 56-ISL**
NAME	**Tropical semi-deciduous broad-leaved well-drained lowland forest (56)** **Bosque tropical semidecíduo latifoliado de tierras bajas, bien drenado (56)**
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	Belize: Calcareous. Guatemala: Non-calcareous. Honduras: Variable. Nicaragua: Non calcareous, central region with Tertiary volcanic substrate; hilly to steep terrain, well-drained. Costa Rica: 56- NC 4.1.lowland and 4.2 submontane. Situated over volcanic substrate, flat to concave to step with 5- 30% slope. 56- 10.1 PN y VC lowland: Over eroded terrain with narrow valleys and mountains ranges. 56- 13.1. PN y VC: Over sedimentary and alluvial substrate with moderated topography: flat or concave by inundation with 5- 20% slope.
CLIMATIC CONDITIONS	Belize and Guatemala: Average rainfall less than 1500 mm per year. Nicaragua: Average rainfall, 500- 2,000 mm En Costa Rica 4.2.NC, presents hydrolic deficiency for more than 90 days.
FIRE EXPOSURE	Limited to areas with slash and burn cultivation.
SPECIAL CONDITIONS	Belize: Coastal 0-10 m. This is a distinctive forest type, which has only been described from the Sarteneja area in the Corozal district. It has a low canopy (8 -12 m) with a more deciduous aspect than most other forest type in Belize. Guatemala: In hills < 1000 m. Between Zacapa and Chiquimula, Jutiapa. HCW = Central West Honduras variant Coastal 0-500 m. CAR = Caribbean coastal variant. 2 = intervened. 0-20 m. Probably identical to VI.B.3. ISL = Caribbean island variant. 2 = intervened. 0-500 m. Probably somewhat similar to the Belize variant. Costa Rica: NC, PN and VC.
SOIL CHARACTERISTICS	
Soil type	Belize: Shallow soils over calcareous rock. Guatemala: Alluvial clay In Nicaragua: Alfisols, Mollisols and Inceptisols; red or

brown clay.
In Costa Rica:
NC: Inceptisols and Antosols, volcanic origin and Latosols red- brown sticky clay.
PN and VC: Thin Inceptisols.
PN and VC: Inceptisols little or not developed with low base saturation.

WATER REGIME

Moist regime

Well-drained.

VEGETATION DATA

Species

Frequent species

Belize: Leguminous trees, such as *Lysiloma latisiliquum* and *Acacia* spp. are frequent. Other characteristic species include: *Bauhinia jennigsii, Bursera simaruba, Caesalpina gaumeri, Ceiba aesculifolia, Gymnopodium floribundum, Jatropha gaumeri, Lonchocarpus rugosus, Manilkara zapota, Metopium brownei, Piscidia piscipula, Simaruba glauca, Thevetia gaumeri, Thrinax radiata* and *Vitex gaumeri*.

Guatemala: *Bursera simaruba, B. bipinnata, B diversifolia, B. Steyermarkii, Byrsonima crassifolia, Gliricidia sepium, Guazuma ulmifolia, Cordia alliodora, Hippocratea excelsa, Karwinskia calderoni, Sapindus saponaria, Simarouba glauca*.

HCW: *Acrocomia* spp., *Bursera simaruba, Ceiba pentandra, Coccoloba* spp., *Dracaena americana, Enterolobium cyclocarpum, Erythrina glauca, Inga* spp., *Lysiloma* spp., *Simarouba glauca, Swietenia humilis* (Pacific only), *Tabebuia rosea, Tecoma stans.*

CAR: *Acoelorraphe wrightii, Annona glabra, Chrysobalanus icaco, Coccoloba uvifera, Conocarpus erectus, Dalbergia ecstaphylla, Dalbergia monetaria, Davilla kunthii, Doliocarpos guianensis, Eugenia aeruginea, Henriettea succosa, Miconia glaberrima, Montricardia arborescens, Myrmecophylla wendlandii, Pachira aquatica, Palicourea triphylla, Quercus oleoides, Symphonia globulifera, Terminalia bucidoides, Thrinax parviflora, Tococca guianensis.*

ISL: *Acacia* sp., *Acrocomia mexicana, Attalea cohune, Bursera simaruba, Casearia sylvestris, Chrysophyllum mexicanum, Cordia alliodora, Cordia currasavica, Hibiscus tiliaceus, Ochroma pyramidale, Persea americana, Psidium guajava, Sabal* spp., *Spondias*

mombin, Thrinax spp.

En Costa Rica:
NC*:* lowland and submontane*: Enterolobium cyclocarpum, Schyzolobium parahybum, Byrsonima crassifolia, Calycophyllum candidissimum, Cupania glabra, Hymenaea courbaril, Neea psicotrioides, Tabebuia* spp., *Attalea butyracea, Rollinia jimenezii, Lonchocarpus* spp., *Quercus oleoides,* ground covered by *Bromelia pinguin.*
PN and VC lowland: *Acrocomia vinifera, Albizia* spp., *Allophyllus occidentalis, Andira inermis, Annona purpurea, Apeiba tibourbou, Bactris minor, Bixa orellana, Bravaisia integerrima, Bursera simarouba, Calycophyllum candidissimum, Tabebuia pentaphylla, Tabebuia chrysanta, Casearia aculeata, Chlorophora tinctorea, Coccoloba* spp., *Cochlospermum vitifolium, Cordia alliodora, Erythroxylon* spp., *Luhea seemannii, Masthicodendron tempisque, Sterculia apetala, Spondia* spp., *Simarouba glauca*

Nicaragua:
Many "bottle" trees, in the Bombacaceae, such as: *Ceiba pentandra, Ceiba barrigon, Pseudobombax septenatus, Bombacopsis quinata*. Also: *Hymenaea courbaril, Nectandra salicifolia, Platymiscium pleiostachyum, Cedrela odorata, Enterolobium cyclocarpum, Luehea candida, Guazuma ulmifolia, Gliricidia sepium, Lysiloma* spp., *Astronium graveolens, Simarouba glauca, Brosimum spp, Mastichodendron capiri, Terminalia oblonga, Chlorophora tinctorea, Spondia mombin, Swetenia macrophyla, Hura crepitans, Tabebuia pentaphylla, T. neocrysantha, Sterculia apetala, Guarea excelsa*. In disturbed sites and successions, deciduous species and also savanna species can be found.

Panama: *Astronium graveolens, Cavanillesia platanifolia, Pachira quinata, Pseudobombax septenatum, Muntingia calabura, Erythrina* spp., *Cedrela odorata, Acacia riparia, Enterolobium shumburgkii, Calycophyllum candidissimum, Genipa americana, Serjania rhombea, Helicteres guazumaefolia, Helicteres* spp., *Sterculia apetala, Jacquinia macrocarpa, Apeiba aspera, Apeiba tibourbou, Luehea seemannii, Urera* spp.

TREE STRATUM

Tree hight
8-18 m.

Canopy cover
Belize: Closed.

Canopy morphology
Broad-leaved

Leaf phenology
Semi-deciduous. Nicaragua: Majority of trees of the dominant canopy are partially deciduous (some trees are

	deciduous and others shed their leaves partially) below the main canopy some evergreen trees and shrubs are more or less sclerophyllous.
Vines	Yes. Nicaragua: Terophytes and hemicryptophytes vines are present.
Arboreal palms	Belize: *Sabal mauritiiformis, Thrinax radiata* Guatemala: None. CAR: *Thrinax parviflora.* ISL: *Attalea cohune Sabal* sp., *Thrinax* sp.
Tree ferns	None.
Sessile epifytes	Few. Nicaragua: there are few epiphytes.
SHRUB STRATUM	Nicaragua: *Miconia argentea, Cytharexylum caudatum, Combretun laxum, C. Farinosum, Cydistia* spp., *Arrabidea* spp., *Operculina pteripes, Malvaviscus arborea, Hamelia patens, Pychotria* spp., *Stemmadenia abovata, Myriocarpa* spp., *Urera caracasana, Maranta arundinaceae, Cestrum, Anthurium crassinervium.*
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	Succulent plants may be present (eg.: Cactaceae). scattered herbs, principally hemicryptophytes, graminoids and medium sized herbs.
Forbes cover (including juvenile trees and acaule palms)	True woody shrubs and juvenile trees in the ground stratum.
FAUNISTIC OBSERVATIONS	The Belize variant is typical habitat for Yucatan endemics such as the Yucatan Jay *Cyanocorax yucatanicus* and the Orange Oriole *Icterus auratus.*
OTHER OBSERVATIONS	Guatemalan variant wrongly classified as lowland. Nicaragua: There is no primary vegetation for these plant formations, due to the advance of the agricultural frontier; remnants are known on hills and mountains slope in the area between the evergreen forest of the Atlantic region and the Central region forest, the last forest have been replaced by production systems at low altitudes. It is probable that the wetter areas of this forest type are included in the humid forests the Pacific. (p Ej: Ometepe, Rivas, Chinandega).
LITERATURE	(Meerman 1993, Bijleveld 1998, Iremonger & Brokaw I.2.2.5.); Cabrera and Sanchez, 1994. Iremonger 1997.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA3a(3)(a) / 57-ISL**
NAME	**Tropical semi-deciduous broad-leaved lowland forest with palm, well-drained, Bay Islands variant (57)** **(only as) moderately intervened** **Bosque semidecíduo latifoliado con palmas de tierras bajas, variante de las Islas de la Bahía, bien drenado, moderadamente intervenido (solamente)**
ECOSYSTEM DYNAMICS	Dynamic.
SPECIAL CONDITIONS	On islands in the Caribbean. Belongs in IA3a(1)(a).
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Frequent species	*Acacia* sp., *Acrocomia mexicana, Bursera simaruba, Casearia sylvestris, Chrysophyllum mexicanum, Cordia alliodora, Cordia currasavica, Hibiscus tiliaceus, Ochroma pyramidale, Persea americana, Psidium guajava, Sabal* spp., *Spondias mombin, Thrinax* spp.
TREE STRATUM	
Tree hight	8-18 m.
Canopy cover	Closed.
Canopy morphology	Broad-leaved.
Leaf phenology	Semi-deciduous.
Arboreal palms	*Sabal* spp., *Thrinax* spp.
Tree ferns	None.
Sessile epifytes	Some.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA3b(1) / 59, 59-2, 59-NC**
NAME	**Tropical semi-deciduous broad-leaved submontane forest (59)** **Bosque tropical semidecíduo latifoliado, submontano (59)**
ECOSYSTEM DYNAMICS	Much human intervention.
GEOLOGY	Costa Rica: Substrate mainly alluvial sediments and volcanic materials.
CLIMATIC CONDITIONS **SPECIAL CONDITIONS**	500-1000 m. On steep hillsides.
WATER REGIME **Moist regime**	Well-drained.
VEGETATION DATA **Species** **Character species** **Frequent species**	Honduras: *Crescentia alata* and *Gyrocarpus americanus.* Guatemala: *Acacia pennatula, Pistacia mexicana, Luehea* spp.*, Haematoxylon* sp.*, Fraxinus* sp.*, Rauvolfia tetraphylla, Hippocratea excelsa, Karwinskia calderoni, Guazuma ulmifolia, Gliricidia sepium, Simarouba glauca, Cordia alliodora, Tecoma stans, Psidium* spp. *Croton* spp.*, Aristolochia* spp. *Bauhinia* spp. Honduras: *Acacia* spp.*, Albizia niopoides, Agondara loranthoides, Calophyllum candissimum., Caesalpinia coriaria, Calotropis procera, Ceiba pentandra, Citharexylum caudatum, Cordia alliodora, Cordia dentata, Crescentia alata, Enterolobium cyclocarpum, Gyrocarpus americanus, Haematoxylum campechianum, Hymenea courbaril, Indigofera* sp.*, Lonchocarpus* spp.*, Lysiloma auritum, Mimosa albida, Moringa oleifera, Mutingia calabura, Neomillspaughia paniculata, Opuntia* spp.*, Pinus caribaea, Pithecellobium leucospermum, Pithecellobium dulce, Plumeria rubra, Prosopis juliflora, Quercus sapotifolia, Samanea saman, Simarouba glauca, Spondias purpurea, Thevetia plumeriifolia, Urvillea ulmacea, Zizyphus mauritiana.* Costa Rica PN:*Cedrela* spp.*, Castilla elastica, Coccoloba caracasana, Godmania aesculifolia, Trophis racemosa, Vismia ferrufinea, Stedmmadenia* spp.*, Verbesina* spp.*, Calea* spp.*, Baccharis* spp.
TREE STRATUM **Tree hight**	5 -10 m.

Canopy cover	Closed.
Canopy morphology	Broad-leaved.
Leaf phenology	Deciduous.
Vines	Few.
Arboreal palms	No.
Tree ferns	No.
Sessile epifytes	Generally just a few. Costa Rica PN: Many xerophytic epiphytes: *Tillandia usneoides, T. ionantha, T. caput- medusae y Catopsis* spp.
SHRUB STRATUM	
Canopy cover	Costa Rica PN: Shrubby and arborescent Asteraceae: *Verbesina* spp., *Calea* spp., *Baccharis* spp.
OTHER OBSERVATIONS	Nicaragua: The Semi-deciduous submontane forest has not been determined yet in this study but it will be a vegetation type similar to Moropotente, Estelí; Wirruca, Boaco; or Amerrisque, Chontales) the tree canopy will be shorter than the low land semi-deciduous forest with abundant xerophytic epiphytes (different *Tillandsia* spp. with the typical *T. usneoides*).
LITERATURE	Iremonger 1997: 19, 20.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA3b(2) / 60** **This vegetation class has been assigned the wrong code, it should be considered IA3b(1/2).**
NAME	**Tropical semi-deciduous mixed submontane forest (60)** **Bosque tropical semidecíduo mixto, submontane (60)**
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	Variable.
CLIMATIC CONDITIONS	Dry.
SPECIAL CONDITIONS	On the Atlantic side 500-1000 m. On the Pacific side 700-1200 m. Mountains.
SOIL CHARACTERISTICS	
SOIL TYPE	Sandy loam.
Cover and nature organic matter	Medium.
Cover rock	High.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Dominant species	*Quercus* spp.
Frequent species	*Pinus* spp., *Quercus* spp., *Guazuma ulmifolia, Acacia pennatula, Bursera bipinnata, Cordia* spp., *Xylosma* spp., *Agave* spp., *Sececio deppeanus, Serjania* spp., *Calliandra* spp.
Associated species	
TREE STRATUM	
Tree hight	10-15 m.
Canopy cover	Variable.
Canopy morphology	Mixed.
Leaf phenology	Semi-deciduous.
Arboreal palms	No.
Tree ferns	No.
Sessile epifytes	Some.
SHRUB STRATUM	
Upper height	2-3 m.
Canopy cover	Open.
Acaule palms	No.
OTHER OBSERVATIONS	

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA3c(1) / 61, 61-PN,**
NAME	**Tropical semi-deciduous broad-leaved lower montane forest (61)** **Bosque tropical semidecíduo latifoliado montano inferior (61)**
SOIL CHARACTERISTICS	
SOIL TYPE	Guatemala: Sandy Loam En Costa Rica: PN and VC over alluvial sediments and volcanic materials.
Soil color	Guatemala: Reddish.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Dominant species	*Quercus* spp.
Frequent species	Guatemala: *Gliricida sepium, Bursera bipinnata, Cordia alliodora, Tecoma stans.* En Costa Rica: PN and VC: *Cedrela* spp., *Castilla elastica, Coccoloba caracasana, Godmania aesculifolia, Trophis racemosa, Vismia ferrufinea, Stedmmadenia* spp., *Verbesina* spp., *Calea* spp., *Baccharis* spp. Asteraceae shrubs and small trees: *Verbesina* spp., *Calea* spp., *Baccharis* spp.
TREE STRATUM	
Tree hight	10 – 20 m.
Canopy cover	Open.
Canopy morphology	Broad-leaved
Leaf phenology	Deciduous.
Vines	No.
Arboreal palms	No.
Tree ferns	No.
Sessile epifytes	Generally few. Costa Rica: abundant xerophytes, *Tillandia usneoides, T. ionantha, T. caput- medusae* and *Catopsis spp*.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA3c(1/2) / 62** **The wrong code was assigned to this vegetation class on the map, it should be IA3c1/2. ## As what has it been classified on the map?**
NAME	**Tropical semi-deciduous mixed lower montane forest (62)** **Bosque tropical semidecíduo mixto montano inferior (62)**
GEOLOGY	Variable.
CLIMATIC CONDITIONS	Semi-dry.
FIRE EXPOSURE	Annual burning.
SPECIAL CONDITIONS	Atlantic side from 1,000 to 1,500 m. Pacific side from 200 to1,800 m; rocky hills.
SOIL CHARACTERISTICS	
SOIL TYPE	Sandy Clay.
Cover and nature organic matter	Variable.
Cover rock	High.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Dominant species	*Quercus* spp., *Pinus* spp.
Frequent species	*Lysiloma* spp., *Bursera bipinnata, Eupatorium* spp., *Rhus* spp., *Agave* spp., *Cordia* spp., *Byrsonima crassifolia, Psidium* spp, *Calliandra* spp., *Acacia pennatula, Croton* spp., *Pachyrrizus erosus*.
TREE STRATUM	
Tree hight	15 – 20 m.
Canopy cover	Open.
Canopy morphology	Mixed.
Leaf phenology	Mixed.
Arboreal palms	No.
Tree ferns	No.
Sessile epifytes	Present.
SHRUB STRATUM	
Upper height	2 m.
Canopy cover	Open.
Acaule palms	No.
Leaf morphology	Broad-leaved.
GROUND STRATUM	
Graminoids cover	Dense.

OTHER OBSERVATIONS

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA3f(4)(a) / 63**
NAME	**Tropical semi-deciduous broad-leaved alluvial gallery forest (63)** **Bosque tropical semidecíduo latifoliado aluvial de galería de tierras bajas (63)**
GEOLOGY	Passes through different areas with different geological substrates.
CLIMATIC CONDITIONS	
FIRE EXPOSURE	Fires in the surrounding ecosystems can affect the margins, and depending on the humidity of the understory enter the forest itself.
SOIL CHARACTERISTICS	
SOIL TYPE	Variable but always with important amounts of silt. In El Salvador found on the lower parts of the river banks and frequently inundated.
Soil color	Dark brown
WATER REGIME	
Moist regime	Mesic, with high water table.
VEGETATION DATA	The riverine communities are long and thin, often imperceptible in the satellite images and difficult to define on the maps as they form a fine network across the savannas were they occur. The composition depends on humidity and oxygenation and saturation and is difficult to define from just a few field trips. According to Taylor (1962), a good part of the species belong to the vegetation type found in the next altitudinal class above or in slightly more humid vegetation classes. For example, the riverine forest that cuts across deciduous lowland savanna, will have many species from a semi-deciduous forest or a submontane deciduous forest, submontane gallery forest will have species from a seasonal evergreen lower montane forest.
Species	
Frequent species	Nicaragua: In semi-deciduous areas, the species found are from seasonal evergreen forests: *Anacardium excelsum, Nectandra globosa, Erythrina fusca, a veces E. glauca, Couropita nicaraguensis, Ficus* spp., *Tabebuia pentaphylla, Hymenea courbaril, Hura crepitans, Annona glabra* and *A. reticulata*. In the intervened deciduous forest: the riverine forests are made up from species from the semi-deciduous forest:

	Enterolobium cyclocarpum, Ceiba pentandra, Terminalia ablonga, Astronium graveolens, Sterculia apetala, Tabebuia pentaphylla, Brosimum alicastrum, Ardisia revoluta, Inga spuria, Ficus sp, Albizzia caribaea.
	In areas of deciduous savannas (dryer than the deciduous forest) are found: *Pseudosamanea guachepele, Samanea saman, Guazuma ulmifolia, Touinidium decandrum, Apoplanesia paniculata, Licania arborea, Coccoloba caracasana y Pterocarpus hayesii*.
	In El Salvador, with few species such: *Salix humboldtiana, Ficus insipida, Castilla elastica, Acacia hindisii, Phyllantus brasiliensis, Erytrina glauca*. Herbáceous are few though *Bactris subglobosa* is found in the understory. No epiphytes were observed.
TREE STRATUM	
Tree hight	Very variable in the same site, but can grow to 30 m.
Canopy cover	50-80%.
Average basal area	Nicaragua: 30 m^2/Ha, but in some better conserved sites more than 100 m^2/ Ha.
Canopy morphology	Sclerphyllous some ombrophyllous species.
Leaf phenology	Variable acording to the above mentioned criteria.
Vines	Few and generally woody.
Arboreal palms	A *Acrocomia mexicana* and *Elaeis* spp.
Tree ferns	Only in the montane zones and sometimes in submontane when cloudy.
Sessile epifytes	Few but frequently on the branches that hang over the river.
Climbing epifytes	*Syngonium podophyllum* and *Monstera obliqua.*
SHRUB STRATUM	In many cases well developed because of the abundance of light.
Lower height	1.5 m.
Upper height	5 m.
Canopy cover	30-40%.
Acaule palms	Just seedlings.
Leaf morphology	Sclerophyllous and ombrophyllous.
Shrub phenology	Evergreen.
Tall herbs periodicity	Evergreen.
GROUND STRATUM	In many cases well developed because of the abundance of light.
Overall herbaceous cover of the ground stratum	50 80%.
Graminoids cover	Very variable.
Forbes cover (including juvenile trees and acaule palms)	Very variable.

Cover of inferior cryptogamytes (no ferns)	Not significant.
Acaule palms cover	Not significant.
Predominant periodicity of herbaceous cover	Annual to perennial.
AQUATIC (SEMI-) SESSILE LIFE FORMS	
Emerged vegetation	*Motrichardia arborescence, Xanthosoma* spp., *Dieffenbachia* spp. on the river margins.
FAUNISTIC OBSERVATIONS	Fauna of the gallery forest, are much richer in species than would be expected based just on the botanical inventory: When crossing open savannas, they perform special functions such as: • Refuges, to hide and to nest • Diverse Source of food • Water • Recreational, hygiene (many species bath in the water). Some amphibians that Villa (1972) considered to be present in this ecosystem: *Hyla boulengeri*, *Leptodactylus pentadactylus, Agalychnis callidryas*, *Eleutherodactylus bransfordii*, *Eleutherodactylus cerasinus*, *Eleutherodactylus fitzingeri*, *Eleutherodactylus gollineri*, *Eleutherodactylus rugulosus*, *Eleutherodactylus talamancae*, *Eteutherodactylus mimus*, *Eteutherodactylus rugosus*, *Bufo valliceps*, *Hyla ebraccata, Smilisca phaeota*, *Leutherodactylus noblei*.
OTHER OBSERVATIONS	In semi-deciduous gallery forest the species that only partially shed their leaves in the dry season, in the satellite images contrast with the surrounding deciduous vegetation. In general in more humid areas its impossible to detect the gallery forest in the images.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA3g(a) / 64**
NAME	**Tropical semi-deciduous broad-leaved lowland swamp forest (64)** **Bosque tropical semidecíduo latifoliado pantanoso de tierras bajas (64)**
GEOLOGY	Lowland (often of volcanic origin) inundated periodically surrounded by deciduous lowland forest.
FIRE EXPOSURE	The surrounding areas are frequently burnt, during agricultural clearing, which might effect the margins of this ecosystem.
SOIL CHARACTERISTICS	
SOIL TYPE	Soil sedimentary with high silt content.
Soil color	Brown to black.
Cover and nature organic matter	Organic material in decomposition.
WATER REGIME	
Moist regime	Hydromorphic, inundated for long periods.
Water cover	2-5 cm.
Water characteristics	Fresh water.
Water bottom composition	Variable depending on the site but generally clay sediments and volcanic rock.
VEGETATION DATA	
Species	
Dominant species	This forest is dominated by *Bravaisia integerrima*.
Co-dominant species	Also: *Terminalia oblonga, Anacardium excelsum, Sterculia apetala, Hura crepitans, Trichilia trifolia, Samanea saman, Cedrella odorata, Trichilia glabra, Guazuma ulmifolia.*
Frequent species	Frequent in areas inundated for longer periods: *pentaphylla, Coccoloba caracasana, Coccoloba floribunda, Annona glabra, Annona* spp.
Associated species	On the edges and more open areas: *Parkinsonia aculeata, Pithecellobium lanceolatum, Pithecellobium dulce, Mimosa pigra, Mimosa dormiens, Acacia farnesiana, Bactris* spp., *Ipomoea carnea, Capparis odoratissima, C. palmeri,* and near standing water and on alluvial banks different communities associated with the freshwater (VII).
TREE STRATUM	
Tree hight	15-20 m.
Canopy cover	70%.

Average basal area	12 m^2/Ha.
Canopy morphology	Predominantly sclerophyllous but some ombrophyllous species.
Leaf phenology	Predominantly semi- deciduous or evergreen.
Vines	Apocinaceaeae, Asclepiadaceae y Aristolochiaceae
Arboreal palms	In clearings: *Sabal mexicana* and *Acrocomia mexicana*, in some areas curiously *Scheelea rostrata*.
Climbing epifytes	*Syngonium podophyllum* and *Monstera obliqua.*
AQUATIC (SEMI-) SESSILE LIFE FORMS	
Emerged vegetation	In open areas: Hymecnachne amplexicaulis, Typha dominguensis, Eleocharis spp.
Free floating vegetation	In mosaics with open water: *Pistia stratiodes*, *Lemma* spp.
FAUNISTIC OBSERVATIONS	The trees serve as roosting perches for aquatic birds. Some amphibians that Villa (1982) considered present in these ecosystems are: *Hyla boulengeri*, *Leptodactylus pentadactylus*, *Agalychnis callidryas*, *Eleutherodactylus bransfordii*, *Eleutherodactylus cerasinus*, *Eleutherodactylus fitzingeri*, *Eleutherodactylus gollineri*, *Eleutherodactylus rugulosus*, *Eleutherodactylus talamancae*, *Eteutherodactylus mimus*, *Eteutherodactylus rugosus*, *Bufo valliceps*, *Hyla ebraccata*, *Smilisca phaeota*, *Leutherodactylus noblei*.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA5a(1) and IA5a(2) / 65 and 66**
NAME	**Caribbean mangrove forest on clay (65)** **Bosque de manglar del Caribe sobre suelo limoso (65)** **and** **Caribbean mangrove forest on coraline sand (66)** **Bosque de manglar del Caribe sobre arena coralina (66)**
ECOSYSTEM DYNAMICS	Moderately dynamic.
GEOLOGY	From 0 to 6 m with almost imperceptible inclines, that consist of marine and alluvial deposits.
CLIMATIC CONDITIONS	Found in tropical climites. Precipitation is less important than the tidal inundation's, though the influence of seasonal variations in precipitation does affect the Mangroves and is explained below. Nicaragua: Average temperatures 22- 40 °C and average precipitation 2,750-6,000 mm a year and relative humidity higher than 90%.
FIRE EXPOSURE	Very rare, not a factor in this ecosystem.
SOIL CHARACTERISTICS	
SOIL TYPE	Soils, inundated, salty, black sandy loam,: Hydromorphic clay Inceptisols.
Cover mineral soil	50 - 100 % or covered in water.
Cover and nature organic matter	Almost absent. The organic material is moved daily by the tides, it decomposes rapidly or is consumed by aquatic organisms.
Cover rock	Absent.
WATER REGIME	
Moist regime	The tides and rainfal. The tides on the Caribean are very minor, often les than half a meter. Areas under tidal regime are predominantly influence by seawater, but areas that are merely occasionally flooded during extraordinary high water may have great fluctuations in moisture and salt content. During dry periods the soils may completely dry up and during prolonged rains, the saltcontents may drop considerably.
Water cover	Some areas are permanently flooded, others are covered at high tide and leave small patches of standing water, that drain at low tide. In the tidal zone the soil is always saturated, but varies with the local inundation regime.
Water formation	Estuarine or coastal waters.
Water characteristics	Generally brackish, but the water on occasion can be

fresh on others saline.

VEGETATION DATA

Positioned in the tranquil fringes of estuarine zones, mangroves receives and capture sediments and are usually rich in nutrientes. The species found here are adapted to different levels of salinity and distribute accordingly through the ecosystem. As only few organisms are tolerant of high concentrations of salt, mangroves are poor in floristic species composition.

In Belize the following types of Mangrove have been described and they occur in other countries in Central America:

a = Dwarf or shrub mangrove found on sandy banks, dominated by *Rhizophora mangle*. These banks occur in many places of between the coast and the outer keys. Similar conditions occur on insular banks in the perifery of the Bay Islands of Honduras, in the area of the Islas Mosquitas off the shores of Nicaragua and Honduras and Bocas del Toro in Panama.

b= Inland shrub mangrove, permanently inundated with fresh water.

c = Mixed shrubby mangrove with vegetation associated with areas beyond the direct influence of the sea.

d = Coastal strip mangrove, forest dominated by *Rhizophora mangle* a narrow strip, shrubby or tall trees, found along the coast. Where it occurs it is rather marine in character It does not occur too often along the North East coast of Central America and is usually too small to map.

e = Riverine mangrove, along the fresh water rivers. This type occurs from Belize to Panama. The salt content of the water may very with the season from brakish during the dry season to seemingly completely fresh during the rainy season.

f = Lagoon forests. Found along the margins of the coastal lagoons. The compositor and structure of these communities varies depending on the frequency of inundation, the exchange of nutrientes and salinity. This type occurs from Belize to Panama. The salt content of the water may very with the season from brakish during the dry season to seemingly completely fresh during the rainy season.

Species

Character species

Rhizophora mangrove, with stilt roots.

Dominant species

In general dominated by *Rhizophora mangle* and *Avicennia germinans* this last is the black mangrove which has neumatophores.

Observations by type:

a: Dominated for R*hizophora mangle* stunted.

b: Dominated for *Rhizophora mangle.*

c: An association of: *Avicennia germinans, Laguncularia racemosa,* and *Rhizophora mangle.*

d: *Rhizophora mangle* is characteristically dominant in this community.

e: *Rhizophora mangle* is the dominant species.

f: *Rhizophora mangle* dominates in the areas influenced by the tide or where the inundation is predominately more than 15 cm deep. Where the water is shallower and the influence of the tide less other species of Mangrove or associated vegetation invades. The salinity reaches levels above 50 % and *Avicennia germinans* dominates when the high salinity is accompanied by poor aeration or anaerobic conditions, *Avicennia* has a ecological advantage because of its neumatophores. In places where the salinity is between 30-40 % the species that dominate are: *Avicennia germinans*, *Laguncularia racemosa*, y *Rhizophora mangle*. It disturbed areas, the fern *Acrostichum aureum* becomes the dominant species.

Co-dominant species

Laguncularia racemosa.

a: Being mostly off-shore it is usually very poor in other species. At the fringes it may go over into marine pastures.

b: The vegetation transforms gradually into VII B4-VG, High herb swamp, with patches of high reeds and occasionally *Rhizophora mangle* as individuals or in small groups.

e: The co-dominate species is *Laguncularia racemosa*

Frequent species

Generally the frequent species are: *Conocarpus erecta, Myrica cerifera, Rhapia taedigera* with neumatophores and *Acoelorraphe wrigthii.*

Belize: *Acoelorraphe wrightii, Acrostichum aureum, Conocarpus erectus, Eragrostis prolifera, Myrica*

	cerifera and *Rhabdadenia biflora.*
Associated species	Accompanying the mangrove are: *Acrostichum aureus, Crinum erubescens, Pterocarpus officinalis* and *Carapa guianensis,* palmas such as: *Asterogyne martiana, Calyptrogyne glauca, Desmoncus* spp., *Socratea* spp. and *Cecropia peltata* taht occupay better drained terrain. The shrubs carry a variety of epiphytes: *Tillandsia bulbosa, T. Balbisiana, T. caput-medusae, T. Streptophylla, Achmea bracteata* and Orchids: *Brassavola venosa, Epidendrum imatophyllum, Catopsis sessiliflora* and *Mymercophila brysiana*.
TREE STRATUM	
Tree hight	The height of the Mangroves varies considerably: the shrubby mangroves are between 1 to 5 m. On the coastal strip between 2 to 15 m in height. The riverine and lagoon mangroves can occasionally reach 30 m in height.
Canopy cover	50% (shrubby mangrove) to 85% (the rest)
Average basal area	Nicaragua: From 2 m^2/Ha in the low mangroves up to 90 m^2/Ha in the dense and high coastal mangroves.
Canopy morphology	Broad-leaved sclerophyllous.
Leaf phenology	Evergreen, even though some individuals loose there leaves in the dry season (seasonality).
Vines	Nicaragua: From the Lagoon "Perlas" to the south there are lianas (Apocynaceae, Asclepiadaceae, Convolvulaceae and Malpighiaceae) that are found in the shrub layer or forest that accompanies.
Arboreal palms	*Rhapia taedigera* with neumatophore, and *Acoelorraphe wrigthii.* Honduras and Guatemala: At some places the Coconut palm invades the mangroves.
Tree ferns	*Acrostichum aureus*
Sessile epifytes	Lichens on the branches and algae on the lower parts of the trees and shrubs. Species of bromeliads: *Tillandsia bulbosa, T. balbisiana, T. caput-medusae, T. Streptophylla, Achmea bracteata*
Climbing epifytes	Orchids such as: *Brassavola venosa, Epidendrum imatophyllum, Catopsis sessiliflora* and *Mymercophila brysiana*.
SHRUB STRATUM	From the Lagoon of the "Perlas", Nicaragua to the south broad-leaved sclerophyllous shrubs with stilt roots or neumatophores accompany the mangrove.
NOTAS GENERALES SOBRE LA FAUNA	Amongst the birds are found: Pelicans (*Pelecanus occidentalis*), Fregates *(Fregata magnificens),* Green Backed Heron *(Butorides viri*scens), Snowy Egret *(Leucophoyx tula*), Cattle Egret *(Bubulcus ibis*), Roseate Spoonbill *(Ajaia ajaja*).

The trees serve as perches for the aquatic birds and as nesting sites for the Herons and Pelicans. Some marine species pass some stages of there life cycle in the Mangroves. Different crabs and bivalves, amongst the last are found the mangrove mussels. In the Mangroves the juvenile stages of various shrimps develop and other marine species. In the diversity of its marine life the Caribbean Mangroves differ from the Pacific mangroves.

In the a-type mangroves faunal species diversity is much higher than in the other mangrove types.

Going with the flow, salt tolorant fish species and less tolerant species wander in and out of the mangroves depending on the tydal fluxes and salt content of the water.

OBSERVACIONES GENERALES

Mangroves, being ecosystems low in species composition, have not been classified according to the sizes of their physiognomic strata. Subclassification by floristic, oceanic location and substrate is more species distinctive. The a type mentioned here is the IA5a(2), (66), Caribbean mangrove forest on coraline sand, Bosque de manglar del Caribe sobre arena coralina. It has usually not been mapped for either being too small or not recognized for its marine faunal distinction.

From the lagoon of the "Perlas" to the north, the silty Mangroves of the Caribbean are easier to detect on the satellite image. In this area the Mangrove dominates because the seasonal variation in rainfall causes a concentration of salt in the dry season. South of the Lagoon of the "Perlas" it is not possible to clearly define the mangroves because of the fresh water from the high year round precipitation, that reduces the salt content of the inundated forest allowing less salt tolerant species to prosper. In Panama the situation is similar to the north. From the south of the Lagoon of the "Perlas) to the Boca Del Torro in Panama, the Mangrove does not grow on the coast as its distribution is limited to the rivers and Lagoons. In this areas the mangroves are combined with species with less salt tolerance. In Panama the Mangroves are again found along the coast itself in the tidal zone.

Originally, *Pelliciera rizophorae* was not expected for the Caribbean coast. But during the project it was discovered in dispersed populations from Trujillo in Honduras to Wountha in Nicaragua and in Boca de Toro, Panama. In Costa Rica this species is known from the

Pacific Coast. It was not possible analyze these areas to included a distinct Mangrove system for these areas.

This ecosystem is affected by increased and heavy sedimentation and the cutting of the Red mangrove for the production of Charcoal.

LITERATURE

(Furley & Ratter 1992, Gray et al. 1990, Wright et al. 1959: 30, Iremonger and Brokaw 1995: II.1.1.1., II.1.2.1. II.1.2.2. II.1.2.3)

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IA5b(1) / 67, 68, 68-2**
NAME	**Pacific mangrove forest on clay (67, 68)** **Bosque de manglar del Pacífico sobre suelo limoso (67, 68)**
PHYSICAL CONDITIONS	The Mangroves of the Pacific develop in the tidal zone with fluctuations between tides of more than 5 m. The tidal waters surrounding and penetrating the Pacific mangroves are usually heavily loaded with fine sediments and visibility often between 10 and 50 cm.
ECOSYSTEM DYNAMICS	Because of the tidal conditions on the Pacific coast, the Mangroves here are more dynamic, than on the Caribbean side. Some parts are permanently inundated while others are inundated twice a day.
GEOLOGY	Large flat and elevated extensions of inter-tidal banks of silt and mud, mostly on estuaries, which explains the marine-fluvial sediments
CLIMATIC CONDITIONS	Develop under tropical climatic conditions. The precipitation is less important than the tidal inundation's. In Nicaragua, average precipitation 1200-1900 mm a year, average temperature 26-28º C and more than 80% relative humidity.
FIRE EXPOSURE	Very rare, not a factor in this ecosystem.
SOIL CHARACTERISTICS	
SOIL TYPE	Soils saturated saline, sandy loam, black: Hydromorphic clay Inceptisols.
Soil color	Clear gray to light gray.
Cover mineral soil	50 - 100 % or covered in water.
Cover and nature organic matter	Almost absent. The organic material is moved on a daily basis by the tides, it rapidly decomposes or is consumed by aquatic organisms.
Cover rock	No stones present on he surface.
WATER REGIME	
Moist regime	Inundated by the tides. Between saturated and inundated standing water in the lowest areas, the tidal waters drain for inclination towards the margins of the estuaries and its tributaries.
Water characteristics	Brackish to saline.
Water bottom composition	
VEGETATION DATA	In that this habitat is positioned between the continental fluvial ecosystems and the marine ecosystems, it receives

a double supply of nutrientes and water. The species found here are adapted to different levels of salinity and distribute accordingly through the ecosystem. The mangroves do not mix with other vegetation classes in that they can not tolerate the salinity.

Species

Dominant species

Rhizophora mangle dominants in the zone of contact fresh water, sometimes immediately replaced by *Avicennia bicolor*, and then inland *Avicennia germinans* where the stress because of high salinity in dry periods is highest.

Co-dominant species

Between the both dominant species *Leguncularia racemosa* can be found.

Frequent species

Behind the Mangroves a thin area of vegetation is found containing: *Prosopis* spp., *Opuntia* spp. and *Uniola* spp.

Associated species

The first two zones have no herbaceous plants or epiphytes, but *Acrostichum* the Mangrove fern and the Lilly *Hymenocaulis,* can be found under *Avicennia germinans* and *Leguncularia*. Occupying the highest zone of the estuaries on sandy terrain *Conocarpus erecta* is found.

In areas influenced by fresh water the following species begin to appear: *Albizia saman, Bactris* spp., *Blechnum* spp., *Entada polystachya, Jacquinia aurantiaca, Pachira aquatica, Panchreatum litorali, Typha latifolia, Sabal guatemalensis, Urechitis antrieuxii.*

TREE STRATUM

Tree hight

From shrubs 2-3 m high to tress 30 m in height, generally between 7 and 15 m. In the context of the project, shrubs and tress where not distinguish, in that in composition they are considered the same.

Canopy cover

The crowns of differing heights give the impression of a tangled canopy, covering 60 to 85%.

Average basal area

In Nicaragua de 9 a 12 $m^{2.}$

Canopy morphology

Broad-leaved and sclerophyllous.

Leaf phenology

Evergreen. Though in the dry season the plants abscission their leaves in an accelerated manner, without loosing total leaf cover due to the accelerated growth of new leaves (semi-deciduous).

Vines

Rare

Arboreal palms

In Nicaragua none. In Honduras and Guatemala: the coconut *Cocos nucifera* can invade the land-side margins of the Mangrove *Sabal guatemalensis* is frequently found on the edges.

Tree ferns	In Nicaragua: *Acrostychum aureus,* en Honduras and Guatemala: *Acrostychum danaeaefolium*, though they are large they are no considered tree fern.
Sessile epifytes	Rare.
Climbing epifytes	
SHRUB STRATUM	Consisting of juveniles
Lower height	1.5 m.
Upper height	5 m.
Canopy cover	10-15%.
Acaule palms	None.
Herbaceous cover (herbs considerably taller than 1.5M)	None.
Leaf morphology	Broad-leaved, sclerophyllous.
Shrub phenology	Evergreen.
Tall herbs periodicity	Perennial.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	10%. Just in areas with fresh water, appear the aforementioned species.
Graminoids cover	None.
Forbes cover (including juvenile trees and acaule palms)	*Acrostichum* the Mangrove fern.
Acaule palms cover	None.
FAUNISTIC OBSERVATIONS	Amongst the birds are found: Pelicans (*Pelecanus occidentalis*), Fregates *(Fregata magnificens),* Green Backed Heron *(Butorides viri*scens), Snowy Egret *(Leucophoyx tula*), Cattle Egret *(Bubulcus ibis*), Roseate Spoonbill *(Ajaia ajaja*). The trees serve as perches for the aquatic birds and as nesting sites for the Herons and Pelicans. Some marine species pass some stages of there life cycle in the Mangroves. Different crabs and bivalves, amongst the last are found the mangrove mussels. In the Mangroves the juvenile stages of various shrimps develop and other marine species.
OTHER OBSERVATIONS	Mangroves, being ecosystems low in species composition, have not been classified according to the sizes of their physiognomic strata. Subclassification by floristic, oceanic location and substrate is more species distinctive. In each of the Pacific coast counties at least one large Mangrove is found.

Mangrove on sandy soil IA5b(2) only exists in small patches of swampy beaches and has been too small to map. When the swampy zones increase, the toplayer tends to fill up with fine sediments and the ecological distinction gets lost. Clear-water mangroves on sand don't exist at all on the Pacific and it is doubtfull whether the ecological distinction which is relevant for the Caribbean has any relevance at all for the Pacific coast.

LITERATURE

For Honduras the information comes from Iremonger, 1997.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IB1a(1) / 69-2, 69-PN**
NAME	**Tropical deciduous broad-leaved lowland forest, well-drained (69)** **Bosque tropical decíduo latifoliado de tierras bajas, bien drenado (69)**
PHYSICAL CONDITIONS	In Nicaragua found between 0-600 m. Plains and volcanic foothills, undulating terrain, hills and plateaus.
ECOSYSTEM DYNAMICS	Recent secondary growth.
GEOLOGY	In Nicaragua the substrate is volcanic, Quaternary in origin, sometimes with Tertiary rocks or sedimentary terrain.
CLIMATIC CONDITIONS	The relative humidity ranges between 40 and 80 % depending on the time of year. The precipitation falls between 900 and 2,000 mm annually (May to October), the average temperature is between 26-29 °C. In Costa Rica the dry season lasts for more than 90 days. (Gómez, 1986).
FIRE EXPOSURE	Fire is a principal factor in the degradation of this ecosystem, normally intentional during agricultural clearing.
SPECIAL CONDITIONS	In Guatemala just one polygon near Asunción Mita, El Salvador, Close to the Volcano Las Víboras, impacted by agriculture. Also on hills at 500 m.
SOIL CHARACTERISTICS	In Nicaragua the soils are volcanic or alluvial.
SOIL TYPE	In Guatemala Silty or Sandy loam In Nicaragua a great variety of textures are found: Clay, Silty Loam, Loam, Sandy Loam, Sandy, etc. Costa Rica: according to Gómez (1986), in the lowland deciduous forests, the substrate is of volcanic origin. The topography can be flat, undulating with hills and irregular peaks. Soils Inceptisoles or deep Latosols; well-drained, can be found in areas of volcanic deposits (tufa) or poorly drained clay soils.
Soil color	Soil color: Brown, Reddish brown, Ochre, sometimes Yellowish
Cover mineral soil	Soils of 1 to 6 m deep, generally more than a 1m. In Guatemala the soils are shallower.
Cover and nature organic matter	In the dry season these soils accumulate between 5 % and

12 % of material organic. En Guatemala medium organic content.

Cover rock

In Nicaragua there are many areas where lavic rocks are found on the surface especially on the hills and valley sides.

Its possible to identify moister and dryer areas. In Guatemala the classification is well-drained.

WATER REGIME

The relative humidity oscillates between 40 and 80% depending on the season.

VEGETATION DATA

Species

In Nicaragua the forest is made up of broad-leaved trees that shed there leaves regularly each year simultaneously, due to the long dry season (5-6 months from November to May). The trees have thick fissured bark. There are very few evergreen species, except for some shrubs and certain succulents.

Dominant species

In Nicaragua, the dominant trees are: *Enterolobium cyclocarpum, Bursera simarouba, Ceiba pentandra* (Bottle tree), *Cordia alliodora, Calycophylum candidissimum, Mastichodendron capiri* var. *tempisque, Tabebuia pentaphylla, Tabebuia neochrysanta, Lysiloma seemanii, L. Kellermanii, Albizzia caribaea, Samanea saman, S. Mombin, Swetenia macrophylla (S. humilis), Cedrela odorata*

Co-dominant species

Brosimun alicastrum, Simarouba glauca, Ficus ovata, F. glabrata, F. Obtusifolia, F.conitifolia, Cecropia peltata, Chlorophora tinctorea, Myrospermum frutescens, Bursera graveolens, Lonchocarpus minimiflorus, L. phaseolifolius, L. Phlebophyllus, Bombacopsis quinatum

Frequent species

Guazuma ulmifolia, Cordia dentata, Plumeria rubra, Karwinskia calderonii, Cassia grandis, Gliricidia sepium, Cochlospermum vitifolium, Tecoma stan, Pithecellobium dulce, Caesalpinia eriostachys, Byrsonima crassifolia.

In guatemala: *Ceiba pentandra, Sapranthus nicaraguensis, Cochlospermum vitifolium, Lysiloma* spp., *Thouinidium decandrum, Simarouba glauca, Acacia* spp., *Croton* spp., *Karwinskia calderon, Bursera bipinnata, Luhea* spp., *Euphorbia spp., Aristolochia spp.*

Panama: Cavanillesia platanifolia, Pachira quinata, Pseudobombax septenatum, Bursera simaruba, Calycophyllum candidissimum.

Associated species

Diospyros nicaraguensis, Thouinidium decandrum, Acrocomia viniferaLuehea candida, Senna otomaria, Sapium macrocarpum, Annona purpurea, Gyrocarpus americana, Apeiba tibourbou, Alvaradoa amorphoides,

	Sabal spp., *Castilla elastica, Erythrina berteroana, Sapranthus nicaraguensis, Coccoloba caracasana*
TREE STRATUM	In Nicaragua different associations can be distinguished according to the dominant species: Guacimal (*Guazuma ulmifolia*), Coyolar (*Acrocomia mexicana*), Guanacastal (*Enterolobium cyclocarpum*), Quebrachal (*Lysiloma sp*), etc; These associations in dry areas and on rocky terrain contain species of cactus such as: *Nopalea* spp., *Cereus* spp. and *Cephalocereus* spp. In El Salvador: *Cochlospermum vitifolium, Ceiba pentandra, Ipomoea arborea, Spondias mombin, Simarouba glauca, Sapindus saponaria, Cedrela odorata, Swietenia humilis, Ceiba pentandra, Samanea saman, Triplaris melanodendron, Annona* spp.,*Bursera simarouba, Pithecelobium dulcis, Enterolobium cyclocarpum, Cordia Alliodora, Cordia dentata.*
Tree hight	In Nicaragua, the mature forests reach 20 to 30 m in height In Guatemala from 8 to 15 m.
Canopy cover	In Nicaragua, in the wet season from 70 to 80% canopy cover but in the dry season, depending on the local soil conditions and the precipitation from 60 to 30% canopy cover, with some trees totally defoliated (eg.: *Bursera simaruba*). In Guatemala the forest is open in structure.
Average basal area	In Nicaragua, the basal area is generally between 8 and 12 $m^{2.}$
Canopy morphology	In Nicaragua, the broad-leaved tress are generally sclerophyllous, the same in Guatemala. The crowns are spreading but not intertwining, the younger forest is much denser. El Salvador: the defoliation is from 80 to 95 % during the dry season (February and march).
Leaf phenology	In nicaragua like in guatemala the majority of the species are deciduous. In nicaragua some species are not obviously deciduous as they do not shed there leaves simultaneously, other species are only partially deciduous.
Vines	In Nicaragua, generally there are vines, In mature forests there is a higher proportion of woody vines, in the younger forest, more annual or herbaceous vines. Vines that include: *Amphylophium paniculatum, Cydistia*

	diversifolia, Aristolochia grandiflora, Banisteria argentea. In El Salvador: Woody vines such as: *Entada polystachya, Combretum fruticosum, Paullinia pinnata, Vitis tiliifolia, Sissampelos pareira, Serjania cardiospermoides, Fernaldia pandurata*. Geophytes: *Dioscorea mexicana* and *Dioscorea floribunda*.
Arboreal palms	In Guatemala very few. In Nicaragua, just 2 very dispersed species: *Acrocomia vinifera* and its presence is associated with cattle ranching and *Sabal mexicana* which is only found in forests with more open canopy (more a plant of savannas). In Guatemala no hay.
Tree ferns	In Nicaragua and Guatemala none.
Drapery epifytes	Some 3 species *Tillandsia* spp. are found but not very frequently. In Guatemala very few.
Sessile epifytes	In Nicaragua, various orchids are found: *Oncidium* spp., *Epidendrum* spp., *Laelia rubescens, Brassavola nodosa* and a cactus: *Achantocereus pentagonus*.
Climbing epifytes	In Nicaragua, only found in wetter areas: *Philodendron* spp., *Monstera adansonii* and *Syngonium* spp.
SHRUB STRATUM	In Nicaragua, amongst the shrubs and herbs are found: *Acacia collinsii, Celtis iguanea, Stemmadenia abovata, Thevetia ovata, Carica papaya, Hamelia patens, Malvaviscus arborea.* In El Salvador: Cactus and other succulents are found.
Lower height	In Nicaragua, 2 m.
Upper height	In Nicaragua, 5 m. In Guatemala to 4 m.
Canopy cover	In Nicaragua, 30-40%. In Guatemala closed.
Acaule palms	In Nicaragua, none, just seedlings of *Sabal mexicana*. En Guatemala none.
Leaf morphology	In Nicaragua, woody shrubs, highly branched, leaves sclerophyllous, reduced in the majority of the species.
Shrub phenology	In Nicaragua, perennial and biannual shrubs, generally deciduous, sometimes semi- evergreen.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	In Nicaragua, 20-30%.
Graminoids cover	In Nicaragua, maybe 10-20%.
Forbes cover (including juvenile trees and acaule palms)	In Nicaragua, 10-20%: *Abutilon* spp., *Rauvolfia tetraphylla, Bytneria aculeata, Russelia sarmentosa,*

Myriocarpa spp, Urera caracasana, Maranta arundinaceae, Elytraria imbricata. From 5 to 10% are ferns or similar, amongest the most frecuent are: *Adiantum* spp., *Lygodium* spp., and *Sellaginela*.

In El Salvador: bulbs o rhizomes and therophytes.

Acaule palms cover

In Nicaragua, none.

Predominant periodicity of herbaceous cover

In Nicaragua, principally deciduous, sometimes hemicryptophytes (Poaceae), cryptophytes and geophytes.

FAUNISTIC OBSERVATIONS

In Nicaragua, amongst the animals are: Spider Monkey *(Ateles geoffroyi*), Rabbit *(Sylvilagus sp.),* Squirrel (*Sciurus spp.),* Coyote (*Canis latrans),* Deer (*Odocoileus virginianus*). This is the natural ecosystem for the white tailed deer, Garrobo negro and the Iguana verde (riberino).

OTHER OBSERVATIONS

In Nicaragua very few areas of this ecosystem are found in there natural state, most are moderately to highly intervened, with the impact of timber extraction of selected species (Mahogany, Tropical Cedar), firewood, grazing, burning etc. Due to the differing human induced impacts, this is a very variable vegetation type, with very few areas that can be called representative. These areas are close to large urban areas, agricultural areas and cattle ranches, the pressure from the expansion of cattle is ever greater as well as a growing demand for firewood. illegal timber extraction and poaching continues in all areas.

El Salvador: typical sites are: Parque Nacional Walter Thilo Deininger, Taquillo, El Socorro, Las Termòpilas and San Diego in La Libertad.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IB1a(2) / 70**
NAME	**Tropical deciduous microphyllous lowland forest, well-drained (70)** **Bosque tropical decíduo microlatifoliado, bien drenado (70)**
ECOSYSTEM DYNAMICS	Recent secondary growth.
CLIMATIC CONDITIONS	Belize: Average rainfall less than 1500 mm per year with a pronounced dry season from February through May. Guatemala less than 1000 mm rain/year.
FIRE EXPOSURE	Belize: Some evidence of past fire disturbance.
SPECIAL CONDITIONS	Belize: 0 – 20 m. This is a very distinctive forest type, which is confined in Belize to dry, shallow soils in the Shipstern Nature Reserve area in the eastern Corozal district and to the Baccalar Chico National Park in Northern Ambergris Caye. The trees are generally of narrow girth, resulting in a forest with a "scrubby" appearance. Guatemala: 200-650 m.
SOIL CHARACTERISTICS	
SOIL TYPE	Belize: Over exposed calcareous rock.
Cover rock	Rocky soil.
WATER REGIME	
Moist regime	Belize: Well-drained but subject to infrequent flooding.
VEGETATION DATA	
Species	
Frequent species	Belize: Notable species in this type of forest includes *Agave angustifolia, Amyris elemifera, Beaucarnea pliabilis, Caesalpinia violaceae, Croton glandulosepalus, Eugenia* spp. *Gymnopodium floribundum, Hyperbaena winzerlingii, Manilkara zapota,* and *Pseudophoenix sargentii,* When disturbed this forest type becomes dominated by *Lysiloma latisiliquum*. Guatemala: *Acacia* spp., *Begonia* sp., *Bursera bipinnata, Bursera graveolens, Bursera simaruba, Cnidoscolus* spp., *Gyrocarpus americanus, Hintonia standleyana, Pachyrrizus erosus, Pseudobombax ellipticum, Spondias mombin, Triplaris melaenodendron, Tecoma stans, Urera* spp.
TREE STRATUM	
Tree hight	Belize: It has a low canopy (7-8 m).

Arboreal palms	Belize: *Pseudophoenix sargentii, Thrinax radiata.*
Tree ferns	None.
Sessile epifytes	Belize: Frequent but species poor.
SHRUB STRATUM	
Upper height	5-7 m.
Acaule palms	Belize: *Chamaedorea seifrizii* Guatemala: None.
Herbaceous cover (herbs considerably taller than 1.5M)	
Leaf morphology	Microphyllous and Broad-leaved.
Shrub phenology	Deciduous.
OTHER OBSERVATIONS	Belize: Only found in the extreme NE. Guatemala: In one polygon (Volcán de las Víboras), the vegetation grows on a volcanic rock substrate.
LITERATURE	Belize: Meerman 1993; Bijleveld 1998, Iremonger and Brokaw 1995: I.2.2.5; Cabrera and Sanchez, 1994.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IIIA1b(1)(a)K-s / 71, 71-s**
NAME	**Evergreen broad-leaved shrubland on steep karstic hills (71)** **Arbustal siempreverde latifoliado bien drenado en colinas cársticas escarpadas (71)**
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	Karstic.
CLIMATIC CONDITIONS	Variable.
FIRE EXPOSURE	K-s (Belize): Probably none. Guatemala: Frequent influence.
SOIL CHARACTERISTICS	
SOIL TYPE	K-s (Belize): Found in steep terrain over calcareous rocks, often where there is no vegetation cover, in particular bare rock. Soils may be extremely organic due to the leaching of the mineral soil and the build-up of organic matter in the limestone cracks and fissures. Guatemala: Variable.
Cover rock	K-s (Belize): High.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Frequent species	K-s (Belize): Some recorded species are *Amyris rhomboides, Byrsonima bucidaefolia, Clusia massoniana,* and *Glossostipula concinna*. Vascular epiphytes are abundant. Guatemala: Secondary Vegetation.
TREE STRATUM	
Tree hight	Low stature.
Vines	K-s (Belize): Unknown. Abundant.
Tree ferns	None.
Sessile epifytes	K-s (Belize): Abundant.
OTHER OBSERVATIONS	K-s (Belize): Vegetation naturally stunted. Not sufficiently documented. Guatemala: Vegetación secundaria K-s Terrenos abandonados de cultivas (Guamiles). It is doubtful that this should have been mapped. **Problemas de altura!!!**

Pologynos en el nivel de 200 – 2500 m!!
Son Guamiles? Unir con 4-02???#

(Belize): A low scrub forest known from limestone crags in the Maya Mountains, but not yet properly described.

LITERATURE

K-s (Belize): Iremonger & Sayre 1994; Iremonger and Brokaw 1995: I.2.4.2.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IIIA1/2b(c) / 72**
NAME	**Seasonal evergreen mixed lower montane shrubland (72)** **Arbustal siempreverde estacional mixto montano inferior (72)**
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	Guatemala: Above1000 m (Lower Montane to Altimontane), mostly disturbed or secondary, (Fallows).
CLIMATIC CONDITIONS	Variable.
FIRE EXPOSURE	Frequent.
SOIL CHARACTERISTICS	
SOIL TYPE	Variable.
Soil color	Variable.
WATER REGIME	
Moist regime	Variable.
VEGETATION DATA	
Species	
Character species	*Pinus spp.*
Dominant species	In very dry areas of Honduras: *Mimosa tenuifolia.*
Frequent species	Honduras: *Acacia pennatula, Andropogon bicornis, Apium leptophylum, Cirsium mexicanum, Cuphea pinetorum, Ardisia* spp., *Baccharis salicifolia, Bocconia arborescens, Boehmeria* spp., *Buddleja crotonoides, Eupatorium bustamenta, Furcraea cabuya, Indigofera suffruticosa, Melinis minutiflora, Myrica serifera, Pehria compacta, Pinus* spp., *Pluchea carolinensis, Priva lappulaceae, Psidium guajava, Rhynchelytrium repens, Russelia sarmentosa, Senecio thomasi, Sida* spp., *Stachytarpheta* spp., *Triumfeta semitrilobata, Vernonia arborescens*.
TREE STRATUM	
Canopy cover	Very open, *Pinus* spp. are the most notable emergents.
Canopy morphology	Needle-leaved.
Leaf phenology	Evergreen.
SHRUB STRATUM	
Canopy cover	The shrub layer dominates the canopy.
Acaule palms	None reported.
Leaf morphology	Mixed.
Shrub phenology	Semi-deciduous.
OTHER OBSERVATIONS	Generally intervened or secondary vegetation.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IIIA1b(a) / 73, 73-M**
NAME	**Evergreen broad-leaved lowland shrubland (73)** **Arbustal siempreverde latifoliado (73)**
CLIMATIC CONDITIONS	Average rainfall mostly less than 2,000 mm per year, with a pronounced dry season from February through May.
FIRE EXPOSURE	Miconia variant: Where Karst limestone hills occur in association with savannas, this vegetation type acts as a buffer, protecting the vegetation on the hills from being affected by the frequent savanna fires.
SOIL CHARACTERISTICS	
SOIL TYPE	Soil is a pale gray brown leached layer overlying a gray layer with manganese concretions. A hog-wallow micro-relief occurs. Miconia variant: Soil has a "hog-wallow" micro-relief, and is gray sandy clay, fairly well mottled below.
Soil color	Gray.
WATER REGIME	
Moist regime	Seasonally inundated: This type undergoes extremes of wetting and drying in the course of the year. Miconia variant: Badly drained, frequently inundated.
VEGETATION DATA	
Species	
Frequent species	Frequently encountered species include *Acoelorraphe wrightii, Ardisia* spp., *Bucida buceras, Byrsonima bucidaefolia, Caesalpinia gaumeri, Cameraria latifolia, Calophyllum brasiliense, Chrysobalanus icaco, Coccoloba reflexiflora, Croton* spp., *Erythroxylum guatemalense, Eugenia rhombea, Gliricidia sepium, Gymnopodium floribundum, Haematoxylon campechianum, Krugidendron ferreum, Manilkara zapota, Margaritaria nobilis, Metopium brownei, Myrica cerifera, Ouratea* spp., *Pithecellobium albicans, Plumeria obtusa, Rapanea guianensis,* and *Swietenia macrophylla.* Epiphytes are abundant. Miconia variant: Frequently encountered species include *Acoelorrhaphe wrightii, Aspidosperma cruenta, Bucida buceras, Calyptranthes* spp., *Chrysobalanus icaco, Clidemia* sp., *Haematoxylon campechianum, Miconia* spp., *Mimosa hemendieta, Rinorea* spp., *Tetragastis stevensonii,* and *Xylopia frutescens.*
SHRUB STRATUM	

Upper hight	4 - 6 m. Miconia variant: 3-4 m.
Canopy cover	The canopy is broken and very level with few or no emergents.
Canopy morphology	Broad-leaved
Leaf phenology	Semi-deciduous: It has a significant complement of deciduous species.
Acaule palms	Miconia variant: *Acoelorraphe wrightii* reaches "canopy" level.
Sessile epifytes	Abundant.
FAUNISTIC OBSERVATIONS	It appears that this is the preferential habitat for the rare and only recently discovered Gray Brocket Deer *Mazama pandora.*
OTHER OBSERVATIONS	Usually found in association with type IA2g(1). This forest is known locally as "akalche" or "tintal".
LITERATURE	Meerman, 1999c, (Zimmerman & Olmsted 1992, Olmsted & Duran 1986, Brokaw & Mallory 1992, Wright et al. 1959: 23, Iremonger and Brokaw 1995: II.1.1.2.1.)

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IIIB1b(a) / 75, 75-2**
NAME	**Deciduous broad-leaved lowland shrubland, well-drained (75)** **Arbustal decíduo latifoliado de tierras bajas, bien drenado (75)**
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	Variable.
CLIMATIC CONDITIONS	Dry to humid.
FIRE EXPOSURE	Frequent human induced fires.
SPECIAL CONDITIONS	2 = intervened. This ecosystem is usually the result of post-(shifting) cultivation recoverly. Belizean types are below 500 m. Guatemala and Honduras types are mostly between 400-2000 m, in Nicaragua 0 - 1200
SOIL CHARACTERISTICS	
SOIL TYPE	Variable.
WATER REGIME	
Moist regime	Well-drained.
VEGETATION DATA	
Species	
Character species	Belize: Highly variable ruderal vegetation with many graminoids and shrubs.
Frequent species	Guatemala: *Bursera bipinnata, Bursera graveolens, Bursera simaruba, Turnera ulmifolia, Zanthoxylum culantrillo, Ocimum micranthum., Ipomea murucoides, Acacia spp., Bursera diversifolia, Clusia* spp., *Croton ciliatoglandulosus, Ceiba aesculifolia, Lippia* spp. *Guazuma ulmifolia, Croton payaquensis, Gliricidia sepium, Cordia curassavica, Mammillaria* spp. *Mimosa skinneri, Tecoma stans, Sageretia elegans, Selaginella, Cassia* spp., *Cochlospermum vitifolium, Mammillaria* spp., *Randia* spp., *Erythrina berteroana, Pasiflora* spp. *Acacia pennatula, Tonduzia pittieri, Thevetia ovata, Fraxinus vellerea, Ficus* spp., *Haematoxylon brasiletto. Luhea speciosa, Zanthoxylum* spp., *Cordia dentata, Heliocarpum sp, Karwinskia calderonii, Aristolochya* spp., *Pachyrrizus erosus, Psidium guajava*. Honduras in upper montane regions: *Ageratum* spp., *Begonia* spp., *Browalia americana, Calilia repens, Cryosophila williamsi, Dicranopteris* spp., *Eupatorium bustamenta, Heterocentron subtriplinervum, Iresine celosia, Lycopodiella cernua, Piper* spp., *Pteridium aquilinum, Solanum erythrotrichum, Trema micrantha,*

	Witheringia spp.
TREE STRATUM	
Tree hight	6 – 12 m.
Canopy cover	Open.
Canopy morphology	Broad-leaved
Leaf phenology	Deciduous to semi-deciduous.
Arboreal palms	In some parts of Guatemala: *Sabal guatemalensis.* In Belize sometimes *Acrocomia aculeata.* In Honduras sometimes *Cryosophila williamsii*.
Tree ferns	None.
Sessile epifytes	*Tillandsia* spp. Are common in the Guatemala variant but absent in the Belize variant.
SHRUB STRATUM	
Upper height	3 - 4 m.
Canopy cover	Dense.
Acaule palms	None.
Leaf morphology	Broad-leaved.
Shrub phenology	Deciduous.
OTHER OBSERVATIONS	
LITERATURE	Iremonger and Brokaw 1995: II.2.3., Iremonger 1997: 57.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IIIB1b(f) / 76**
NAME	**Deciduous broad-leaved lowland riparian shrubland (76)** **Arbustal decíduo latifoliado ripario de tierras bajas (76)**
ECOSYSTEM DYNAMICS	Highly dynamic.
GEOLOGY	Variable.
CLIMATIC CONDITIONS	Average rainfall mostly below 3,000 mm a year.
FIRE EXPOSURE	H (Hills variant): None. P (Plains variant): Frequently exposed to wildfires.
SPECIAL CONDITIONS	H: In Hills, 200 – 500 m. This community is found along fast flowing mountain streams of the Maya Mountains. Typically the vegetation is a mixture of vines, graminoid, herbaceous and shrubby species adapted to annual disturbance caused by sudden flash floods. Tree species have difficulty to get established in this highly dynamic habitat but isolated trees occur. P: Of the plains, 0-200 m. Found along riversides where disturbance may be natural, such as the displacement by a river after flooding, or it may be anthropogenic as when land is cleared and left fallow.
SOIL CHARACTERISTICS	
SOIL TYPE	Usually deep soils, often sandy.
WATER REGIME	
Moist regime	H: Well-drained, but subject to brief submergence during flash floods. P: Well-drained, but subject to river flooding which can last for many days.
VEGETATION DATA	
Species	
Frequent species	H: The trees are usually fast growing and short-lived species such as *Ceiba pentandra* and *Schizolobium parahybum.* Other recorded species include: *Acalypha* spp., *Byttneria* spp., *Calathea* spp., *Calliandra emarginata, Canna indica, Casearia* spp., *Castilia elastica, Cecropia obtusifolia, Cedrela odorata, Cestrum racemosum, Cordia aliodora, Critonia morifolia, Croton* spp., *Crysophila stauracantha, Ficus insipida, Gouania* spp., *Guazuma ulmifolia, Hamelia patens, Heliconia latispatha, Helicteres guazumifolia, Inga affinis, Ipomoea* spp., *Lonchocarpus guatemalensis, Maranta arundinaceae, Mimosa hondurana, Mucuna* spp.,

	Pleuranthodendron lindenii, Quararibea spp., *Solanum americanum, Spondias mombin, Tripsacum latifolium, Waltheria indica* and *Xanthosoma* spp.
	P: Tall graminoids (reeds, rushes, and sedges) mix with shrubs, and many types of ruderal communities.
TREE STRATUM	
Tree hight	H: 20 m. P: Usually no tree cover.
Canopy cover	H: Very open.
Canopy morphology	Broad-leaved.
Leaf phenology	Semi-deciduous.
Vines	Abundant.
Arboreal palms	Rare or absent.
Tree ferns	None.
Sessile epifytes	Rare.
SHRUB STRATUM	
Acaule palms	H: *Crysophila stauracantha.*
Leaf morphology	Broad-leaved.
Shrub phenology	Semi-evergreen.
GROUND STRATUM	
Graminoids cover	H: Dominated by *Tripsacum latifolium.* P: High coverage percentage including invasive species such as *Hyparrhenia rufa* and *Rottboellia cochinchensis.*
FAUNISTIC OBSERVATIONS	H: This habitat type appears to be a favored habitat for the endangered Central American Tapir *Tapirus bairdii* and critical breeding habitat for the even more endangered local subspecies of the Scarlet Macaw *Ara macao cyanopteris*.
LITERATURE	H: Meerman 1999c, 1999d, Wright et al. 1959: 7; Iremonger and Brokaw 1995: I.2.2.2; II.2.3. P: Iremonger and Brokaw 1995: II.2.3.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IIIB1b(g) / 79**
NAME	**Deciduous broad-leaved shrubland swamp with dispersed shrubs (79)** **Arbustal pantanoso con árboles dispersos (79)**
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	Variable.
CLIMATIC CONDITIONS	Variable.
FIRE EXPOSURE	In the Peten fire is probably a common phenomenon, being described in some detail by Lundell, 1937.
SPECIAL CONDITIONS	0-500 m.
SOIL CHARACTERISTICS	
SOIL TYPE	Clay.
Cover rock	No.
WATER REGIME	
Moist regime	Inundated principally in the rainy season.
Water characteristics	Fresh water.
Water bottom composition	Organic.
VEGETATION DATA	
Species	
Co-dominant species	Cladium jamaicense
Frequent species	*Sapindus saponaria, Coccoloba* spp., *Inga* spp., *Scleria* spp.
TREE STRATUM	
Tree hight	5 – 15 m.
Canopy cover	Open.
Canopy morphology	Broad-leaved.
Leaf phenology	Evergreen or semi-deciduous.
Arboreal palms	No.
Tree ferns	No.
Sessile epifytes	Some.
GROUND STRATUM	
Graminoids cover	1 m., with *Cladium jamaicense* and *Scleria* spp.
OTHER OBSERVATIONS	The largest area of this ecosystem is found in the north of the Peten the Biosphere Maya (Tigre lagoon).

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**IIIA1a / 80**
NAME	**Evergreen shrubland swamp dominated by bamboo shrubs (80)** **Arbustal siempreverde de carrizal de bambú, pantanoso (80)**
GEOLOGY	Karstic.
CLIMATIC CONDITIONS	Found in areas with less than the 2,500 mm of average annual rainfall.
FIRE EXPOSURE	Possible that fire from human intervention is present in this ecosystem.
SPECIAL CONDITIONS	0-500 m. Very humid most of the year.
WATER REGIME	
Moist regime	Bad drainage.
VEGETATION DATA	
Species	
Dominant species	*Phragmites australis* / *Guadua longifolia*?
TREE STRATUM	
Arboreal palms	Not present.
SHRUB STRATUM	
Lower height	5
Canopy cover	100%.
OTHER OBSERVATIONS	The description is based on observations made from flying over the area.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VA1b(1) / 81**
NAME	**Tall-grass savanna with evergreen broad-leaved trees (81)** **Sabana de graminoides altos con árboles latifoliados siempreverdes (81)**
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	Flat plains from 0 to 20 m.
CLIMATIC CONDITIONS	Average annual rainfall from 1,500 to 1,800 mm, relative humidity 83% the average temperature between 24-29 °C.
FIRE EXPOSURE	In general this ecosystem is subjected to slash and burn, and over-grazing.
SOIL CHARACTERISTICS	
SOIL TYPE	Soils Histosols developed from organic matter and Entisols Silty loam to Sandy loam.
Soil color	Dark brown to almost black.
WATER REGIME	
Moist regime	Poorly drained: saturated to seasonally inundated
Water cover	Temporary standing water in depressions.
VEGETATION DATA	Dominated by tall grasses (adapted to the humid conditions) cespitose hemicyptophytes that wither during the dry season. Some broad-leaved herbs are found, broad-leaved trees in groups or isolated, are dispersed between patches of grasses. Groups of shrubs of different compositions occur across the grassland. Trees and shrubs can show signs of fire, which are common in the dry season.
Species	
Frequent species	*Hymenachne amplexicaulis*, *Oryza latifolia*,
Associated species	*Inga vera*, *Anacardium excelsum*, *Castilla elastica*, *Cecropia peltata*.
TREE STRATUM	
Tree hight	20-30 m.
Canopy cover	20-30 %.
Canopy morphology	A mix of evergreen and sclerophyllous.
Leaf phenology	Evergreen and semideciduos, many trees shed there leaves but not all of them at once.
Vines	Some.
Arboreal palms	Some.
Tree ferns	No.
Drapery epifytes	*Encyclia* spp.,
Sessile epifytes	*Bromelia* spp.,

Herbaceous cover (herbs considerably taller than 1.5M)	5% (*Heliconia* spp., *Thalia geniculata*).
Leaf morphology	Evergreen.
Shrub phenology	Perennial.
Tall herbs periodicity	Permanent (*Heliconia* spp., *Thalia geniculata*).
GROUND STRATUM	
Graminoids cover	Amongst the herbaceous species: *Oryza latifolia*, *Hymenachne amplexicaulis*, *Paspalum* spp. and other grasses Gramineae y Cyperaceae.
FAUNISTIC OBSERVATIONS	Amongst the most evident animal species are:*Felis pardalis, Tapirus bairdi* and *Tayassu tajacu*.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VA1e(1) / 82**
NAME	**Tall-grass waterlogged savanna with evergreen broad-leaved trees and/or palms (82)** **Sabana de graminoides altos con árboles latifoliados siempreverdes y/o palmas, anegada (82)**
GEOLOGY	Nicaragua: from 0 to 20 m topography flat, developed from organic material and silts. Honduras: from 0 to100 m.
CLIMATIC CONDITIONS	Nicaragua: Average precipitation 1,750 mm a year, relative humidity 83% and average temperature between 24 and 29°C.
FIRE EXPOSURE	Nicaragua: this ecosystem is subject to slash and burn, during agricultural clearing.
SOIL CHARACTERISTICS	
SOIL TYPE	In Nicaragua, soils Histosols and Entisols silty loam to clay loam black with high amounts of organic material.
WATER REGIME	
Moist regime	Inundated.
VEGETATION DATA	
Species	
Frequent species	No data from Honduras. Nicaragua: *Rhapia taedigera*, *Tabebuia penthaphylla* and *Anacardium excelsum*, *Malvaviscus arboreus*, Gamalotes and various Cyperaceae.
TREE STRATUM	
Arboreal palms	Nicaragua: significant in sites that are periodically saturated in a mosaic with broad-leaved trees in higher places. Honduras: some.
FAUNISTIC OBSERVATIONS	In Nicaragua, this ecosystem poses ecological characteristics of great importance as they are the most extensive and best conserved of the coastal wetlands in Nicaragua, and poses a diversity of aquatic and terrestrial species of some conservation value, as well as an aesthetic value for tourism, the conservation value is augmented by migratory birds such as *Electron*

carinatum, Trogon massena. Amongst the typical animals: *Caiman crocidylus* and *Crocodylus actus*, Hunting of these reptiles occurs.

OTHER OBSERVATIONS

Little is known of these ecosystems. Those of Nicaragua and Honduras though fisiognomically similar, floristically and ecologically they are not the same.
Nicaragua: In general in the area the Reserve Los Guatuzos, between lake Cocibolca and the frontier with Costa Rica.

LITERATURE

Iremonger 1997: 61

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VA2a(1)(2) / 85**
NAME	**Short-grass savanna with needle leaf trees (85)** **Sabana de graminóides cortos con árboles aciculifolias (85)**
CLIMATIC CONDITIONS	Average rainfall generally less than 2500 mm per year, with a pronounced dry season from February through May.
FIRE EXPOSURE	Annual. With increased fire regime this forest type quickly degenerates to open short-grass savanna.
SPECIAL CONDITIONS	0-500 m.
SOIL CHARACTERISTICS	
SOIL TYPE	The soils all have in common that they have a pale colored, course textured topsoil sharply overlying a compact, brightly red and white mottled finer textured subsoil. The soils are all acid and very deficient in nutrients (King et al. 1992).
WATER REGIME	
Moist regime	This and related ecosystems are often waterlogged during the rainy season but show drought stress during the dry season, especially in the understory.
VEGETATION DATA	
Species	
Character species	*Pinus caribaea* is the most distinctive species but rather sparse.
Frequent species	Common trees and shrubs are *Acoelorrhaphe wrightii, Byrsonima crassifolia, Chrysobalanus icaco, Clidemia sericea, Curatela americana, Hirtella racemosa, Miconia albicans, Quercus oleoides* and *Xylopia frutescens*. Generally there is a graminoid herbaceous layer

dominated by sedges but with other herbs such as *Cassytha filiformis, Passiflora urbaniana, Polygala adenophora, Turnera odorata, Xyris baldwiniana,* and sometimes *Gynerium sagittatum*. Small insectivorous plants such as *Drosera capillaris* and *Utricularia* spp.

Honduras, Mosquitia, include *Aristidia* spp., *Arthrostemma ciliatum, Axonopus aureus, Blechum serrulatum, Senna irwinii, Chamaecrista jalicensis, Desmodium barbatum, Eupatorium vitalbe, Gerardia* spp., *Ischaemum latifolium, Polygala* spp., *Pteridium aquilinum, Spermacoce* spp., *Thrasya trinitensis, Thrasya mosquitensis.*

TREE STRATUM

Tree hight 5 – 15 m.

Canopy cover Open.

Canopy morphology Needle-leaved.

Leaf phenology Evergreen.

Vines Few.

Arboreal palms None, but the medium sized *Acoelorraphe wrightii* is a common feature.

Tree ferns None.

SHRUB STRATUM

Upper height 5 m.

Acaule palms None.

Leaf morphology Broad-leaved, often sclerophyllous.

Shrub phenology Semi-deciduous.

GROUND STRATUM

Graminoids cover Generally there is a graminoid herbaceous layer dominated by sedges.

FAUNISTIC OBSERVATIONS This vegetation type appears to be an important breeding habitat for the Yellow-headed Parrot *Amazona oratrix.*

OTHER OBSERVATIONS This vegetation type is transitional from Short-grass savanna with shrubs (VA2a1) to Tropical evergreen seasonal needle-leaf lowland dense forest, IA2a(2)(b). This ecosystem occurs in Nicaragua Mosquitia's in the higher and drier areas of the inundable or waterlogged pine savanna.(VA2a(1)(2)(g).

LITERATURE (Meerman 1999c, Wright et al. 1959: 17, Iremonger and Brokaw 1995: I.2.2.7.); Iremonger 1997: 66, 67. Cabrera and Sanchez, 1994.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VA2a(1)(2)(g) / 86-M**
NAME	**Short-grass waterlogged savanna with needle-leaved trees (86)** **Sabana de graminoides cortos con árboles aciculifoliados, anegada (86)**
GEOLOGY	From 20 to 40 m, topography almost flat, or slightly undulating.
CLIMATIC CONDITIONS	Temperature between 25 and 27°C, average precipitation between 2,000 and 2,500 mm a year, relative humidity 90%.
FIRE EXPOSURE	An ecosystem that's subjected to frequent burning which can develop into widely spreading forest fires. The impact of the burning affects the regeneration of the pine (brinzals and latizals) and broad-leaved species.
SOIL CHARACTERISTICS	
SOIL TYPE	Generally acid Ultisols sometime Inceptisols, clayey to sandy, hydromorphic; in some parts quartz gravel is found on the surface.
Soil color	Reddish brown
WATER REGIME	
Moist regime	Frequent inundation's during the rainy season though the natural drainage while poor is sufficient to avoid permanent inundation. Water can accumulate for prolonged periods in low laying areas. The soils are compacted and remain saturated throughout the rainy season.
VEGETATION DATA	
Species	
Dominant species	The *Pinus caribaea* is found on slightly higher ground accompanied by species of Poaceae and other herbs mentioned in the saturated savannas with Pine. However the majority of the area is occupied by low laying terrain inundated for most of the year on hydromorphic soils.
TREE STRATUM	
Canopy cover	*Pinus caribaea* covers between 40 and 50% of the area
Average basal area	9 m^2/Ha.
Canopy morphology	Needle leaved and sclerophyllous.
Leaf phenology	Evergreen with some seasonality.
Arboreal palms	On mounds the palm *Acoelorraphe wrigthii.*
Sessile epifytes	*Tillandsia* spp. epiphyte on pine.
Climbing epifytes	*Philodendrum* spp.

SHRUB STRATUM	Very scarce.
GROUND STRATUM	La vegetation in low laying parts consists of: *Rhynchospora cephalotes, Oxycarium spp., Scleria cyperina, Fimbristylis complanata, Utricularia subulata, Eriocaulon decangulare, Xyris* spp. *Hypoxis* spp., *Curculigo* spp., *Drosera capillaris, D. Rotundifolia, Ludwigia* spp., *Senna undulata, Eriosema* spp., *Desmodium barbatum, Nexea* spp., *Conostegia* spp., *Polygala higrophylla, Nepsera aquatica*. In places with better drainage Poaceae are found: *Thrasya campylostachya, Axonopus aureus, Trachypogon angustifolius, Panicum* spp., *Shizachrium sanguineum, Andropogon leucostachyus.* On the margins between *Acoelorraphe wrigthii* and the inundated areas: *Hibiscus* spp., *Abutilon* spp., *Panicum* spp., *Hyptis savannarum, Walteria indica, Lantana camara, Clitoria rubiginosa* and *Tripsacum latifolium*.
Overall herbaceous cover of the ground stratum	80%.
Graminoids cover	75%.
Forbes cover (including juvenile trees and acaule palms)	5%.
Predominant periodicity of herbaceous cover	Some hemicryptopytes (whose shots die back annually but the rhizome is perennial).
FAUNISTIC OBSERVATIONS	Amongst the most commonly observed animals are deer, frogs, and aquatic birds.
OTHER OBSERVATIONS	The impact of timber extraction is much less than the impact of fire. the vegetation seems natural with selected extraction of more suitable specimens. This ecosystem could be managed as a sustainable commercial forest and maintain its role as in the conservation of both soil and water resources. The forest contains an important genetic resources in its pine, which should be both protected and exploited through the collection of seeds.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VA2b(2) / 87, 88-PN, 89-VG**
NAME	**Short-grass savanna with deciduous shrubs (87, 88, 89)** **Sabana de graminoides cortos con arbustos decíduos (87, 88, 89)**
PHYSICAL CONDITIONS	Flat plains sometimes undulating or with low hills: generally on the coastal plains with an altitude of between 0 and 500m.
GEOLOGY	Substrate variable at higher altitudes, at lower altitudes marine sediments.
CLIMATIC CONDITIONS	In Nicaragua, average precipitation 750-1,250 mm a year, relative humidity 68% and average temperature 26-29 °C. En Belize the average precipitation is less than 2,500 mm a year, with a dry period from February to May. In Costa Rica, Gómez (1986) mentions that the dry season lasts for more than 90 days a year.
FIRE EXPOSURE	Fires due to human intervention are frequent.
SPECIAL CONDITIONS	As well as the soil and climate diverted climax, these ecosystems are used for cattle ranching, and the frequent burning promotes the extension of the savanna. The woody elements can be evenly distributed or grouped together in islands of vegetation, dotted across the grass savanna, possibly caused by differences in soil makeup. Typical savannas in Belize occur on virtually flat alluvial deposits. The result of a combination nutrient poor soils and reoccurring fires, have resulted in a vegetation highly specialized. The variability of these ecosystems is high, Moss (1998) classified 12 types of savanna from the coast to the Pine Forests. The shrubs generally are found as islands of shrubs and trees. Gómez (1986), mentions in his classification shrubby patches *Acacia* spp., along side areas of intervened semi-deciduous Forrest.
SOIL CHARACTERISTICS	
SOIL TYPE	In Nicaragua, found on terrain with clay soils, Vertisols, that are inundated during the wet season and dry and cracked during the dry season. Gravel and stones can de found on the surface and in the subsoil. In Costa Rica found on soils of volcanic origin, with a topography that's flat to concave or undulating. Soils Inceptisols, alluvial or Litosols.

In Belize the soil is pale in color, and thick in texture, on the surface there is a layer of soil that's red mottled with white and fine in texture. The soils are acid and very infertile (King et al, 1992).

Soil color Black or dark gray.

Cover mineral soil Generally deeper than 1 m.

Cover and nature organic matter The organic content of the soil is around 12-15%, decomposition occurs principally during the wet season.

Cover rock In places stony on the surface, in other places no stones are found.

WATER REGIME

Moist regime In the dry season, very dry to almost xeric and in the wet season so poorly drained due to the clay soils, that they remain saturated and inundated for long periods, forming areas of standing water, with there own aquatic flora.

In Belize, a very dense layer in the subsoil impedes regular subterranean drainage, provoking seasonal inundation during the rains, but becoming very dry in the season dry season.

Water cover In the rainy season small to medium sized areas of standing water can form.

VEGETATION DATA

Species

Character species *Acacia colindsii, A. farnesiana, Crescentia alata, Caesalpinia coriaria, Haematoxylon brasiletto*

Dominant species Típically 40 % of the area is dominated by deciduous shrubs (*Acacia colindsii, A. farnesiana, Senna skinerii, Jaquinia pungens, Cordia globosa* desde 1 to 4 m) y árboles (*Crescentia alata, Caesalpinia coriaria, Haematoxylon brasiletto, Karwinskia calderonii, Zizypus guatemalensis)* generally low from 3-10 m), all with reduced leaves.

Co-dominant species More developed are: *Phyllostylon brasiliensis, Guazuma ulmifolia, Samanea saman y Albizia caribaea.*

Frequent species Frequent species in Belize are: *Acoelorraphe wrightii, Calyptranthus* spp.*, Cameraria latifolia, Chrysobalanus icaco, Clidemia* spp.*, Crescentia cujete, Curatela americana, Erythroxylum guatemalense, Gliricidia sepium, Hippocratea excelsa, Metopium brownei, Miconia* spp.*, Mimosa albicans, Pinus caribaea, Quercus oleoides and Roupala montana.* The herbaceous flora includes: *Bletia purpurea, Borreria* sp.*, Casytha filliformis, Chamaecrista* spp.*, Cipura campanulata, Coutoubea spicata, Drosera cappilaris, Eriocaulon* spp.*, Passiflora urbaniana, Xyris* spp. and *Zamia polymorpha.* The Poaceae that are found here are: *Aristida appressa,*

	Axonopus poiophyllus, Eragrostis maypurensis, Eragrostis. Acutifolia, Eragrostis elliottii, Gymnopogon spicatus, Leptocoryphium lanatum, Mesosetum filifolium, Panicum rudgei, Paspalum peckii, Paspalum pulchellum, Sporobolus cubensis and *Trachypogon plumosus.* Cyperaceae present include : *Rhynchospora* spp., but also *Bulbostylis paradoxa* and *Fimbristylis vahlii.* In wetter areas are found: *Eleocharis* spp. and *Cyperus ligularis.* The last generally near the coast.
TREE STRATUM	
Tree hight	3-7 m. Belize: Its rare that trees reach 10 m in height, though commonly higher in the gallery forest along streams and brooks.
Canopy cover	10-20%.
Average basal area	5-6 m^2
Canopy morphology	Sclerophyllous. In Belize mixed.
Leaf phenology	Deciduous, almost all the species are deciduous. In Belize mixed.
Vines	Common vines are: *Cyssus* spp., *Ipomoea* spp., and *Combretum laxum*, this last being sometimes being found as a rambling shrub. Not found in Belize.
Arboreal palms	In places, generally close to water *Sabal mexicana* is found. In Belize *Acoelorraphe wrigthii* is conspicuous.
Tree ferns	No.
Drapery epifytes	In the branches of the trees hanging epiphytes are common such as: *Acanthocereus pentagonus*.
Sessile epifytes	*Tillandsia ionantha, T. Recurvata, Brassavola nodosa, Epidendrum alata, Laelia rubescens* sessile. In Belize some are found.
SHRUB STRATUM	
Lower height	1 m.
Upper height	4 m. En Belize not more than 6 m.
Canopy cover	20-30%. In Belize patches, with dense canopies.
Acaule palms	No.
Leaf morphology	Sclerophyllous.
Shrub phenology	Deciduous and semi-deciduous.
GROUND STRATUM	50 % of the area is covered in short grasses, indicating dry conditions. Annual grasses *Bouteloua* spp., *Aristida* spp. and *Eragrostis* spp. Sedges: *Fimbristylis* spp., *Rhynchospora* spp. and *Eleocharis* spp. These annuals are more common than the perennial and hemi-cryptophytes such as: *Paspalum* spp., *Hyparrhenia ruffa, Andropogon* spp.
	The remaining 10 % is covered by herbs such as:

	Zornia diphylla, Stylosanthes humilis, Macroptilium atropurpureus, Centrosema angustifolia, Waltheria americana, Hyptis suaveolens, Sida spp., *Croton niveus, Chamaesyse* spp., *Malvastrum* spp. and some Geophytic Liliaceae. These herbs are found dispersed amongst the dominant grasses, though they can be found in denser patches in disturbed areas. The xeromorphic species such as: *Bromelia karatas, Opuntia lutea, Acanthocereus horridus* and *Jatropha urens* can be found in the herbaceous cover, but principally below the shrubs and trees. In areas of standing water Cyperaceae as mentioned are common as well as some more specialized *Paspalum* and *Oriza latifolia*.
Overall herbaceous cover of the ground stratum	60%
Graminoids cover	50%. In Belize dominated by Cyperaceae.
Forbes cover (including juvenile trees and acaule palms)	10%.
Predominant periodicity of herbaceous cover	Annuals (Terophytes, annuals and Hemi-cryptophytes)
AQUATIC (SEMI-) SESSILE LIFE FORMS	In standing water.
Emerged vegetation	Various species of Cyperaceae: Fimbristylis spp., Eleocharis spp
Fixed floating vegetation	*Sagittaria* spp., *Pontederia* spp.,
FAUNISTIC OBSERVATIONS	Many species of bees, wasps, beetles, bats, are found on the savanas. Amongst the mammals found are: The white tailed deer, coyote and fox. The Garrobos (small iguanas) are almost extinct because of over hunting. The sediments in the rivers hide the fish: *Rhamdia managuensis* and *R. nicaraguensis*; in the summer and during the spring. The short grass savannas are the habit of a number of rare species such as: The Fork-tailed Flycatcher *Tyrannus savanna*, the Grasshopper Sparrow *Ammodramus savannarum* and the Aplomado falcon *Falco femoralis*.
LITERATURE	Meerman 1999a, Wright et al. 1959: 19, 19a, 19b, Iremonger & Brokaw II.1.1.2.3.

CHARACTERISTIC	**DESCRIPTION**
CLASSIFICATION-CODE AND MAP-CODE	**VA2b(6)(g) / 90**

NAME	**Herbs and grass swamp with shrubs and/or palms (90)** **Herbazal pantanoso con gramíneas, palmas y/o arbustos (90)**
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	Variable.
CLIMATIC CONDITIONS	Variable.
FIRE EXPOSURE	Probably during dry years.
SPECIAL CONDITIONS	Wetlands.
WATER REGIME	
Moist regime	Inundated for almost all year.
Water characteristics	Fresh water.
VEGETATION DATA	
Species	
Co-dominant species	No data.
Associated species	Wetland of Xiridaceae in El Tigre lagooon. *Eleocharis* spp. *Nynphaea ampla*; also *Acaelorraphe wrigthii*, *Quercus oleoides, Byrsonima crassifolia* and *Zamia* spp. (Castillo, 2000).
OTHER OBSERVATIONS	No data.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VA2c(b/c) / 91**
NAME	**Short-grass savanna submontane or montane without woody plants (91)** **Sabana de graminoides cortos sin cobertura leñosa, submontano o montano (91)**
GEOLOGY	In Nicaragua, these ecosystemsa are found on quaternary volcanic cones and craters, on a substrate of volcanic lava (Cosigüina, San cristóbal, Casita, Telica, Masaya) not very well consolidated and with little soil formation. In Costa Rica found on the pacific side on the volcano's; Orosí, Santa María and Mount Pelado, all in Guanacaste, Gómez (1986) what he called open savanna of *Trachypogon*.
CLIMATIC CONDITIONS	Found at altitudes from 800 to 1,600 m (submontane to montane). Average rainfall 1,850mm a year, relative humidity 80%, average temperature 20-22ºC.
FIRE EXPOSURE	Because of the vegetation these forest are very susceptible to fire, though the vegetation is well adapted to such occurrences.
SPECIAL CONDITIONS	In Panama in "Llanos del Volcán" (Chavarría, 1989), a similar vegetation is found but with shrubs and dispersed trees, at 1,400 to 2,000 m, this would appear to be in transition to paramo.
SOIL CHARACTERISTICS	
SOIL TYPE	Soil are just beginning to form. In Costa Rica, Gómez (1986) describes an open savanna with grases, that is found on old relic volcano's, with a hilly topography and gentle slopes. Soils Inceptisols, lithic or vertic, shallow. Dominant grasses such as *Axonopus* spp.
Soil color	Brown
Cover and nature organic matter	A great part of the organic material accumulates on the surface of the ground without decomposing.
WATER REGIME	
Moist regime	Xéric though in the area it can rain from1,200 to 2,000 mm, as this type of vegetation is found on hillsides and the substrate is gravel, the rain washes away the recently

formed soil.

VEGETATION DATA

Species

Frequent species

In Panama (Chavarría, 1989) the following species have been observed: *Amaranthus spinosus, Hypoxis decumbens, Hypoxis humilis, Mauria heterophylla, Sanicula liberta, Anthurium seibertii, Zantedeschia aethopica, Ageratina molinae, Ageratum chiriquense, Ageratum panamense, Baccharis pendulata, Bidens pilosa, Bidens triplinervia, Calea jamaicensis, Chaptalia nutans, Chromolaena laevigata, Conyza canadensis, Critonia daleoides, Elephantopus mollis, Fleischmannia pratensis, Gnaphalium attenatum, Jaegeria hirta, Oyedeae verbesinoides, Senecio boquetensis, Sonchus oleraceus, Stevia caracasana, Stevia lucida, Stevia ovata, Tagetes filifolia, Verbesina turbacensis, Begonia glabra, Alnus acuminata, Tournefortia hirsutissima, Tillandcea juncea, Viburnum costaricanum, Viburnum stellato- tomentosum, Drymaria villosa, Zinowiewia costaricensis, Clethra lanata, Clusia dukei, Clusia minor, Clusia salvinii, Tinantia erecta, Evolvus alsinoides, Ipomoea capillacea, Coriaria ruscifolia, Weinmannia glabra, Bulbostylis juncoides, Cyperus hermaphroditus, Cyperus ischnos, Cyperus luzulae, Lipocarpa sellowiana, Cavendishia bracteata, Cavendishia crassifolia, Cavendishia pubescens, Comarostaphylis arbutoides, Gaultheria odorata, Pernettya coriaceae, Satyria warszewiczii, Vaccinium consanguineum, Croton pungens, Canavalia biloba, Cologania procumbens, Crotalaria cajanifolia, Crotalaria sagittalis, Desmodium maxonii, Desmodium molliculum, Desmodium sericophyllum, Desmodium sistortum, Desmondium barbatum, Eriosema crinitum, Eriosema diffusum, Stylosanthes guyanensis, Zornia thymifolia, Quercus rapurahuensis, Xylosma flexuosa, Alloplectus tetragonus, Kholeria spicata, Wigandia urens, Cipura paludosa, Sisyrichium convolutum, Hyptis mutabilis, Marsypianthes chamaedrys, Salvia polystachya, Persea caerulea, Persea vaeraguasensis, Echeandia venusta, Lobelia laxiflora, Buddleia americana, Buddleia nitida, Dendrophthora ambigua, Struthanthus rotundatus, Cuphea carthagenensis, Cuphea infundibulum, Pavonia schiedeana, Sida rhombifolia, Heterocentron glandulosum, Monochaetum floribundum, Pterolepis pumila, Rhynchanthera paludicola, Tibouchina longifolia, Acacia angustissima, Inga minutula, Mimosa pudica, Mimosa somnians, Rapanea pellucido- punctata, Eugenia acapulcensis,*

Myrcia costaricensis, Myrcia fallax, Psidium guajava, Psidium guineense, Forestiera aff cartaginense, Lopezia miniata ssp paniculata, Ludwigia peruviana, Bletia campanulata, Brassia gireoudina, Corymborchis flava, Habenaria trifida, Malaxis fastigiata, Malaxis soulei, Oncidium ansiferum, Oncidium cabragrae, Pleurothallis lepidota, Sobralia lindleyana, Trichopilia suavis, Oxalis latifolia, Passiflora apetala, Phytolacca rugosa, Peperomia galioides, Piper amalago, Aegopogon cenchroides, Andropogon leucostachyus, Arundinella deppeana, Hyparrhenia rufa, Melinis minutiflora, Paspalum humboldtianum, Pennisetum purpureum, Monnina cf cartaginense, Monnina sylvatica, Polygala hygrophila, Polygala leptocaulis, Thalictrum viridulum, Rhamnus sphaerosperma, Rubus glaucus, Borreria laevis, Borreria suaveolens, Crusea longiflora, Galium mexicanum, Mitracarpus hirtus, Richardia scabra, Rondeletia amoena, Buchnera pusilla, Lamourouxia gutierrezii, Russelia sarmentosa, Browallia americana, Solanum lanceolatum, Triunfetta bogotensis, Trema micrantha, Valeriana urticaefolia, Citharexylum hirtellum var guatemalensis, Duranta costaricensis, Lantana hirta, Lantana hispida, Lantana velutina, Verbena litoralis.

SHRUB STRATUM

On the edges of this ecosystem shrubs are found, that constitute some (10%) of the flora: *Lippia cardiostegia, Acacia albida, Tecoma stan, Byrsonima crassifolia* and *Psidium guianensis.*

Graminoids cover

Almost a total covering of herbaceous plants (70%) such as the grasses: *Andropogon brevifolius, Andropogon condenstatus, Pennisetum complanatum, Eragrostis ciliaris, Aristida ternipes, A. jorulensis y el naturalizado Rhynchelytrium repens.*

Costa Rica: Gómez (1986) identifies the grasses: *Andropogon bicornis, A. leucostachyus, A. selloanus, Aristida capillacea, A. jorullensis, A. laxa, A. orizabensis, A. recurvata, Axonopus aureux, A. volcanicus, Bouteloua disticha, B. repens, Diectomis angustata, Echinolaena gracilis, Pentarraphis annua y Trachypogon plumosus* In highnumber also the sedges such as: *Albilgaardia* spp., *Rhynchospora barbata, R. nervosa, Bulbostylis junciformis, B. paradoxa y B. Tenuifolia* as well as various dicotyledonous shrubs.

Forbes cover (including juvenile trees and acaule palms)

From 5 to 15% such as: *Zornia diphylla, Stylosanthes humilis, Senna deamii* and *S. Tajera, Macroptipium atropurpureum, Tagetes* spp., *Poligala* spp., *Sida acuta,*

S spinosa, Hyptis suaveolens, Baltimora recta, Waltheria americana y Lantana camara.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VA2c(g) 92**
NAME	**Short-grass savanna without trees or shrubs, waterlogged (92)** **Sabana de graminoides cortos sin plantas leñosas, anegada (92)**
PHYSICAL CONDITIONS	From 0 to20 m, with a notably flat topography and poor drainage. Subjected to frequent and prolonged inundation's during most of the year.
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	50 m.
CLIMATIC CONDITIONS	Average precipitation from 3,000 to 3,400 mm a year, relative humidity from 75 to 90 % and average temperature between 25-27 °C. In Belize high precipitation close to 4,000 mm annually with a dry season from February to May.
SOIL CHARACTERISTICS	
SOIL TYPE	Entisols and Inceptisols but turbid when excess humidity impedes the decomposition of the organic residues, which accumulates on the surface in a band some 20 to 30 cm thick. In Belize not known.
WATER REGIME	
Moist regime	From inundated to saturated.
Water cover	Seasonally inundated.
Water characteristics	Fresh water.
VEGETATION DATA	Herbaceous plants adapted to these conditions, no shrubs or herbaceous plants over 50 in height.
Species	
Dominant species	A large number of Cyperaceae: *Rhynchospora cephalotes, Cyperus* spp., *Oxycarium* spp., *Scleria cyperina, Fimbristylis complanata, Fimbristylis* spp;
Associated species	Herbaceous marsh plants such: *Eriocaulon ecangulare, Xyris* spp., *Hypoxis* spp., *Curculigo* spp., also: *Utricularia subulata, Drosera capillaris, Polygala higrophylla, Nepsera aquatica, Selaginella* spp. that grows close to the ground under the shadow of taller grasses. On the edges towards the beaches or the savannas patches of grass occur.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	70% dominated grass that forms a cushion of 15 to 20 cm with occasional herbs.
Graminoids cover	65%
Cover of inferior cryptogamytes (no	*Selaginella* spp.

ferns)	
Predominant periodicity of herbaceous cover	The majority are hemicryptophytes which behave like annuals.
AQUATIC (SEMI-) SESSILE LIFE FORMS	
Fixed floating vegetation	*Utricularia* spp.
FAUNISTIC OBSERVATIONS	Belize: Area frequented by storks including Mycteria americana, American Woodstork.
OTHER OBSERVATIONS	Only been observed in the swamp of Aguacaliente in the district of Tolado, Belice. The area is a watershed, surrounded by forest, that seasonally inundates.
LITERATURE	Belize: Iremonger and Brokaw 1995: III.1.1.2.2

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VC2b / 93**
NAME	**Tropical altimontane meadow or paramo (93)** **Vegetación de páramo, altimontano (93)**
PHYSICAL CONDITIONS	
ECOSYSTEM DYNAMICS	According to Gómez (1986), paramos are High mountain savannas.
FIRE EXPOSURE	Fire is important in maintaining this ecosystem the same as in savannas lower down.
SOIL CHARACTERISTICS	
SOIL TYPE	The soils are histosols not very deep over very mineralized soil, with seasonally water deficiency. For the high savannas, Gomez (1986) describes that the substrate is tectonic, topography with moderate slopes of 15- 39%, soils Inceptisols and Andosols with some shrub and small tree cover. Consists of a continuos layer or cushion of grass surrounded by IA1e(1). Seasonal water shortage in the soil.
Cover mineral soil	Soils leached
Cover and nature organic matter	Histosols formed from a biomass that decomposes very slowly in anaerobic conditions (hydromorphic) and accumulates in layers over the mineral soil.
WATER REGIME	
Moist regime	Seasonally saturated, on occasions it become mesic provoking stress in the plants that are adapted to high humidity.
Water cover	Small patches of standing water in the depressions almost still, with some slow movement down the shallow slopes.
Water characteristics	Water pluvial and with some accumulation from condensation.
VEGETATION DATA	
Species	
Character species	The grasses *Aciachne pulvinata* and *Lorenzochloa rectifolia* are indicators of unaltered paramo.
Dominant species	*Chusquea spp.*, the cushion grasses *Cortaderia spp.* and *Calamagrostis* spp. and Asteraceae thickets: *Diplostephium* spp. and *Senecio* spp.
Co-dominant species	Herbaceous vegetation consists of: Umbeliferae (*Azorella* spp., *Hydrocotyle* spp., *Centella* spp.),

Ranunculaceae (*Ranunculus* spp.), Rosaceae (*Alchemilla* spp., *Acaena* spp.), Rubiaceae (*Arcytophyllum* spp., *Nertera* spp.), Cyperaceae (*Carex* spp., *Oreobolus* spp., *Rhynchospora* spp.).

Frequent species

In Panama on the paramos and neighboring areas, the following species have been observed: *Castilleja quirosii, Comarostaphylis arbutoides, Gaultheria odorata, Lycianthes beckneriana, Monnina xalapensis, Monochaetum floribundum, Ageratina herrerae, Alchemilla aphanoides, Alchemilla orbiculata, Begonia oxacana, Bidens triplinervia, Calceolaria perfoliata, Castilleja arvensis, Centropogon leucocarpus, Coriaria ruscifolia, Erigeron karvinskianus, Fuchsia microphylla, Galium mexicanum, Geranium repens, Gnaphalium americanum, Gnaphalium attenuatum, Gunnera insignis, Hackelia mexicana, Hypericum moranense, Jungia ferruqinea, Lachemilla pascuorum, Lepechinia schiedeana, Lupinus clarkei, Muehlenbeckia tamnifolia, Neomirandea sp, Oxalis spiralis, Pernettya coriacea, Phoebe aff pitieri, Phytolacca rugosa, Pilea auriculata, Sabazia sarmentosa, Salvia membranacea, Schitocarpha croatii, Senecio megaphyllus, Senecio oerstedianus, Sigesbeckia iorullensis, Solanum diodontum, Sonchus asper, Symplocos serrulata, Verbesina baruensis, Calceolaria irazuensis, Cavendishia crassifolia, Centropogon ferrugineus, Dendrophthora costaricensis, Escallonia poasana, Gaiadendron punctatum, Garrya laurifolia, Gnaphalium roseum, Halenia woodsoniana, Lupinus costaricensis, Miconia sp, Myrrhidendron maxonii, Oreopanax capitatus, Peperomia hylophila, Peperomia reptabunda, Solanum nigrescens, Vaccinium consanguineum*.

Acording to Cleef & Chaverri (1992), in the paramos the following have been observed: 50 families and 150 genera. The families with most genera: Asteraceae and Poaceae (19 each), Apiaceae (7), Cyperaceae, Ericaceae, Rosaceae (6 each), Orchidaceae y Scrophulariaceae (5 each), Caryophyllaceae, Brassicaceae, Rubiaceae (4 each).

Of the 6 endemic genera (4%) of the páramos of Mesoamérica 4 are in the Asteraceae: *Aphanactis, Iltisia, Pterichis, Westoniella* 2 in the Apiaceae *Laestadia, Myrrhidendron*. There are no giant roseate herbs such as those in the Espeletiinae; (Cleef & Chaverri, 1992).

37 génera (25%) are Neotropical montane elements: *Aciachne* (Andes), *Ageratina, Arcytophyllum, Bomarea,*

Centropogon, Chaetolepis, Chusquea, (antes *Swallenochloa*), *Dendrophthora, Diplostephium* (Andes), *Disterigma, Drymaria, Eriosorus, Gaiadendron* (Andes), *Halenia, Hesperomeles, Holodiscus* (Mexico-Guatemala), *Jamesonia, Lachemilla, Lepechinia, Lorenzochloa* (Andes), *Lypsipomia* (Andes), *Mcleania, Miconia, Monnina, Moritzia, Nasella, Niphogeton* (Andes), *Ottoa, Pentacalia, Puya* (Andes), *Relbunium, Romanschulzia* (Mexico-Guatemala), *Sabazia, Shiedella* (Orchidaceae, Mexico- Guatemala), *Stevia, Triniochloa, Werneria* (Andes); the genera not mentioned have wider ranges (Cleef & Chaverri, 1992).

10 genera son amply distributed in the tropics: *Buddleja, Grammitis, Clethra, Elaphoglossum, Habenaria, Maytenus, Paepalanthus, Phytolacca, Rapanea, Xyris*; (Cleef & Chaverri, 1992).

Holartic region is reprersented by 23 génera (15%): *Agropyron, Comarostaphylis (antes Arctostaphylos), Draba, Castilleja, Cerastium, Cinna, Cirsium, Erigeron, Eryngium, Garrya, Hackelia, Helianthemum, Hypochoeris, Lupinus, Mahonia, Muhlenbergia, Oenonthera, Potentilla, Ribes, Sibthorpia, Vaccinium, Valeriana* (Cleef & Chaverri, 1992).

The austral- antartic region is represented by 21 génera (15%): *Acaena, Azorella, Calandrinia, Calceolaria, Cortaderia, Cotula, Desfontainia, Escallonia, Fuchsia, Gaultheria, Hydrocotyle, Muehlenbeckia, Myriactis, Nertera, Oreobolus, Oreomyrrhis, Orthrosanthus, Pernettya, Sisyrinchium, Ugni, Uncinia*; (Cleef & Chaverri, 1992).

Fuchsia and *Gunnera* appear in the montane forests close by.

36 genera (24%) are amply distributed in the temperate region: *Agrostis, Arenaria, Brachypodium, Bromus, Calamagrostis, Carex, Cardamine, Cytopsteris, Epilobium, Equisetum, Eriocaulon, Erysimum, Festuca, Galium, Gentiana, Geranium, Gnaphalium, Hieracium, Hierochloe, Hymenophyllum, Hypericum, Juncus, Limosella, Luzula, Montia, Plantago, Poa, Polystichium, Ranunculus, Rubus, Rumex, Senecio, Stellaria, Trisetum, Veronica, Viola* (Cleef & Chaverri, 1992).

17 elements can be considered cosmopolitan (11%): *Asplenium, Bidens, Blechnum, Eleocharis, Erigeron,*

Isoetes, Liparis, Lobelia, Lycopodium, Malaxis, Ophioglossum, Oxalis, Polypodium, Pteridium, Rhynchospora, Scirpus, Utricularia (Cleef & Chaverri, 1992).

Within the paramo and high mountain forests *Sphagnum* bog is found. (Gómez, 1986).

In El Salvador on the summit of volcano Santa Ana exsists a small relic of a similar vegetation type, described as open broad-leaved ombrophyllous vegetation, with dense low shrubs(Páramo);(IIIA1c). The flora of Ericaceae, Agavaceae and Plantaginaceae does not coincide with the paramos of Costa Rica and Panama, however the description of Laüer (1955), coincides with a form of elfin forest (Gómez, 1986) that has *Weinmannia, Conostegia, Oreopanax, Clusia, Podocarpus, Myrica* and Ericaceous shrubs. These forests because of the extreme ecological conditions and isolation could contain endemic elements (Gómez, 1986). According to, Lötschert (1953) in Ventura et al (2,000) this vegetation also exists on the volcano's of San Miguel and San Salvador. Lötschert (1955), classified the vegetation as Ericaceous shrubs stunted by the wind, 1,800-2,000 m; Laüer (1955) as: high savannas, de 1,800-2,000 m on the volcano's of Santa Ana and San Miguel, mainly shrubs such as *Myrica mexicana* Ericaceae; Daugerty (1973): Shrubs of wind swept ridges. For more details see IA1e(1).

Associated species

At a lower level, you can distinguish various associations such as *Sphagnum* bogs, with *Myrrhydendron donnell-smithii* and *Rumex costaricensis*, etc. (Gómez, 1986).

TREE STRATUM

Exist patches of shrubs.

SHRUB STRATUM

Canopy cover

Chusquea subtessellata and shrubby Asteraceae (*Diplostephium spp.* and *Senecio oerstedianus*).

Leaf morphology

Broad-leaved and graminoid sclerophyllous.

Shrub phenology

Evergreen with some seasonality.

Tall herbs periodicity

Perennial.

GROUND STRATUM

Overall herbaceous cover of the ground stratum

The ground cover is: Apiaceae (*Azorella* spp., *Hydrocotyle* spp., *Centella* spp.), Ranunculaceae (*Ranunculus peruvianus, Ranunculus* spp.), Rosaceae (*Alchemilla pectinata, Acaena* spp.), Rubiácea (*Arcytophyllum* spp., *Nertera* spp.)(Gómez, 1986). Also *Ageratina chiriquensis, A. kupperi, Diplostephium*

	costaricense, Gnaphalium roseum, Iltisia echandiensis, Laestadia costaricensis, Werneria nubigena, Westoniella lanuginosa, Viburnum venustum, Cerastium triviale, C. viscosum, Paepalanthus kupperi, Comarostaphylis arbutoides, Pernettya coriacea, Vaccinium consanguineum, Macleania rupestris, Bomarea hirsuta, Hesperomeles heterophylla, Calceolaria irazuensis, Castilleja talamancensis, Valeriana pulchella (Luteyn 1999, mencionado por Berger, 2000)
Forbes cover (including juvenile trees and acaule palms)	Grasses such as: *Cortaderia apalotricha* and *Calamagrostis* spp., Cyperaceae (*Carex* spp., *Oreobolus* spp., *Rhynchospora sp*), las Poaceae *Aciachne pulvinata* y *Lorenzochloa rectifolia* are indicators for unaltered páramo. Also found: *Agrostis tolucensis, Festuca herrerae, Trisetum irazuense*
Cover of inferior cryptogamytes (no ferns)	In the super-páramo the vegetation is reduced to lichens and mosses (Only in Costa Rica, in the highest points of Mount Chirripó).
Acaule palms cover	
Predominant periodicity of herbaceous cover	Stoloniferous grasses that that form small circular mounds, behaving as long lived perennials.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VD1a / 94, 94-2**
NAME	**Tall sedge swamp (94)** **Pantano de ciperáceas altas (94)**
ECOSYSTEM DYNAMICS	These systems vary from moderately dynamic to dynamic. The dynamcis of the systems in Panama and Costa Rica are so stable that peat formation with Sphagnum occurs.
GEOLOGY	Variable.
CLIMATIC CONDITIONS	Variable.
SPECIAL CONDITIONS	Wetlands in low lying areas or around rivers and lakes. This ecosystem is very similar to VIIB1A, tropical fresh water reed swamp formation. The Guatemala situation - although classified under this type is better described under VIIB1A. Please consult that description.
SOIL CHARACTERISTICS	
Cover and nature organic matter	For Panama and Costa Rica (Bocas del Toro and Manzanillo) it has been described with soil with considerable accumulation of organic matter and even a peat layer.
WATER REGIME	
Moist regime	Inundated for most of the year
Water characteristics	Fresh water or brackish
VEGETATION DATA	
Species	
Dominant species	Sedges and/or grasses.
Co-dominant species	In some areas in Belize Pontederiaceae more prominent.
Frequent species	Honduras: *Andropogon brevifolius, Aristida* sp., *Crescentia alata, Eleocharis* sp., *Eragrostris* sp., *Fimbristylis spadicea and Paspalum* sp. *Phragmites australis, Thalia geniculata, Typha dominguensis.* In Panamá Cyperaceous plants (*Cyperus sp, C. ligularis, C. odoratus, Rhynchospora macrostachya*; Phillipps *et al, 1996*) dominate with the presence of some shrubs of: *Myrica mexicana, Cyrilla racemiflora, Chrysobalanus icaco, Clusia sp, Capnosperma panamensis* and musci (*Sphagnum sp*); Bergier *et al* (2,000).
TREE STRATUM	
Arboreal palms	None.
Tree ferns	None.
Sessile epifytes	Absent.

GROUND STRATUM

Graminoids cover

Sedges and grasses dominate. Height of the stratum varies from 50 cm – 3 m, depending on wetland type and species composition.

OTHER OBSERVATIONS

LITERATURE

Iremonger 1997.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VD1a(1) / 95**
NAME	**Eleocharis marsh (95)** **Pantano de Eleocharis (95)**
GEOLOGY	1-100 m.
FIRE EXPOSURE	In savanna areas potentially exposed to fires.
WATER REGIME	
Moist regime	Mostly waterlogged to inundated, frequently with water of a somewhat higher salinity
Water cover	Complete
Water characteristics	Fresh – slightly brackish water
VEGETATION DATA	
Species	
Dominant species	The dominant species is an *Eleocharis* sp.
Frequent species	Additional plant species commonly found here include *Blechnum serrulatum, Centrosema* sp.*, Crinum erubescens, Hyptis* sp.*, Ludwigia* spp.*, Mimosa pigra, Sagittaria lancifolia* and *Thalia geniculata*.
GROUND STRATUM	
Graminoids cover	*Eleocharis* sp. forms a unifom mat of approximately 50 cm above the water level. These almost monospecific marshes may be found in waterlogged plains, fringed with shrubs. Common in small patches in short-grass savannas but mostly too small to be mapped.
AQUATIC (SEMI-) SESSILE LIFE FORMS	
Emerged vegetation	*Eleocharis* sp. forms a unifom mat of approximately 50 cm above the water level.
FAUNISTIC OBSERVATIONS	
OTHER OBSERVATIONS	A good example of this vegetation type can be found along the Hopkins road in the Stann Creek district.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VE1a(1) / 96**
NAME	**Marine salt marsh rich in succulents (96)** **Pantano marino con muchas suculentas (96)**
GEOLOGY	Coastal calcareous sediments. 0-20 m.
CLIMATIC CONDITIONS	In the 1200 – 2000 mm rainfall/year zone.
FIRE EXPOSURE	Rare.
WATER REGIME	
Moist regime	Waterlogged to partially inundated.
Water characteristics	Marshes in the coastal plains where the salinity level is high, generally greater than 5%. Brakish during the rainy season. Salinity increases as water evaporates in the dry season.
VEGETATION DATA	
Species	
Co-dominant species	*Batis maritima, Distichlis spicata, Fimbristylis spadicea, Fuirena* sp., *Juncus spp., Salicornia perennis, Solanum donianum* and *Spartina cynosuroides.*
Associated species	Limestone outcrops may have Cacti on them. Flats with these principally herbaceous species may contain stunted *Conocarpus erecta* and dwarf *Rhizophora mangle.* Slightly elevated areas in this type of marsh contain forest species such as *Bravaisa tubiflora, Metopium brownei*, *Manilkara zapota* and *Thrinax radiata*. In the Shipstern Nature Reserve, a characteristic plant along small creeks through this vegetation type is *Bucida spinosa*. These small shrubs are often covered with *Tillandsia* epiphytes.
TREE STRATUM	
Tree hight	Max 6 m.
Canopy cover	Very open.
Canopy morphology	Broad-leaved, sclerophyllous.
Leaf phenology	Semi-deciduous.
Arboreal palms	*Thrinax radiata.*
Sessile epifytes	One *Tillandsia* sp. and some orchids.
SHRUB STRATUM	
Lower height	1-5 m.
Acaule palms	None.
Leaf morphology	Broad-leaved, sclerophyllous.
Shrub phenology	Semi-dediduous.

GROUND STRATUM	
Overall herbaceous cover of the ground stratum	This community is highly heterogeneous; it contains patches dominated by different species, which are all taken together here to indicate one main salt marsh community type.
Graminoids cover	*Distichlis spicata, Fimbristylis spadicea, Fuirena* sp., *Juncus spp.*, and *Spartina cynosuroides.*
OTHER OBSERVATIONS	Good examples occur in the Shipstern Nature Reserve.
LITERATURE	Davis 1943, Gray et al. 1990, Meerman 1993, Bijleveld 1998, Iremonger & Brokaw III.1.2.1

CHARACTERISTIC	**DESCRIPTION**
CLASSIFICATION-CODE AND MAP-CODE	**VE1a(2) / 97**
NAME	**Salt meadow poor in succulents (97)** **Pradera salobre pobre en suculentas (97)**
GEOLOGY	Sealevel.
WATER REGIME	
Water characteristics	Saline.
VEGETATION DATA	
Species	
Dominant species	Panama: dominated by ciperaceous plants: *Eleocharis acutangulata, Cyperus ligularis, Espartina espartes* (Paja puyúa it is used to make huts), *Fimbristylis spatacea*.
Frequent species	*Avicennia germinans, Acrostichum aureum, Sesuvium portulacastrum, Sporobolus* sp.
Associated species	Juveniles stages of *Laguncularia racemosa, Rhizophora mangle and Pelliciera rizophorae.* Sheets of algae colonies may cover the ground (Berger, 2000).
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	In Honduras, the herb layer often no more than 15 cm high. Iremonger, 1997

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VF1c1-2 / 98-2**
NAME	**Fire-induced fern lowland thicket(98)** **(only as) intervened** **Herbazal de helechos, inducido por fuego, solamente como intervenido (98)**
ECOSYSTEM DYNAMICS	Highly dynamic.
GEOLOGY	Variable.
CLIMATIC CONDITIONS	Variable.
FIRE EXPOSURE	This vegetation type results after repeated burning of the forest on hills. In some cases, on isolated hilltops, this vegetation type appears natural and resulting from repeated lightning strikes. But in most cases the vegetation type is directly or indirect anthropogenic and resulting from careless slash and burn agriculture activities or deliberately started savanna fires (Meerman 1999a). Dramatic examples of this vegetation type can be found on the Cabbage Haul Range in the Stann Creek District. This location was identified by Wright et al (1959) as covered with IA2a(1)(a) but, as a result of an increased fire influence, is now degenerating to IIIB1b(b). Costa Rica: pioneer fern vegetation has been found on the Pacific slopes of Talamanca (sites not identified on the images). When burnt, the fires may be extremely hot and often continue into the natural vegetation of the national park. For some years the Amistad National Park was loosing several hundreds of meters of natural vegetation due to these fires.
SPECIAL CONDITIONS	1: 0 -500 m. 2: 500 –1000m.
SOIL CHARACTERISTICS	
Soil color	Variable.
Cover and nature organic matter	None.
Cover rock	Usually a thick mat of fern roots and leaves.
WATER REGIME	
Water cover	Well-drained.
VEGETATION DATA	
Species	
Co-dominant species	On non-calcareous hills the dominant species is “Tiger bush” (*Dicranopteris*) while on calcareous hills, *Pteridium caudatum* dominates.
Associated species	2: On acidic soils: Additional species frequently include *Calea* spp., *Senecio* spp., *Clethra occidentalis, Clusia* spp., *Scleria bracteata, Chamaecrista* sp., *Quercus* sp.,

	Citharexylum caudatum, Coutoubea spicata, Cassytha filiformis, Lycopodiella sp., *Byrsonima bucidafolia, Melastomataceae, Tococca* spp., *Myrica cerifera, Psidium guajava, Sobralia macrantha, Pinus caribaea* and *Coccocypselum* spp.
TREE STRATUM	
Canopy cover	1: NA. 2: 5-10 m.
Average basal area	2: Open.
Leaf phenology	2: Mixed.
Vines	Semi-evergreen.
Arboreal palms	Rare.
Tree ferns	None.
Drapery epifytes	1: None. 2: Occasional.
SHRUB STRATUM	
Canopy cover	5 m.
Acaule palms	Variable.
Herbaceous cover (herbs considerably taller than 1.5M)	None.
Shrub phenology	Varied.
Tall herbs periodicity	Variable.
GROUND STRATUM	
Graminoids cover	Dense.
Forbes cover (including juvenile trees and acaule palms)	Variable.
Cover of inferior cryptogamytes (no ferns)	Dominating.
FAUNISTIC OBSERVATIONS	
LITERATURE	This type of vegetation also occurs in Honduras and Nicaragua Mosquitia but they were not mapeables. 1: Iremonger & Sayre 1994, Meerman 1999a, Wright et al. 1959: 18b, Iremonger & Brokaw III.2.1.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VIAd / 101, in Guatemala VIA / 100, 101**
NAME	**Scarcely vegetated lava flow (100, 101)** **Flujo de lava con escasa vegetación (100, 101)**
ECOSYSTEM DYNAMICS	Very Dynamic.
GEOLOGY	Lava flows and recent volcanic basaltic rock.
CLIMATIC CONDITIONS	In Guatemala found from 2,000 m and are humid. In Nicaragua found between 300 and 1,750 m, with average annual precipitation from 1,000 to 1800 mm, average temperature 28°C in the pains and 20°C at the higher sites. Panama at altitudes above 2,000 m.
FIRE EXPOSURE	Fire often occurs in these vegetation types. In Nicaragua, when these areas are not protected, they are popular hunting grounds for lizards, pigeons, and partridges, etc. fire is sometimes used to scare the partridges out of there hiding places, which can lead to wild fires. The frequent fires are very destructive in these ecosystems as the dry leaf litter, falls between the cracks and fissures in the volcanic rock and lava, enabling the fires to spread below ground, appearing in distant and distinct part of the ecosystems.
SPECIAL CONDITIONS	Depending on the altitude and the ecological conditions of the area where the lava flow is found. According to Ventura *et al* (2,000) in El Salvador this formation vegetal is characterized by different successional stages, from bear rock, to rocks covered in lichens and on through mosses, ferns, grass, herbaceous members of the Leguminosae and Compositae, until the area is covered in shrubs and low trees.
SOIL CHARACTERISTICS	
SOIL TYPE	When there is soil it is recent and found between the cracks of the volcanic rocks (“aa”), in general very shallow. In Nicaragua, very variable, generally none or only in small patches formed of Inceptisols, loose and well aired. In the few areas were soil has developed, the vegetation is more like that of a normal lowland deciduous forest.
Soil color	In Nicaragua, when soils have formed they are orange-brown to ochre, when no soil is present the rocky substrate is dark or black.

Cover mineral soil
80-90% rock, gravel and tuffa on the surface and 100% of the subsoil.

Cover and nature organic matter
Accumulation of organic material in the between rocks or in the long fissures in the lava.

Cover rock
More than 50% of the area covered in large and medium sized rocks.

WATER REGIME

Moist regime
In Guatemala humid but well-drained.
In Nicaragua mesic to xeric in the dry period.

VEGETATION DATA
In most of the countries where this ecosystem is found, inventories or lists have been made of the vegetation, which show that the species very according to the different altitudes and successional stages.

Species

Co-dominant species
Guatemala: *Pinus pseudostrobus, Fucsia microphylla, Fuhsia splendens, Buddleia nítida, Gaultheria odorata, Muehlenbeckia volcánica, Hieracium stuposum, Lamourouxia multifida, Arctostaphylos arbutoides*.

Frequent species
El Salvador : *Cochlospermun vitifolium, Bursera simarouba, Pentas lanceolata, Cnidosculus urens, Threma micrantha, Epiphyllum stricta, Bauhinia ungulata, Omphalea oleifera*.

Nicaragua: *Plumeria rubra, Byrsonima crassifolia, Bursera simarouba, B. Graveolens, Cecropia peltata, Tecoma stan, Thevetia ovata, Cochlospermum vitifolium.*

Associated species
Nicaragua, sometimes: *Simarouba glauca, Dalbergia tucurensis* and *Exostema mexicanum*.

TREE STRATUM

Tree hight
El Salvador: generally 5 m, in places 7 m.

Sessile epifytes
On the branches of some trees and on certain rocks: *Tillandsia ionantha, T. Recurvata, Encyclia alata, Oncidium ascendens, Brassavola nodosa y Laelia rubescens*.

SHRUB STRATUM
El Salvador: Some areas covered in a shruby layer of Compuestae, Malpighiaceae and Cactaceae.
Nicaragua: *Miconia argentea, Podopteris mexicanus* and *Amaioua corymbosa.*
In Panama the most frequent shrubby species is, *Mauria heterophylla*.

Upper height
Guatemala: 1.5 m

Canopy cover
Guatemala: less than 1%. Generally than 10%.

Acaule palms
No.

Leaf morphology
Xeric.

Shrub phenology	Guatemala and Panama, evergreen.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	Guatemala: less than 1%. Costa Rica: on the lowland lava flows, are found: *Axonopus, Andopogon, Trachypogon* and *Hyparrhenia rufa*. On the lava flows of Irazú volcano are found: *Cheilanthes* spp., *Notolaena* spp., *Pytirogramma* spp., *Calomelao* spp., *Flavoconia* spp. In very humid conditions the following are found: *Fimbristilis* spp., and *Cyperus* spp.
Graminoids cover	El Salvador: some areas are covered in grass.
Cover of inferior cryptogamytes (no ferns)	In over large extensions where the rock has not been softened, and no soils has formed, only the following are found: *Selaginella pallescens, Polypodium kuhnii, Anemia hirsuta, Notolaena brachypus, Adiantum coccinum, Dryopteris karwinskiana,* and other Chamaephytes, xerophytes, mosses and lichens.
FAUNISTIC OBSERVATIONS	In Salvador: many insects are found, as well as the birds that feed on them. In Nicaragua, there are many wasps, beetles, birds and rabbits, as well as white tail deer and coyotes. Large numbers of bats are sometimes found where there are lava flows (Parque Nacional Masaya, Nicaragua).
OTHER OBSERVATIONS	En Nicaragua, some of the problems are: la extraction of volcanic rock and lava for construction as well as the production of gravel, conversion to waste dumps, also to a lessor extent the extraction of vines and arial roots (Bignoniaceae and Araceae) for basket making and fish poisons. The area of the Masaya volcano National Park, has been used as a site of scenic tourism, and as the site for environmental education for schools and collages. Panama: The plains of Bugaba volcano; upper part of the road to Cerro Punta, Boquete volcano and the crater of Barú volcano, Chiriquí.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VIA2 / 103**
NAME	**Scarcely vegetated scree (103)** **Lajar con escasa vegetación (103)**
PHYSICAL CONDITIONS	At altitudes from 100 to 800 m in the Pacific region Pacific and from 400 to 800 m in the mountainous regions, agricultural areas and hills and foothills.
ECOSYSTEM DYNAMICS	Very dynamic.
GEOLOGY	Hillsides, more or less unstable with a substrate of shifting rocks or soil, the original soils, having slipped down the hillside. In 1998 with hurricane Mitch, the rain water accumulated in certain watersheds behind accumulated debris, until breaking through, sending torrents of water, soil, rock and other debris, sometimes hundreds of meters wide, tumbling down the hillsides to the plans and valleys below.
CLIMATIC CONDITIONS	Relative humidity from 60 to 70 %. Average annual precipitation in the Pacific region from 1,600 to 1,800 mm and in the Mountainous region from 1,000 to1,800 mm. Average annul temperatures from 27 to 28 °C in the Pacific region and 25 to 26 °C in the Mountainous region.
SOIL CHARACTERISTICS	
SOIL TYPE	Soils Inceptisols with a molic epipedon (Superficial horizon ± 25 cm), texture, sandy loam, dark with good drainage.
Cover mineral soil	Recent, a mixture of clay, gravel, sand and stones of different sizes, up to the size of boulders.
Cover and nature organic matter	Virtually none.
WATER REGIME	
Moist regime	Mesic to dry.
VEGETATION DATA	
Species	Permanent herbs or semi-woody plants predominate, that can adapt to the rockslides and landslides, to some point helping to consolidate the hillsides.
Character species	Shrubs *Wigandia urens* and juveniles of *Muntingia calabura.*
Associated species	Joined by *Boheravia recta, Cleome spinosa, Amaranthus spinosus, Cenchrus* spp. and different Cucurbitaceae.

TREE STRATUM	
Tree hight	Still no trees just juveniles of *Muntingia calabura* with some shrubs.
SHRUB STRATUM	
Lower height	2.0 m.
Upper height	4.0 m.
Canopy cover	In some places (10-20% of the area) dense with total cover from 50 to 60 %, but mostly with herbs.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	50-60%
Graminoids cover	10%
Forbes cover (including juvenile trees and acaule palms)	40- 50%
Cover of inferior cryptogamytes (no ferns)	Not significant.
Predominant periodicity of herbaceous cover	Annuals y biennials.
FAUNISTIC OBSERVATIONS	Amongst the fauna seen: beetles, bees and butterflies.
OTHER OBSERVATIONS	The few trees that remain from before the landslides are young from 2 to 6 years (*Enterolobium cyclocarpum* and *Pithecellobium saman*), the older ones having fallen or been washed away, in populated areas, some Mango *Mangifera* indica survives.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VIB1a(1) / 104** **-VIB1a(1a) del Caribe** **-VIB1a(1b) del Pacífico**
NAME	**Scarcely vegetated tropical dune and beaches(104) Caribbean** **Duna y Playa tropical escasamente vegetada del Caribe VIB1a(1a)** **Scarcely vegetated tropical dune and beaches, Pacific** **Duna y Playa tropical escasamente vegetada del Pacífico, VIB1a(1b)**
ECOSYSTEM DYNAMICS	Very dynamic.
GEOLOGY	Coastal beaches
CLIMATIC CONDITIONS	**On the Caribbean VIB1a(1a):** The ecosystem consists of a narrow coastal strip (0-2 m in altitude), the average temperature is between 26 and 30°C and the average annual precipitation between 3,000 and 4,800 mm. **On the Pacific, VIB1a(1b):** The Altitude is from 0 to 4 m. The relative humidity 68% in the dry season and 83% in the wet season. The average annual precipitation is from 1,400 to1,600 mm. The average annual temperature is 27.5 °C.
FIRE EXPOSURE	Not relevant.
SOIL CHARACTERISTICS	
SOIL TYPE	The substrate is sand with a variable content of fine sediments. Occasionally turning into salt flats. On the Pacific coast of Panama they are commonly called sand banks and on their map it is classified as Coastal vegetation in transition, on very recent marine soils, (considering sand to be a soil). (ANAM– CBMAP-L. Berger Int. Inc. 2,000).
WATER REGIME	
Moist regime	Well-drained in the upper part, saturated below, considered hydromorphic on the Caribbean side.
Water formation	Beach.
Water characteristics	Brackish, with some fresh water influence and high marine salt water influence.
VEGETATION DATA	Pioneer vegetation between the sea and the vegetation behind the beach, though mostly without vegetation.
Species	
Frequent species	**On the Caribbean VIB1a(1a):** On many beaches the pioneer vegetation begins with naturalized Coconuts, then *Chrysobalanus icaco*, *Coccoloba uvifera*, *Acoelorraphe wrigtii*. Iremonger (1997) reports that in

	Nicaragua : *Crysobalanus icaco* and *Coccoloba uvifera* are a constant pairing on the beach front forest edge as well as :*Citharexylum caudatum, Hibiscus tiliaceus* and *Phyllanthus acidus*. **On the Pacífic, VIB1a(1b):** In El Salvador (Flores 1978, cited by Ventura et al 2,000) its mentioned: *Caesalpinia crista* and *Pithecellobium dulcis.* In Nicaragua the following species have been observed: *Prosopis juliflora, Pithecellobium dulce,* and *Bromelia karatas,* accompanied by *Crataevia tapia* and *Coccobola floribunda.* In Panama reports of *Prosopis juliflora* and *Pithecellobium oblongum* (ANAM– CBMAP- L. Berger Int. Inc. 2,000).
Associated species	*Hippomane mancinella y Conocarpus erecta* more frequent close to the mangroves.
TREE STRATUM	In truth, the palms are not part of the beach ecosystem, but they are generally associated with them, and generally it is not possible to map them separately, for which reason they are included here.
Tree hight	7-10 m
Canopy cover	0%, but with Coconuts from 50-60% on the Caribbean and 40% on the Pacific. For the Pacific coast of Panama its reported that the vegetation dose not cover more than 33.3 % of the surface. (ANAM– CBMAP- L. Berger Int. Inc. 2,000). In many cases the Coconuts are planted.
Canopy morphology	Broad-leaved, sclerophyllous.
Leaf phenology	Evergreen on the Caribbean and deciduous on the Pacific.
Arboreal palms	Coconut. Just on the Caribbean: *Manicaria* spp., *Acoelorraphe* spp.
SHRUB STRATUM	**On the Caribbean VIB1a(1a)**: In Nicaragua the following are found *Morinda citrifolia* and *Dodonea* spp., also the shrubs *Crysobalanus icaco* and *Coccoloba uvifera.* **On the Pacific, VIB1a(1b)**: In Nicaragua spiny shrubs are found such as *Acacia farnesiana.*
GROUND STRATUM	**On the Caribbean VIB1a(1a):** In Nicaragua on the beach certain herbs are found, including: *Canavalia maritima, C. rosea, Ipomoea pes-caprae, Sesuvium portulacastrum, Sporobolus* spp. which help to consilidate the dunes, also *Mimosa pudica, Crotalaria retusa, Wedelia trilobata, Clitoria rubiginosa, Stachytarpheta jamaensis, Tridax procumbens, Dactyloctenium aegyptium, Hymenocallis littoralis* In Honduras as well as the above *Euphorbia buxifolia*

and *sporobolus virginicus* can be added (Iremonger 1997).
In Costa Rica: the following are found: *Bromus* spp., *Sesuvium portulacastrum, Turnera* spp., *Coccoloba uvífera*. (Gómez com. Personal),
On the Pacific, VIB1a(1b): In El Salvador according to flores (1978 mentioned for Ventura *et al*, 2000) the typical species are: *Uniola pittieri, Joubea pilosa, Cenchrus equinatus, Ipomoea pes-caprae, Heliotropium curassavicum, Calotropis gigantea.* In Honduras Iremonger (1997) mentions *Bromelia* spp., *Crotalaria retusa, Croton punctatus* y *Opuntia* spp. In Nicaragua in the dunes "cabeza de playa" the folowing species have been reportedr: *Ipomoea pes-caprae, Canavalia rosea, Crotalaria* spp., *Opuntia lutea, Croton niveus*. In Panama from "zacate playero", *Uniola pittieri, Caesalpinia crista y Canavalia maritima* are reported(ANAM–CBMAP- L. Berger Int. Inc. 2,000).
In Costa Rica (Gómez, pers. Com.), the following are found: *Caesalpinia crista- galli, Ipomoea pes- caprae, Canavalia maritima* and *Uniola pittieri*.

FAUNISTIC OBSERVATIONS

The beaches have a low total biodiversity, but depending on there geographic position, can play an important part in the lives of various organisms, some of the most appealing are the seas turtles, that depend on the beaches for their reproduction, and survival. Also there are a variety of invertebrates including crabs, and many plants that are only found in these dynamic ecosystems.

Amongst the seas turtles that nest on these beaches: The green turtle (*Chelonia mydas*); la tortuga baula, (*Dermochelys coriacea*), (to 1.5 m long, 350 Kg), loggerhead (*Caretta caretta*), (to 1m long,125 Kg) and la tortuga carey (*Eretmochelys imbricata*), (to 0.75 m long and 60 Kg).

OTHER OBSERVATIONS

The beaches are used for recreation and tourism, though this type of use, due to the lack of zonifcation, is transforming these ecosystems. Plantations of palms, that replace natural vegetation combined with the unregulated use of the beaches, is threatening the survival of the species that depend on these unique ecosystems.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VIB3a / 105**
NAME	**Tropical coastal transition vegetation on very recent sediments, moderately drained (105)** **Vegetación tropical costera en suelos muy recientes, moderadamente drenado (105)**
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	Recent coastal deposits.
CLIMATIC CONDITIONS	Variable.
FIRE EXPOSURE	Unknown.
SOIL CHARACTERISTICS	
SOIL TYPE	Mostly sandy.
Cover rock	None.
WATER REGIME	
Moist regime	Well-drained but groundwater level near the surface.
VEGETATION DATA	
Species	
Frequent species	Typically they are bordered on the seaward side by low herbaceous beach vegetation with species such as *Argusia gnaphalodes, Canavalia rosea, Euphorbia trichotoma* and *Surania maritima*. On the inland side this vegetation type may be bordered by IA5a(1)(c), with mostly *Rhizophora mangle* and *Myrica cerifera*. The forest itself varies in composition but in Belize it usually contains the following species: *Brassavola nodosa, Bursera simaruba, Cassytha filiformis, Chrysobalanus icaco, Coccoloba uvifera, Cordia sebestena, Hymenocalis latifolia, Metopium brownei, Myrmecophylla tibicinis, Passiflora suberosa, Pouteria campechiana, Sophora tomentosa* and *Thrinax radiata.* The introduced *Cocos nucifera* now forms an integral part of this community. Panama reports: zacate playero (*Uniola pittieri*), a different herb, *Prosopis juliflora, Pithecellobium oblongum, Caesalpinia crista y Canavalia maritima;* floristically it fits better in scarcely vegetated tropical dune and beaches: VIB1a(1).
TREE STRATUM	
Tree hight	6 – 12 m.
Canopy cover	0 - 25%.
Canopy morphology	Broad-leaved.

Leaf phenology	Evergreen, semi-deciduous.
Arboreal palms	*Thrinax radiata* and *Cocos nucifera.*
Tree ferns	None.
Sessile epifytes	Some, most notably *Brassavola nodosa* and *Myrmecophylla tibicinis.*
SHRUB STRATUM	
Canopy cover	0 - 25%.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	50 - 100%.
FAUNISTIC OBSERVATIONS	Important habitat for migratory birds and breeding the American Crocodile *Crocodylus acutus.*
OTHER OBSERVATIONS	These vegetation types are not widespread and under considerable pressure from coastal development. In the past much of it has been transformed to coconut plantations and more recently, tourist and residential developments have claimed much of what remained.
LITERATURE	Meerman and Boomsma 1995a, Wright et al. 1959: 32, Iremonger and Brokaw 1995: II.2.2.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VIB3aK / 106**
NAME	**Coastal vegetation on karstic hills (106)** **Vegetación costera en colinas kársticas (106)**
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	Karstic.
SPECIAL CONDITIONS	At, or just above sea level.
SOIL CHARACTERISTICS	
SOIL TYPE	
Cover rock	Nearly complete.
WATER REGIME	
Moist regime	Salt water spray.
Water cover	Spray.
Water formation	Marine.
Water characteristics	Saline.
VEGETATION DATA	
Species	
Frequent species	*Cannavalia maritima, Chloris* spp., *Coccoloba uvifera, Dactylotenium aegyptium, Euphorbia* spp., *Gromphrena* spp., *Harrisia* spp., *Jacquinia arborea, Lippia nodiflora, Mimosa pudica, Neea psychotrifolia, Pancratium littorale, Portulaca* spp., *Rhynchospora ligularis, Sesuvium portulacastrum, Sporobolus virginicus, Stachytarpheta jamaicencis, Tournefortia gnaphalodes, Tridax procumbens.*
TREE STRATUM	
Tree hight	NA.
SHRUB STRATUM	
Upper height	Stunted shrubs and herbs.
Canopy cover	Very open.
Acaule palms	None.
Leaf morphology	Sclerophyllous.
Shrub phenology	Evergreen.
LITERATURE	Iremonger 1997: 56.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VIB3b / 107**
NAME	**Coastal transition swamp vegetation on very recent sediments (107)** **Vegetación costera pantanosa en suelos muy recientes (107)**
PHYSICAL CONDITIONS	From 5 to 10 m, topography notably flat, almost at sea level, inundated most of the year.
ECOSYSTEM DYNAMICS	This type of vegetation is associated the coast, estuaries and lagoons.
CLIMATIC CONDITIONS	Average temperature between 26-30°C and average annual precipitation between 2600- 4800 mm.
SOIL CHARACTERISTICS	
SOIL TYPE	Soils Entisols and Inceptisols sedimentary, hydromorphic, marine with poor drainage to very poor drainage.
Soil color	Black when high in organic material.
Cover and nature organic matter	Can be elevated.
WATER REGIME	
Moist regime	Inundated for most of the year.
Water cover	Covered for most of the year.
Water characteristics	Generally fresh water, sometimes brackish, but very little salt.
VEGETATION DATA	
Species	
Frequent species	In the north of Nicaragua, the vegetation is abundant consisting of: *Symphonia globulifera*, *Raphia taedigera* and *Calophyllum brasiliense* the first two being more associated with lower laying areas. In higher (dryer) parts *Xylopia frutescens* and *Vochysia hondurensis*, on the edges and more open parts *Acoelorraphe wrigtii*.
Associated species	In estuaries and areas with high rainfall, there is less salinity and *Pterocarpus officinalis*, *Erythrina* spp., *Carapa nicaraguensis* and *Raphia taedigera* are found.
TREE STRATUM	
Tree hight	15-20 m
Canopy cover	80%
Average basal area	8 – 10 m^2/Ha
Canopy morphology	Ombrophyllous.
Leaf phenology	Evergreen.
Vines	*Smilax* spp.

Arboreal palms	Some dense populations of *Acoelorraphe wrigthii* and *Manicaria saccigera.*
Tree ferns	None.
Drapery epifytes	None.
Sessile epifytes	Some *Tillandsia* spp.
Climbing epifytes	Climbers such as: *Vanilla* spp. *Phylodendron* spp.
SHRUB STRATUM	The undergrowth is scarce in species: *Acidoton nicaraguensis, Vismia spp., Isertia haeakeana, Alibertia edulis, Psychotria aubletiana.*
Lower height	1.5 m.
Upper height	3 m.
Canopy cover	Variable depending on the amount of available light and length of inundation, from 10 to 30 %.
Herbaceous cover (herbs considerably taller than 1.5M)	On the edges of the inundated areas *Motricardia arborescens,* on terrain that more aired even for short periods: *Saccharum* spp., and *Costus sanguinalis.*
Leaf morphology	Ombrophyllous.
Shrub phenology	Evergreen.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	Variable from 10 to 40% depending on the amount of available light and length of inundation: *Rhynchospora* spp. and *Cyperus spp.,* with a herbaceous covering of: *Calea jamaensis, Piper* spp., in the wetter places *Spathiphyllum friedrichsthalii* in more open areas *Blechnum serrulatum* that grows permanently inundated areas.
Graminoids cover	5-10%
Forbes cover (including juvenile trees and acaule palms)	5%
Cover of inferior cryptogamytes (no ferns)	Not significant.
Predominant periodicity of herbaceous cover	A mixture of evergreen and annual.
AQUATIC (SEMI-) SESSILE LIFE FORMS	On the edges and open places, there is permanent standing water with aquatic vegetation.
FAUNISTIC OBSERVATIONS	The trees serve as perches for aquatic birds: Herons, Spoonbills and Pelicans, all observed from a plane.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VIB5 / 109, 110 (previous classes combined)**
NAME	**Scarcely vegetated saline flat (109, 110)** **Albina con escasa vegetación (109, 110)**
ECOSYSTEM DYNAMICS	In Honduras and Nicaragua, the area is divided by small estuarine tributaries whose banks are high because of the deposition of sticky sediments that only permit occasional inundation and then for short periods. When the water evaporates the salt is concentrated on the terraces, impeding the development of arboreal vegetation. Its possible that the isolation of the terraces from the waters of the estuary is increasing due to the increasing height of the banks of clay, itself due to the increased amounts of sediments being washed down stream from agricultural areas. Also causing an increase in sand banks and a decrease in the more ecologically and economically useful Mangroves.
GEOLOGY	In Honduras and Nicaragua, these sedimentary banks are permanently covered in saline deposits.
CLIMATIC CONDITIONS	In Honduras and Nicaragua, average precipitation 1,200-1,600 mm a year and an average temperature of 28.5 °C.
SPECIAL CONDITIONS	En Honduras and Nicaragua, less than 15 m, wide extensions of mud flats, covered in sand, forming banks, only found extensively on the Pacific coast, between the River Negro and The Real Estuary (Honduras and Nicaragua) and in Panama. Based on ANAM– CBMAP- L. Berger Int. Inc. (2,000), in Panama, Sarigua National Park in the Azuero region there are salt-flats of a similar geological formation but with more extreme conditions: Climate dry (xeric), ecology (saline and alkaline), the vegetation suggests different ecosystem from that of Honduras and Nicaragua. Though some of the same species can be found in the dryer parts of the Honduran and Nicaraguan salt-flats.
SOIL CHARACTERISTICS	
SOIL TYPE	Clay with sometimes a layer of silt or sand on the surface. In Panama the soil is slightly more sandy, alkaline and with a marked salinity that limits the vegetation.
Soil color	Dark, in Panama the surface is covered in whitish gray sand.
WATER REGIME	
Moist regime	From saturated to inundated in the wet season, dry to

xeric in the dry season.

VEGETATION DATA

Species

Character species

In Honduras and Nicaragua extensive areas with dense stands of *Avicennia germinans* are found.

Frequent species

In Honduras and Nicaragua, in some sandy areas *Conocarpus erecta* appears, forming a vegetation type similar to Scarcely vegetated tropical dunes and beaches, Pacific VIB1a(1b).

In Panama the ecosystem is less influenced by the sea, the species found according to Caballero & Sandoval (1986) are: *Bromelia pinguin, Tillandsia flexuosa, Botriochloa pertusa, Brachiaria fasciculata, Chloris inflata, Dactyloctenium aegyptium, Eragrostis acutiflora, Sporobolus jacquemontii, S. pyramidatus* and *S. virginicus; Achyranthes aspersa, Sciadodendron excelsum, Marsdenia rotheana, Avicennia germinans, Cordia curassavica, Acanthocereus pentagonus, Opuntia elatior, Cuscuta* spp., *Melotria trilobata, Momordica charantia, Jatropha gossypifolia, Acacia costaricensis, Caesalpinia coriaria, Cassia reticulata, Desmanthus virgatus, Mimosa pigra, Parkinsonia aculeata, Gossypium* spp., *Pavonia sessiflora, Petiveria alliaceae, Antigonon leptopus, Portulaca oleracea, Paullinia fuscescens, Solanum hayesii, Waltheria indica, Jacquinia macrocarpa, Cissus sicyoides.*

Associated species

In Honduras and Nicaragua, these areas often are next to and form a mosaic with: 1) the Savannas VA2b(2) of deciduous shrubs, the variant with the palm *Sabal mexicana, Rehdera trinervis*, *Parkinsonia aculeata* and cactaceae, 2) Scarcely vegetated tropical dunes and beaches of the Pacific VIB1a(1b) and 3) Tall sedge swamp VD1a.

TREE STRATUM

Tree hight

En Honduras and Nicaragua, *Avicennia germinans* of 15-20 m in height along the banks of the tributaries of the estuaries, further in land, “bonsai” de 20-30 cm in fruit.

In Panama no trees just shrubs.

Canopy morphology

In Honduras and Nicaragua, broad-leaved, sclerophyllous.

Leaf phenology

In Honduras and Nicaragua, the trees and shrubs of *Avicennia germinans* partially loose their leaves, behaving like a semi-deciduous species.

SHRUB STRATUM

Lower height

Always dwarf *Avicennia germinans* forming “bonsai” of 20-30 cm in fruit.

	In Panama in that the ecosystem is more terrestrial and extreme (xeric, saline and alkaline) predominate spiny plants: *Acanthosereus pentagonus* and *Opuntia eliator* with succulent stems, *Acacia costaricensis* and *Parkinsonia aculeata* with reduced leaves (ANAM–CBMAP- L. Berger Int. Inc. 2,000).
Leaf morphology	In Honduras and Nicaragua, broad-leaved, sclerophyllous, in Panama microphyllous and succulents.
Shrub phenology	Semi-deciduous to deciduous xeric.
GROUND STRATUM	
Overall herbaceous cover of the ground stratum	In Honduras and Nicaragua, in sandy and humid areas dense populations of *Sesuvium portulacastrum* can be found.
Graminoids cover	En Honduras and Nicaragua, also in seasonally inundated areas *Fimbristylis sadicea* (hemi-cryptophyte) is found.
Cover of inferior cryptogamytes (no ferns)	In Honduras and Nicaragua, large areas have no vegetation, except for micro-algae.
FAUNISTIC OBSERVATIONS	Various crabs. Also aquatic birds, boa, iguana even jaguar, among others.
OTHER OBSERVATIONS	In Honduras and Nicaragua, large areas of these salt flats have been converted into artificial lagoons for the commercial shrimp farm industry, also affecting the Mangroves *Rizophora mangle*, the drainage canals that cut across the dividing banks of mud, eliminate the populations of *Avicennia germinans*, therefore interfering with the balance of the ecosystem, and impacting the vertebrate fauna.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VIIB1a / 111**
NAME	**Tropical freshwater reed-swamp formation (111)** **Carrizal pantanoso de agua dulce (111)**
PHYSICAL CONDITIONS	
ECOSYSTEM DYNAMICS	Dynamic.
GEOLOGY	0-100 m.
CLIMATIC CONDITIONS	Variable.
FIRE EXPOSURE	Yes, but but not every year.
SPECIAL CONDITIONS	Ecosystem frequently occurs in mosaics with other aquatic ecosystems such as rooted floating communities (VIIC), with species of Nymphaceae, as well as free floating freshwater communities (VIID); the latter may

include *Pistia* spp., *Lemna* spp. and *Eichornia* spp.

SOIL CHARACTERISTICS

SOIL TYPE

Hydromorphic alluvial soils.

Cover and nature organic matter

Surface material often entirely organic.

WATER REGIME

Moist regime

Inundated through much of the year.

Water characteristics

Sometimes there could be influence of brackish water (Gómez, 1986). In Belice the increasing salinity will favor the development of *Cladium jamaicense,* while increasing nutrient availability will favor the development of *Typha dominguensis*.

VEGETATION DATA

Species

Dominant species

Common species throughout the region: *Typha domingensis.*

Co-dominant species

Common species throughout the region: *Thalia geniculata.*

Belice: *Phragmites australis* and/or *Cladium jamaicense*. Locally the Maranthaceae *Thalia geniculata* is the dominant species. In the Stann Creek district, the sedge *Cyperus giganteus* is common.

Frequent species

El Salvador: *Lasiacis spp, Eleocharis* spp., *Fimbristylis* spp., *Echinodorus* spp., *Eichhornia crassipes,* and *Parkinsonia aculeata.* In the south of the country: *Utricularia* spp.

In Nicaragua: *Hymecnachne amplexicaulis, Eleocharis* spp. (5) asociated in different conditions with: *Echinochloa colona, E. crusgali, E. polystachia, Paspalum virgatum, P. vaginatum, Paspalidium geminatum, Brachiaria mollis, Oriza latifolia, Rhynchospora* spp., *Fimbristylis* spp., *Cyperus spp* (10), *Oxicarium* spp.

Associated species

Nicaragua: Also some Phanerophyte herbs coud be asociates among them depending conditions any of these species could be found: *Aeschynomene sensitiva, Sesbania emerus, Canna edulis*, differents species of *Ludwigia* spp. and *Polygonum* spp.; even a horse tail *Equisetum myriochaetum* which is diminishing its presence due to the continuos disturbance of the wet land areas.

In Panama other associated species are: scattered *Elaeis oleifera* (oil palm), *Pterocarpus officinalis, Mora oleifera* and *Acrostichum aureum* in the border of the ecosystem

and Marsilea polycarpa some floating plants as: *Pistia stratiotes, Azolla carolliniana and Lemna* spp. in the free water mirror.

SHRUB STRATUM

Upper height 5 m.

FAUNISTIC OBSERVATIONS

Nicaragua: Some associated fish species (Villa, 1982): *Rivulus isthmensis, Ophisternon aenigmaticus, Eleotris amblyopsis Guabina lucia, Synbranchus marmoratus*.

Some Amphibians mentioned for this ecosystem by Villa (1972): *Rana pipiens*, *Rana maculata*, *Hyla microcephala*, *Hyla staufferi*, *Dermophis mexicanus* Cope, *Rhinophrynus dorsalis*, *Bufo luetkenii*, *Hypopachus variolosus*, *Bufo marinus*, *Leptodactylus melanonotus*, *Smilisca baudinii*, *Rana warschewitschii*.

OTHER OBSERVATIONS

Belize: Good examples are found near Hopkins village, Stann Creek District.

El Salvador: this type of vegetation is typical on the borders of the following lakes: el Jocotal; NW of San Juan, San Miguel and N of Olomega, la Unión. However these areas have been drained for cattle ranging.

LITERATURE

Rejmánková et al. 1996, Ventura *et al*, 2000.

CARACTERISTIC	DESCRIPTION
	VIIB4 / 112-VG, 112-ZA
NAME	**Tall-herbs lowland swamp 112** **Pantano de hierbas altas de tierras bajas 112**
ECOSYSTEM DYNAMIC	Moderately dynamic.
GEOLOGY	Sedimentary.
CLIMATIC CONDITIONS	From 0-100 m, with flat relief. In Nicaragua found in zones with an average precipitation of 1,800 mm a year, temperature between 24-29 °C and relative humidity relative of 83 %.
CARACTERISTICS SOIL	
Soil type	In Nicaragua found on sedimentary clay soils reddish in color: Oxisols and Histosols, black when rich in organic material more or less decomposed moved by the frequent inundation's.
Soil color	Reddish to black, the last when rich in organic material.
Cover mineral soil	Silt and clays deposited by the erosion of ground along the rivers.
Cover and nature organic matter	Organic material washed down from up stream and deposited here.
WATER REGIME	
Moist regime	Inundated for most of the year. Intermediate between the terrestrial ecosystems and the fluvial aquatic ecosystems.
VEGETATION DATA	
Species	Abundant, permanent broad-leaved herbs.
Dominant species	In Nicaragua, generally dense populations of *Thalia geniculata*, are accompanied by different species of *Jussiaea* spp., *Aeschynomene sensitiva* and *Ipomoea reptans.* In Costa Rica two types of vegetation, one type VIIB4-VG where Poaceae and Cyperaceae cover 50% of the area and 50% is covered by *Heliconia* spp. and Marantaceae. Found with or with out open water, or floating vegetation (*Pistia* spp., *Eichornia* spp. and *Hetherantera*. The other type VIIB4-ZA is found on the Atlantic coast, in both the north and south, dominated by *Agrostis danaefolia* with Cyperaceae: *Cyperus* spp. and *Rhynchospora* spp., also some Forbs, as well as *Cordia gerascanthus* and *Triplaris americana*.

Co-dominant species	In the shadier sites: *Heliconia* spp., *Calathea* spp. and *Heliotropium indicum* (naturalizada) predominate.
Associated species	On the margins of these communities the high grass: *Hymenachne amplexicaulis* is frequent.
OTHER OBSERVATIONS	Niacargua: originally classified as herb marsh with organic deposits. Differs visibly from VD1a and VIIB1a for the abundance of forbs.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**VIID2b o VIIIA**
NAME	**Rooted underwater communities of tropical salt waters (Seagrass beds)** **Comunidad fija sumergida de agua dulce tropical (Pasto marino)**
ECOSYSTEM DYNAMICS	Dynamic. The seagrass beds are found around the quays and coral reefs of the Caribbean Coast, with a extensive population, that is possibly the largest and purest area of seageass in the world. Dominated by angiosperms adapted to submarine conditions, The turtle sea-grass (*Thalassia testudinum*; Hydrocharitaceae) and Manati sea-grass (*Syringodium filiforme;*. Cymodoceaceae) both with high levels of primary production and accompanied by corrals, sponges, equinoderms, crustaceans, fish and bentic organisms. The *Thalassia testudinum* stablizes the sand substrate, and is grazed by marine turtles and Manatees and serves as the habitat and food source for many marine species of economic interest. Lobsters (*Panulirus argus*; more information in: USAID, 1996) and shrimp (*Peneaus* spp. see Coastal alluvial lagoons in this document). The sea-grass beds have a close relationship with the corral reefs. According to Nietschmann (1977), three of the most productive ecosystems in the world are found of the coast of Central America: the Coastal lagoons and Estuaries, the corral reefs and the Sea-grass Beds. In the three, there is a very efficient conversion of sunlight to vegetable tissue and latter animal tissue. The efficiency of this conversion is many times superior to terrestrial ecosystems and in most case more efficient than intensive agriculture.
SPECIAL CONDITIONS	In Belize found below sea level. The sea-grass beds are principally found en shallow lagoons between the shore and the coral reef, but also on atolls close to the shore. En Nicaragua, the sea-grass beds are found in shallow waters (18 – 22 m) with a blue-green color in contrast to the deep blue color of the deep sea, where the continental shelf ends abruptly.
WATER REGIME	
Moist regime	In Belize, they are found in places that are inundated all year round, the fluctuation in the tide is less than 30 cm.
Water cover	Complete.
Water formation	Marine.
Water characteristics	Saline.

VEGETATION DATA

Species

Dominant species

The dominant sea-grass is Turtle sea-grass, *Thalassia testudinum*

Co-dominant species

Other species of sea-grass are manatee sea-grass *Syringodium filiforme*, also *Halodule wrightii* and *Halophila baillonis*.

Emerged vegetation#

Its known that (Espinoza, 1996 y UZCH/ MARENA, 1998) the dominant species are: *Thalassia testudinum* and *Syringodium filiforme* but based on information from Gomez (1984), between the submerges aqutic plants, its possible to find: *Syringodium filiforme*, *Halodule wrightii* (both Cymodoceaceae), *Zannichellia palustris* (Zannichelliaceae), *Potamogeton perfoliatus* (Potamogetonaceae), *Ruppia maritima* (Ruppiaceae), *Najas* spp. (Najadaceae) and *Thalassia testudinum* and *Halophila baillonis* and *H. Decipiens* (Hydrocharitaceae).

FAUNISTIC OBSERVATIONS

The banks of sea-grass are of critical importance for the West Indian Manatee, *Trichechus manatus*.

OTHER OBSERVATIONS

Seagrass beds have not been mapped for lack of experience in the teams. This needs to be done in future exercises. Guzmán has successfully done so through supervised classification for Bocas de Torro.

La historic abundance of Green-backed turtles in Nicaragua, famous for the excellent quality of its turtle meat, was the result of these animals being large and astute, quick to escape its predators, as it had an almost unlimited supply of sea-grass, that grew without any seasonal fluctuations, as the this marine environment has no seasons, the herds grew only limited by the this food supply (Nietschmann, 1977).

As the continental platform narrows and deepens in the south limiting foraging areas for the greenback turtle, the omnivorous carey turtle comes to dominate. The greenback turtle only deposits it eggs on El Tortugero in Cost Rica.

Nietschmann (1977) cited a text of Carr (1969) that resumed says: “A decade ago, the exploitation of the Greenback turtle went something like this: Costa Rica produced the turtles; Nicaragua feed them; the boats from the Caiman Islands captured them; and the English and the North Americans ate them”.

LITERATURE Wantland and Pusey, 1975; Nietschmann (1977); Burke, 1982

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CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**SA1a(2)(b) ó VIII1a(2)(b) / 119**
NAME	**Mid stream river of the Caribbean (119)** **Río de la cuenca media del Caribe (119)**
	Occurs in the whole region, but in the majority of cases they are not mapable. Some specific cases are the following: 1. River San Pedro, Petén. 2. River Pasión
ECOSYSTEM DYNAMICS	1. The San Pedro river is large, being up to 2 m deep, in a watershed with many tributaries: on the right, the San Juan Chocop and Escondido rivers. On left, the Sacluc and Tamaris rivers, amongst others and many streams. 2. The level of the River Pasión can reach 8.5 m, flowing into the River Usumacinta, a river that runs to the frontier with Mexico. The average flow of the River Pasión is from 322 m3/seg.
GEOLOGY	The waters of the river and lagoons of San Pedro are a potential source of energy. The water of the river and lagoons of San Pedro are not fit for human consumption. May vary from mountenous ranges to alluvial plains and depending on the conditions, the morphology may vary from rapid currents with waterfalls to wide meandering rivers. In the Peten the subsoil is Karstic in nature and the rivers pas through extensive planes, forming meanders and causing extended floods.
CLIMATIC CONDITIONS	1. Caluroso. The average precipitation varies from 600 mm to 900 mm, that is the cause for the variable level of the river from 1.10 m to 1.60 m
SPECIAL CONDITIONS	1. The watershed of the River San Pedro has an area of 13, 800 Km^2 and a length of 186.
WATER REGIME	1. the amount of water depends on the season.
Frequent species	1. Riparian species: *Cladium jamaicense, cyperus diffusus.*
Emerged vegetation	According to (Gómez, 2001) some species that appear along the banks of the river are: *Coix lacrima- jobi, Heliconia* spp., *Thalia geniculata, Lindenia* spp., *Musa textilis, Trisnea trifoliata, Pytirogramma* spp. and Poaceas

varias.

Fixed floating vegetation

1. By the banks in the stiller parts of the river *Cabomba aquatica* is found. In the rivers that run into the Atlantic, on semi-submerged stones and rocks are found *Marathrum* spp. and *Tristicha* spp.

Free floating vegetation

1. In the stiller partsd of the river are found *Pistia stratiotes*(Araceae) and *Salvinia auriculata (*Salviniaceae).

FAUNISTIC OBSERVATIONS

A list of fish found in these Atlantic side rivers (Villa, 1982) include: *Dormitator maculatus*, Pigfish; *Bryconamericus scleroparius*, Sabalete; *Hyphessobrycon tortuguerae*, sabalete del Tortugero; *Gymnotus cylindricus*; *Rhamdia barbata*, Barbudo; *Carlana eigenmani*, Sabalito; *Brycon guatemalensis*, Machaca; *Roeboides guatemalensis*, Sabalete de Guatemala; *Brachyrhaphis holdridgei*, Olomina de Holdridge; *Melaniris hubbosi*, Sardina de Hubbs; *Mugil lisa*, Liza; *Mugil trichodon*, Fantail mullet; *Joturus pichardi*; *Cichlsoma urophthalmus*, Carate; *Cichlsoma nicaraguense*, Moga amarilla; *Sphoeroides spengleri*, Bandtail puffer; *Lutjanus jocu*, Dog snapper*; Diapterus olisthomus*, Irish pompano; *Guabina guabina* Guabina; *Lagocephalus leavigatus* Smooth puffer also in Spain and Africa; *Harengula pensacolae* Scaled sardine; *Anchoa parva*, Anchoa; *Pornadasys crocro*, Roncador; *Citharichthys spilopterus*, Sandfish, Bay Whiff; *Citharichthys uhleri*, Sandfish, Bay Whiff; *Achirus lineatus*, *Pejetortilla rayado*; *Trinectes maculatus*, Hogchocker; *Sphoeroides testudineus*, Checkered puffer; *Pornadasys boucardi*, American eel; *Tarpon atlanticus*, Tarpon; *Caranx latus*, Horse-eye Jack; *Awaous taiasica*, Temepechín del Atlántico; *Centropomus parallelus*, Róbalo; *Centropomus pectinatus*, Tarpon snook; *Bagre filamentosus* Bagre; *Polydactylus virginicus*, Barbo threadfin; *Phallichthys tico*, Pepesca tica; *Cichlsoma alfaroi*, Mojarra de Alfaro; *Gambusia nicaraguensis*, Pepesca de Nicaragua; *Cichlsoma spilurum*, Congo; *Belonesox belizanus*, Pepesca gaspar; *Cichlsoma maculicauda*, Palometa; *Cichlsoma centrarchus*, Mojarra rayada; *Cichlsoma tuba*, Moga verde, Tuba; *Arius melanopus*, Tunkí; *Neoheterandria umbratilis*; *Heterandria bimaculata*, Pepesca de dos manchas; *Centropomus ensiferus*, Róbalo, Swordspine snook; *Centropomus nigrescens*, Róbalo; *Elops saurus*. Sábalo, Ten pounder; *Cichlsoma rostratum*, Carate mediano; *Neetroplus nematopus*, Picaculo, Masca tabaco; *Melaniris sardina*, Sardina Nica; *Cichlsoma nigrofasciatum*, Carate pequeno, Convict cichlid; *Gobiomorus dormitor*, Guabina

del Atlántico; *Cichlsoma managuense*, Guapote barcino; *Pornadasys grandis*, Tronador; *Cichlsoma labiatum*, Red devil cichid; *Cichlsoma citrinellum*, Midas cichlid; *Cichlsoma dowi*, Guapote lagunero; *Astyanax fasciatus*, Sabalete; *Rhamdia guatemalensis*, Chulín guatemalteco, Filín; *Cichlsoma; friedrichsthalii*, (similar to *C. dowi*, *C. managuense* and C. *motaguense*), Guapotito; *Cichlsoma longimanus*, Carate pecho rojo; *Atractosteus tropicus*, Gaspar tropical, Tropical gar; *Phallichthys amates*; *Alfaro huberi*, Olomina de Huber; *Alfaro cultrato*, Olomina de Alfaro; *Agonostomus monticola*, Mountain muller, *Mugil curema* White mullet, also in Africa; *Herotilapia multispinosa*, Mojarrita; *Gerres cinereus*, Mojarra playera; *Atractosteus spatula* Alligator gar; *Tilapia mossambica*, Tilapia, introduced and naturalized, *Poecilia gillii*, Olomina de Gill; *Poeciliopsis gracilis*, Olomina gracil; *Priapichthys panamensis*, Pepesca de Panamá; *Poecilia sphenops*, Pepesca común.

Amongst the Amphibians observed by Villa(1982) in these ecosystems are : *Rana palmipes*, *Rana maculata*, *Bufo marinus*, *Leptodactylus melanonotus*, *Smilisca baudinii*.

CARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**SA1a(3)(a) / 120** **o VIII1a(3)(a)**
NAME	**River course of the Pacific littoral (120)** **Segmento del río del litoral del Pacífico (120)**
FAUNISTIC OBSERVATIONS	Villa (1982) mentions for the rivers on the Pacific side of Nicaragua the following species: *Astyanax fasciatus, A nicaraguensis,* Sabalete; *Rhamdia guatemalensis,* Chulín guatemalteco, Filín; *Cichlsoma friedrichsthalii (* similar to *C. dowi, C. managuense* and *C. motaguense),* Guapotito; *Cichlsoma longimanus*, Carate pecho rojo; *Atractosteus tropicus,* Tropical gar; *Phallichthys amates*; *Alfaro huberi,* Olomina de Huber; *Alfaro cultrato,* Olomina de Alfaro; *Agonostomus monticola,* Mountain muller; *Mugil curema* White mullet, found in Africa; *Herotilapia multispinosa*, Mojarrita; *Atractosteus spatula*, Alligator gar; *Tilapia mossambica* Tilapia, introduced, naturalized out competes native species; *Poecilia gillii*, Olomina de Gill; *Poeciliopsis gracilis*, Olomina grácil; *Priapichthys panamensis*, Pepesca de Panamá; *Poecilia sphenops*, Pepesca común; *Sicydium salvini*, Chupapiedra; *Centropomus armatus*, Róbalo; *Sphoeroides annulatus*, Bulleye puffer; *Diapterus peruvianus*, Mojarra playera; *Eucinostomus gracilis*, Mojarra playera; *Harengula thrisina*, Flatiron herring; *Anchovia macrolepidota,* Anchovia; *Oxyzygonectes dowi*, Ojo blanco; *Caranx marginatus*, Caballa; *Pornadasys branicki*, Burrito; *Achirus mazatlanus*, Peje tortilla; *Trinectes fonsecensis*, Pejehoja del golfo de Fonseca; *Citharichthys gilberti*, Pez tortilla, Pez hoja; *Microgobius miraflorensis*, Miraflores goby; *Awaous transandeanus*, Temepechín del Pacífico; *Bagre panamensis*, Bagre de Panamá; *Bagre pinnimaculatus*, Bagre; *Lile stolonifera*; *Polydactylus opercularis*, Bobo Yellow threadfin; *Pornadasys bayanus*, Roncador; *Arius guatemalensis*, Bagre de Guatemala; *Arius seemanii*, Bagre de Seeman; *Polydactylus approximans*, Bobo, Pacific Threadfin; *Netuma planiceps*, Bagre; *Poeciliopsis turrubarensis*, Olomina de Turrubares; *Poecilia* spp., Pepesca no descrita Some anphibians that Villa (1972) considered to be present in this ecosystem are: *Rana pipiens Rana maculata, Hyla microcephala, Hyla staufferi, Dermophis mexicanus, Rhinophrynus dorsalis, Bufo luetkenii, Hypopachus variolosus, Bufo marinus, Leptodactylus melanonotus, Smilisca baudinii, Rana*

warschewitschii.

CARACTERISTIC	DESCRIPTIÓN
CLASSIFICATION-CODE AND MAP-CODE	**SA1b(2) / 124, 125, 128**
NAME	**Tectonic lakes (124, 125, 128)** **Lago o Laguna Tectónica (124, 125, 128)**
	In the beginning a distinction was made between the tectonic lakes and the karstic lakes. But now it seems that there are no strong arguments to separate the two ecosystems. The Ictiofauna appears to be the same in both systems. The information about the aquatic ecosystems of Guatemala was supplied by Dra. Elfriede Pöll (2,001), Universidad del Valle.
	1. Tectonic lakes in the Karstic region Petén (Lago Petén-Itzá). **2. Tectonic lake Yax há and Laguna Sacnab.** **3. Tectonic lake, called "*Aguadas*" in Petén.** **4. Tectonic lake, Izabal.** **5. Tectonic lake, El Golfete.** **6. Tectónic lakes of El Salvador and Nicaragua.**
PHYSICAL CONDITION	There exists considerable variation in the physical conditions of tectonic lakes. In Central America there are no important tectonic lakes at high elevations and they are all ecologically integrated with their watersheds.
ECOSYSTEM DINAMICS	The dynamics can vary depending on a series of factors: • Size/depth: Waves increase with the size of the water surface; waves cause increased dynamism in the water, in shallow (parts of the) water they may bring fine material in suspension, causing turbidity. • Wind. This is particularly a factor on the lakes Managua and Nicaragua (6) • The current of the rivers that enters the lake.
Geology	Depressions caused by geological faults. 6**.** El Salvador has 9 tectonic lakes. Nicaragua has 3 aquatic ecosystems of tectonic origin: la Lagoon of Tismay and the Caribbean lakes of Managua (Xolotlán) (127) and Nicaragua (Granada ó Cocibolca). In Spanish the distinction between lagoon and lake is based on size, this has no ecological relevance, and does not form part of the classification here.
SPECIAL CONDITIONS	6. The two lakes are different: Managua is in an advanced state of eutrophism with a reduced ictiofauna. the lake of Nicaragua is more stable. Both lakes receive nutrients and organisms from the ecosystem of the mosaic of fresh waters vegetation (vii) which in turn receives nutrients from the terrestrial

ecosystems via the network of rivers that enter the lakes.

WATER REGIME

Water cover Generally the seasonal fluctuations are slight.

Water formation

Water caracteristic Fresh.

VEGETATION DATA

The species that accompany the lakes, are basically species found in other ecosystems. In that they are not mapable at the scale of 1:250,000 they are mentioned here.

Dominant species *Typha domingensis, Eleocharis interstincta, Phragmites communis, Cladium jamaicense*

Associated species Cyperaceae different species of Poaceae, as well as *Haematoxylum campechianum* (Caesalpiniaceae), *Acacia costaricensis* and *Acacia mayana* (Mimosaceae) on the margins of the lake

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Cover of inferior Cryptogamites The phytoplankton of these ecosystems remains unknown.

AQUATIC (SEMI) SESSILE LIFE FORMS

Emerged vegetation

1. *Cladium jamaicense, Eleocharis cellulosa, Phragmites communis, Typha domingensis.*
2. *Typha domingensis, Eleocharis interstincta*.
3. *Cladium jamaicense, Eleocharis* spp., *Cyperus* spp., *Phragmites communis, Acrostichum aureum.*
4. Graminae on the stiller margins, the emergent vegetation consists of: *Typha domingensis, Montrichardia arborescens, Acrostichum danaefolium, Pontederia rotundifolia, Pontederia sagittata, Bletia purpurea, Habenaria bractescens, Habenaria repens, Sagittaria latifolia, Hymenocallis littoralis.*
5. Most of the aquatic vegetation is found in sheltered areas: *Juncus effusus, Crinum erubescens, Montrichardia arborescens, Acrostichum danaefolium*, Riparian swamp vegetation is common, such as: *Chrysobalanus icaco, Machaerium lunatum, Cladium jamaicense, Paurotis wrightii,* and *Rhizophora mangle*.
5. Symphonia globulifera and *Vohysia guatemalensis* are característic trees of the margins of the Golfete. *Pachira aquatica* in Golfete and River Dulce, as well as *Pseudo-bombax elipticum* and *Annona glabra*. Along both margins are found: *Typha domingensis* and *Juncus effusus*.

Fixed floating vegetation

1. *Nyphaea ampla, Nymphoides humboldtianum, Pontederia lanceolata*
3. *Cabomba aquatica*.
4. *Nymphaea ampla, Hydrocotyle verticilata, Jussiaea natas.*
5. *Nymphaea ampla* y *Cabomba piauhyensis.*

Free floating vegetation

1. *Eichhornia crassipes, Pistia stratiotes*.

3. *Pistia stratiotes, Lemna* spp. and *Wolffia* spp., forms large continuos stretches.
4. *Utricularia foliosa, Pistia stratiotes, Salvinia auriculata, Azolla caroliniana*.
5. *Salvinia auriculata*

Submerged vegetation

1. Chara foetida, Najas guadalupensis, Najas wrightiana, Potamogeton illinoensis, Vallisneria americana.
2. *Potamogeton illinoensis*.
3. Few submerges plants present. In the "Aguadas" with permenante water the following species were found *Chara* spp., *Nitella* spp., *Potamogeton* spp.
4. *Ceratophyllum demersum, Vallisneria americana*. The *Vallisneria* is an important source of food for the Manatee *(Trichechus manatus),* still found in this region, but hunted for its meat and is in serious danger of becoming extinct here.
5. V*allisneria americana, Ceratophyllum demersum, Chara foetida Utricularia foliosa*. These submerges plants are abundant in the protected "Chocón- Machacas" area, situated in the lower part of the Golfete, here its been the presence of the marine algae *Noctiluca miliaris* has been observed when strong winds have forced salt water up the River Dulce.

In the lake Coter of Costa Rica is found *Chara foetida* (Gómez, 2,001).

Tectonic lakes of El Salvador

FAUNISTIC OBSERVATIONS

1. **Peces.** Amongest the fish repoted for the lake Petén-Itzá, are: *Petenia splendida* and *Cichlasoma affine*. *Petenia splendida* is of special interest in that it is considered endemic. It is a large predator, that is sought after for its flavor.
2. As well as the fish in the following list, in these lakes are alligators.
5. It is the habit of many birds such as: Herons, Kingfisher, and Pelicans.

The lake of Nicaragua, also has some elements of Caribbean marine fauna (entering through the River San Juan)such as sharks that adapt to the low salinity and remain in the lake.

According to Astorqui (1974), in the lake of Nicaragua (Cocibolca or Granada) are found 29 genera and 47 species of fish, in 16 families.

Salt water species (though they adapt to the fresh water): **Carcharhinidae** (Sharks): *Carcharhinus leucas*. **Pristidae** (Saw Fish): *Pristis perotteti, P. pectinatus*. **Megalopidae** (Tarpones ó Sábalos reales): *Megalop atlanticus*. **Clupeidae** (Sabalete): *Dorosoma chavensis* (different from the lake of

Managua). **Atherinidae** (Sardinas plateadas): *Thyrinops sardina*. **Pomadasyidae** (robalo ó roncador): *Pomadasys grandis*, P. boucardi ?. **Eleotridae** (Guabina): *Gobiomurus dormitor*. **Symbranchidae** (curious eel like fish, monogeneric with 3 species with disjunct populations): *Symbranchus marmoratus*. **Centropomidae** (Róbalos that enter from the River San Juan; Atlántico from South Carolina, Caribbean to Brazil, Pacific, California to Peru): *Centropomus undecimalis*.

Freshwater fish (though some can live in brackish water): Lepisosteidae *Atractosteus tropicus* (límite sur el lago Nicaragua): Cíclidos: *Cichlasoma dovii C. friedrichstahlii, C. managuense, C. labiatum, C. spilurum, C. centrarchus, C. citrinellum, C. maculicauda, C. nicaraguense, C. rostratum, C. longimanus, Neetroplus nematopus, Herotilapia multispinosa*. Poeciliidae (pepesca or uluminas,): *Mollienisia sphenops, Mollienisia dovii, Mollienisia* spp., *Xenophallus umbratilis, Belonesox belizianus* (ulumina gaspara), *Alfaro cultratus, Poeciliopsis gracilis*. Characidae: *Bramocharax bransfordii, Rhoadesia eigenmanni, Hyphessobrycon tortugueme, Astyanax fasciatus*, A. *fasciatus aeneus* ?, *A. Nasutus, Bryaconamericus ricae, Hemybrycon* spp., *Roeboides guatemalensis, Brycon guatemalensis.* Pimelodidae (Bagre, Cat Fish): *Rhamdia managuensis, R. Nicaraguensis, R. Barbata*. Gymnótidos (American eel): *Gymnotus carapo*. Cyprinodontidae: *Rivulus istmensis.*

Amongst the endemic fish are: for the lake of Nicaragua, *Pmadasys grandis* and *Rhamdia luigina*; for the lake Nicaragua and the lake of Managua: *Asynax nasurus, Rhamdia barbata, R. managuensis*. Some endemic species are shared between the tectonic lake and the Volcanic lakes: *Dorosoma chavensii, R. nicaraguensis, Cichlasoma nicaraguensis* (both lakes and Xiloá), *Melaniris sardina* (both lakes and Masaya), *C. labiatum* (both lakes, Apoyo and Masaya); source UZCH/MARENA (1998).

Peces encontrados en la **Laguna Yaxhá:**	Peces encontrados en la **Laguna Sacnab :**
Petenia splendida	*Petenia splendida*
Cichlasoma affine	
Cichlasoma aureum	*Cichlasoma aureum*
Cichlasoma synspilum	*Cichlasoma synspilum*
Cichlasoma salvini	*Cichlasoma salvini*
Cichlasoma urophthalmus	*Cichlasoma urophthalmus*
Cichlasoma friedrichsthalii	*Cichlasoma robertsoni*
Cichlastoma robertsoni	*Belonesox belizanus*
Belonesox belizanus	*Poecilia mexicana*
Poecilia mexicana	*Gambusia sexradiata*
Gambusia sexradiata	*Dorosoma petenense*
Dorosoma petenense	*Melaniris sp.*
Melaniris sp	*Hyphessobrycon compressus*
Hyphessobrycon compressus	
Simbranchus mormoratus	

OTHER OBSERVATIONS

LITERATURE

Guatemala: Ríos, 1996.
El Salvador: Ventura, et al. , 2000

TECTONIC LAKES OF EL SALVADOR

NOMBRE	**UBICACION**	**CARACTERISTICAS FISICAS**	***CARACTERISTICAS BIOLOGICAS***	**OBSERVACIONES**
METAPÁN		Formed in a valley with lava flows and small volcano's but not a volcanic lake	*Eichornia crassipes, Pistia stratiodes, Lemna* spp., *Thalia geniculata*	
GÜIJA.	North west of the Dep. of Santa Ana and extends into Guatemala	Formed with the closing of a valley with a lava flow		The surrounding vegetation has been altered.
ZAPOTITLÁN	At the unión between the Dep: Sonsonate La Libertad and the Dep. Santa Ana	Similar in size to Ilopango, extinct 65 years ago, its waters used for irrigation through the River Sucio, its natural drainage; in 50's a swamp, then an agriculture, today an industrial zone.		An example of how a water resource can disappear in a accelerated manner through drainage and a change in land use.

OLOMEGA	Pacific Coast, 8 Km south of the Pan-American highway, on a road that leaves El Cantón El Carmen 20 Km from San Miguel	The largest on the coastal plain,	*Eichhornia crassipes, Setaria longifolia, Eleocharis elegans, Spirodella pollrhiza*	Human and agricultural pressure, when the water level drop the cattle enter the lake to graze the aquatic plants. Large trees on the margins.
NAHUALAPA	A short distance NE from the crossroads of the road San Vicente-Zacatecoluca and the road to Herradura	In a depression formed by erosion, surrounded by a band of spiny shrubs.		The natural vegetation surrounding the lagoon has been replaced by plantations of *Tectona grandis, Gliricidia sepium* and *Eucalyptus* spp.
SAN BRANAL	500 m south of the bridge de Oro, Usulutlán, in the area of the Rver Lempa	Formed in a similar way to Nahualapa and only has 50 m in diameter.	Ringed by *Thalia geniculata*, spiny legumes: *Mimosa pigra, M. pudica* and *Acacia hindsii*, also emergent and submerged hydrophytes	
EL JOCOTAL	South East of the Department San Miguel	Just 20 m, above sea level, formed from small gaps in a large lava flow. The surrounding terrain is irregular, the area of the lake varies from 800 Ha in the dry season to 1,800 Ha in the wet season. Though it has decreased in size in the last decade	The vegetation is dominated by emergent rooted hydrophytes: *Agrostis* spp., *Typha angustifolia, Cyperus* spp., *Mimosa pigra*, *Desmodium* spp, *Wedelia trilobata*. Amongst the floating Hydrophytes *Eichhornia crassipes* and *Nymphaea spp.* the lagoon is visited by many migratory bird species	*Nymphaea spp*, has disappeared due to the introduction of an exotic snail species.
MAQUIGÜE Y MANAGU	Known as the Complex Los Negritos,	Tectonic, limited by blocks of faulted rock. In many places its	It area has reduced and now consists of islands of aquatic	The surrounding area is heavily populated and the

ARA	found South of the Dep. of La Union.	impossible to navigate because of the shallow water and aquatic vegetation.	vegetation.	lands used for agriculture with little cover.

CARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**SA1b(5)b / 129**
NAME	**Predominantly brackish lake or canal of the Caribbean littoral plain (129)** **Lago, laguna o canal littoral de agua salobre del Caribe (129)**
PHYSICAL CONDITIONS	Part of the complex of estuary ecosystems: Coastal areas where fresh water from the rivers or from surface drainage accumulates in closed water courses, mixing in varying degrees with sea water. The mix of fresh and salt water is influenced by many factors, such as: • Amount of fresh water; • Evaporation. • Wind. • Waves. This type of ecosystem links fresh water and salt water ecosystems, the rivers that flow into them, carry sediment and nutrients, though this is less evident in the systems feed by surface drainage. The margins of these ecosystems generally contain Mangroves, and other salt tolerant tree species.
ECOSYSTEM DYNAMICS	Dynamic, confirmed by USAID (1996). According to Nietschmann (1977), three of the most productive ecosystems in the world are found of the coast of Central America: the Coastal lagoons and Estuaries, the corral reefs and the Sea-grass Beds. In the three, there is a very efficient conversion of sunlight to vegetable tissue and latter animal tissue. The efficiency of this conversion is many times superior to terrestrial ecosystems and in most case more efficient than intensive agriculture.
GEOLOGY	These systems are considered to be brackish, related to semi-closed estuaries, causing the accumulation of large amounts of sediment on the lagoon bed.
WATER REGIME	
Water cover	Permanent with some seasonal fluctuations but with daily and annul cycles of changes in salinity. In the majority of the lagoons the tidal fluctuations are minimal.
Water formation	Fluvial-marine
Water characteristic	Brackish
Water bottomcomposition	Muddy.
VEGETATION DATA	
Dominant species	Based on Gómez (1984), amongst the submerged aquatic plants its possible to find: *Syringodium filiforme, Halodule*

wrightii (both Cymodoceaceae, the last reported by the USAID, 1996)

Co-dominant species

Also: *Zannichellia palustris* (Zannichelliaceae), *Potamogeton perfoliatus* (Potamogetonaceae), *Ruppia maritima* (Ruppiaceae), *Najas* spp. (Najadaceae); *Thalassia testudinum, Halophila baillonis* and *H. Decipiens* (Hydrocharitaceae), (Gómez, 1984).

Associated species

Other associated species are the plants found in the Caribbean Mangroves and some aquatic plants found in the Reed Swamps.

AQUATIC (SEMI) SESSILE LIFE FORMS

Submerged vetation

In the lagoons, the permanent population of submerged aquatic plants mentioned above.

FAUNISTIC OBSERVATION

According to Espinoza (1996) y UZCH/MARENA (1998), a high diversity of mobil organisms in transit, adapted to the daily and seasonal fluctuations in salinity, temperature and nutrientes.

The nursery for the larval and juvenile stages of many species; almost all of the Caribbean Shrimp, *Peneaus*: Red Shrimp (*P. duorarum* and *P. brasiliensis*), White Shrimp (*P. schmitti*) Brown Shrimp (*P. aztecus*) and *Trachypeneaus* spp.) the equilibrium of these populations are fundamental in the maintenance of the economically exploited populations of the open sea. The coastal marine species found are: *Centropomus* spp. (robalo), *Tarpon atlanticus* (sábalo real), *Lutjanus griseus* (pargo de manglar), *Penaeus* spp. and *Trachypenaeus* spp. (Shrimp), *Callinectes* spp. (Blue crab), *Caiman crocodilus* (caiman).

The local people have observed in these lagoons “White Dolphins” (2 species) of fresh water (similar to those of the Amazon and Orinoco of South America). In the smaller branches of the lagoons and estuaries there are populations of Manatee, that feed on the submerged, *Syringodium filiforme* called Manatee Sea-grass.

A list of fish species found in Coastal lagoons by (Villa, 1982) includes: *Melaniris milleri*, Sardina de Miller; *Anchoviella elongata*, *Anchoita larga*; *Oostethus lineatus*, Opossum pipefish; *Lutjanus cyanopterus*, Cubera Snapper; *Diapterus evermanni*, Mojarra playera; *Diapterus rhombeus*, Mojarra playera; *Eucinostomus jonesi*, Slender mojarra; *Eucinostomus melano*pterus, Flagfin mojarra; *Bathygobius mystacum*, Island frillfin; *Bathygobius soporator*, Frillfin goby; *Evorthodus*

lyricus, Lyre goby; *Gobioides broussonetti*, Gobi; *Lutjanus apodus*, Schoolmaster; *Lutjanus griseus*, Gray snapper; *Eleotris amblyopsis*, Swapfish; *Diapterus plumieri*, *Mojarra playera*, Striped mojarra; *Lutjanus jocu*, Dog snapper; *Diapterus olisthomus*, Irish pompano; *Guabina guabina*, Guabina; *Lagocephalus leavigatus*, Smooth puffer; Also Spain and Africa; *Pornadasys boucardi*, Roncador; *Centropomus parallelus*, Róbalo; *Bagre filamentosus*, Bagre; *Gambusia nicaraguensis*, Pepesca de Nicaragua; *Cichlsoma spilurum*, Congo; *Belonesox belizanus*, Pepesca gaspar; *Cichlsoma maculicauda*, Palometa; *Arius melanopus*, Tunkí; *Cichlsoma dowi*, Guapote lagunero; *Oligoplites saurus*, Leatherjacket; *Alfaro huberi*, Olomina de Huber; *Alfaro cultrato*, Olomina de Alfaro; *Gerres cinereus*, Mojarra playera

OTHER OBSERVATIONS

These ecosystems are only known from the Caribbean. It has a high ecological value because it protects many species of commercial interest, it permits the recycling of nutrients, and is valuable resource for local communities who earn incomes from the fish and shrimp.

These ecosystems are seriously threatened by solid waste (amongst which are sediments) and liquid waste (amongst which are the hydrocarbons), also the over exploitation of the Shrimp nursery beds. Threats that are observed by the indigenous communities the live off these resources.

In Nicaragua organizations that work in these ecosystems are: PROCODEFOR, MARENA, DIPAL, BICU, and in the communities RAAN. DIPAL and CAMP-LAP are monitoring hydro-biological resources of the lagoon Perlas, where they promote the sustainable development of its resources, PROARCA/COSTA monitors the water quality, depth and other indicators in the lagoons Karatá and Wounta, additionally fish inspection and volume and size of captured species.

DESCRIPTION

CLASSIFICATION-CODE AND MAP-CODE

SA1c(1)(a), SA1c(2)(a) / 130, 132

NAME

Open estuary of the Pacific (130)
Semi-closed estuary of the Pacific (132)
Estuario abierto del Pacífico (130)
Estuario semicerrado del Pacífico (132)

PHYSICAL CONDITIONS

The estuaries are the coastal zones where the fresh waters of the rivers mixes with the salt water from the sea (Britanica, 2000). The combination of fresh water and salt water is influenced by many factors, such as:

- Quantity of fresh water.
- Morphology of the estuary.
- Coastal currents and river currents.
- Wind.
- Waves.

The majority of these factors change through the day or with the seasons. So that the limits of these ecosystems are continually changing. In these zones various ecosystems are found.:

- Mangroves
- Tropical coastal vegetation on very recent soils
- Brackish coastal Lagoons
- Salt flats
- Open brackish water

This type of ecosystem links fresh water and salt water ecosystems, the rivers that flow into them, carry sediment and nutrients, from the terrestrial ecosystems to the marines ecosystems. The margins of these ecosystems generally contain Mangroves, themselves ecosystems found between the land and sea.

In the context of the estuaries, we are just considering the systems below the tidal zone.

ECOSYSTEM DYNAMICS

They are very dynamic ecosystems with continual variation in its elements or in there combination:

- Changes in salinity.
- Changes in the strength of the currents.
- Changes in the direction of the currents with the tide.
- Amplification of the tide if the Estuary is funnel shaped.
- Changes in the amount of sediment carried.

GEOLOGY

Geologically very young, the estuaries are areas in geological construction, where geological processes are directly visible. In many cases the estuaries are sedimentation ponds for the rivers. Beyond the currents a lot of sediment accumulates for

three reasons:
The rivers are heavy with eroded terrestrial sediment;
The mix of fresh water with salt water causes flocculation;
Beyond the currents the water slows and the sediments precipitate. There exists various sorts of estuaries:

- Deltas;
- Funnel;
- Brackish coastal lagoons and canals.

Generally the estuaries do not just have areas of sedimentation they also have areas of erosion.

CLIMATIC CONDITIONS
The tropical conditions determine the temperature of the water.

FIRE EXPOSURE

SPECIAL CONDITIONS
During the study, a distinction was made between open and semi-closed estuaries. But there appears now to be no data to support this separation. What is important is to separate the Pacific and Caribbean estuaries.

SOIL CHARACTERISTICS

SOIL TYPE

WATER REGIME

Moist regime

Water cover

Water formation
Estuary

Water characteristics
Brackish

WATER BOTTOM COMPOSITION
Sediments whose quantity varies with the velocity of the currents.

AQUATIC (SEMI-) SESSILE LIFE FORMS

Submerged vegetation
No submarine vegetation is found in the estuaries of the Pacific.

Submerged (Semi-) sessile fauna
The sessile fauna does better in less dynamic areas, such as the sand banks. Different species of mollusks can be very abundant. In the canals with stronger currents, the abundance and biodiversity is generally low.

FAUNISTIC OBSERVATIONS

The estuaries serve as natural nurseries for many different marine species and fresh water species.

Villa (1982) mentions these fish species for the coastal lagoons of the Pacific. In that no genuine lagoons exit on the Pacific side of Central America we assume that he was referring to semi-closed estuaries. The following species are listed: *Oligoplites saurus* Leatherjacket; *Alfaro huberi*, Olomina de Huber; *Alfaro cultrato*, Olomina de Alfaro; *Gerres cinereus*, Mojarra playera; *Centropomus armatus*, Róbalo; *Anchoa starksi*, Anchoa; *Anchoviella balboe*, Anchoita de Balboa; *Anchoviella miarcha*, Anchoita; *Melaniris guatemalensis*, Sardina de Guatemala;

Pseudophallus starksi, Pez lápiz; *Oligoplites mundus*, Pámpano; *Lutjanus argentiventris*, Pargo amarillo; *Lutjanus colorado*, Pargo colorado; *Lutjanus guttatus*, Flamenco; *Diapterus brevimanus*, Mojarra playera; *Diapterus lineatus*, Mojarra playera; *Eucinostomus argenteus*, Spotfin mojarra; *Pornadasys leuciscus*, Roncador; *Pornadasys macracanthus*, Burro; *Hemieleotris latifasciatus*, Guabinita; *Bathygobius* spp.; *Lutjanus novemfasciatus*, Pargo negro; *Sphoeroides annulatus*, Bulleye puffer; *Diapterus peruvianus*, Mojarra playera; *Eucinostomus gracilis*, Mojarra playera; *Citharichthys gilberti*, Pez hoja; *Anchoa lamprotaenia*, Anchoa nariguda; *Anchoa lucida*, Anchoa; *Microgobius miraflorensis*, Miraflores goby; *Bagre panamensis*, Bagre de Panamá; *Bagre pinnimaculatus*, Bagre; *Netuma planiceps*, Bagre; *Poeciliopsis turrubarensis*, Olomina de Turrubares.

Amongst the species mentioned by Abt et al (1998) for the Pacific are: *Anchoa naso, Arius* spp., *Chloroscombrus orqueta, Diapterus peruvianus, Lutjanus guttatus, Micropogon actipinnuis, Opisthonema libertate, Peprilus medis, Pepuilus snyderi, Pomadsys panamensis, Scoberomorus sierra*; out at sea: *Euthynnus lineatus, Katsuwonus pelamis* and *Thunnus albacares*.

OTHER OBSERVTIONS

The local fishing is disordered and uses inadequate methods: explosives (hand grenades and dynamite), poisons (pyrethroides, natural fish poisons) and nets with small mesh that are not selective, so that all sizes and stages are taken affecting the replacement populations of the very resource they exploit for a living. Other threats are less obvious but are constantly impacting the estuaries, sedimentation, from the erosion of the watershed due to inadequate agricultural practices is affecting the marine life also the contaminants, especially pesticides, used in the agriculture in the watershed.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**SA1c(1)(b), SA1c(2)(b) / 131, 133**
NAME	**Open estuary of the Caribbean (131)** **Semi-closed estuary of the Caribean (133)** **Estuario abierto del Caribe (131)** **Estuario semicerrado del Caribe (133)**
PHYSICAL CONDITIONS	The estuaries are the coastal zones where the fresh waters of the rivers mixes with the salt water from the sea (Britanica, 2000). The combination of fresh water and salt water is influenced by many factors, such as: • Quantity of fresh water. • Morphology of the estuary. • Coastal currents and river currents. • Wind. • Waves. The majority of these factors change through the day or with the seasons. So that the limits of these ecosystems are continually changing. In these zones various ecosystems are found.: • Mangroves • Tropical coastal vegetation on very recent soils • Brackish coastal Lagoons • Salt flats • Open brackish water This type of ecosystem links fresh water and salt water ecosystems, the rivers that flow into them, carry sediment and nutrients, from the terrestrial ecosystems to the marines ecosystems. The margins of these ecosystems generally contain Mangroves, themselves ecosystems found between the land and sea. In the context of the estuaries, we are just considering the systems below the tidal zone.
ECOSYSTEM DYNAMICS	They are very dynamic ecosystems with continual variation in its elements or in there combination: • Changes in salinity. • Changes in the strength of the currents. • Changes in the direction of the currents with the tide. • Amplification of the tide if the Estuary is funnel shaped. • Changes in the amount of sediment carried. According to Espinoza (1996) and UZCH/MARENA (1998), a high diversity of mobile organisms principally in transit and adapted to the daily and seasonal fluctuations in salinity, temperatures and nutrients.

GEOLOGY

Geologically very young, the estuaries are areas in geological construction, where geological processes are directly visible. In many cases the estuaries are sedimentation ponds for the rivers. Beyond the currents a lot of sediment accumulates for three reasons:
The rivers are heavy with eroded terrestrial sediment;
The mix of fresh water with salt water causes flocculation;
Beyond the currents the water slows and the sediments precipitate. There exists various sorts of estuaries:

- Deltas;
- Funnel;
- Brackish coastal lagoons and canals.

Generally the estuaries do not just have areas of sedimentation they also have areas of erosion.

CLIMATIC CONDITIONS

The tropical conditions determine the temperature of the water.

SPECIAL CONDITIONS

During the study, a distinction was made between open and semi-closed estuaries. But there appears now to be no data to support this separation. What is important is to separate the Pacific and Caribbean estuaries.

WATER REGIME

Water formation

Estuary

Water characteristic

Brackish

AQUATIC (SEMI) SESSILE LIFE FORMS

Submerged vegetation

On the Caribbean, sea-grass beds are found in the estuaries of Boca Del Toro and possibly in Belize. (Consult the description of the sea-grass beds).

Submerged (semi)sessile fauna

The sessile fauna does better in less dynamic areas, such as the sand banks. Different species of mollusks can be very abundant. In the canals with stronger currents, the abundance and biodiversity is generally low.
Coral reefs are found in the estuaries of Boca del Toro. (Consult the description of the coral reefs).

FAUNISTIC OBSERVATIONS

The diversity of these areas depends on the seasonal fluctuations of salinity, temperature and nutrients.

This is a transitional area between the more tranquil ecosystems such as the lagoons and Mangroves, that are considered the nursery for many species.

The coastal marine species found here are: *Centropomus* (Robalo), *Tarpon atlanticus* (Sábalo real), *Lutjanus griseus* (Pargo de manglar), *Penaeus* and *Trachypenaeus spp.* (camarón), *Callinectes spp*. (Cangrejo azul) and when mixed with Mangroves *Rhizophora mangle* and *Pelliciera rizophorae*. Abt et al (1998) mentions the presence of: *Calamus* spp., *Chlorosconbrus chrysurus, Decapterus punctatus, Eucinostomus havana, Haemulon spp, Lutjanus synagris, Ophistonema oglinum, Scomberomorus* spp.; and in the south: *Caranx* spp. and *Lutjanus analis*.

A list of species that frequent the estuaries of the Caribbean coast of Nicaragua (Villa, 1982) includes: *Dormitator maculatus*, Pigfish; *Bramocharax brandsfordii*, Sabalete de Bransford; *Cichlsoma urophthalmus*, Carate; *Melaniris milleri*, Sardina de Miller; *Myrophis punctatus*, Anguila gusano del Atlántico; *Anchoa hepsetus, Anchoa rayada*; *Eleotris pisonis*, Swampfish; *Erotelis smaragdus*, Esmerald sleeper; *Gobionellus boleosoma*; *Anchoviella elongata*, *Anchoita larga*; *Oostethus lineatus*, Opossum pipefish; *Lutjanus cyanopterus*, Cubera Snapper; *Diapterus evermanni*, Mojarra playera; *Diapterus rhombeus*, Mojarra playera; *Eucinostomus jonesi*, Slender mojarra; *Eucinostomus melanopterus*, Flagfin mojarra; *Bathygobius mystacum*, Island frillfin; *Bathygobius soporator*, Frillfin goby; *Evorthodus lyricus*, Lyre goby; *Gobioides broussonetti*, Gobi; *Lutjanus apodus*, Schoolmaster; *Lutjanus griseus*, Gray snapper; *Eleotris amblyopsis*, Swapfish; *Diapterus plumieri*, Striped mojarra; *Lutjanus jocu*, Dog snapper; *Diapterus olisthomus*, Irish pompano; *Guabina guabina*, Guabina; *Lagocephalus leavigatus*, Smooth puffer; also in Spain and Africa; *Harengula pensacolae*, Scaled sardine; *Anchoa parva* Anchoa; *Pornadasys crocro*, Burro grunt; *Citharichthys spilopterus*, Sandfish, Bay Whiff; *Citharichthys uhleri*, Sandfish, Bay Whiff; *Achirus lineatus*, Pejetortilla rayado; *Trinectes maculatus*, Hogchocker; *Sphoeroides testudineus* Checkered puffer; Pornadasys boucardi Steinachner, Roncador; *Centropomus parallelus*, Róbalo; *Centropomus pectinatus*, Tarpon snook; *Bagre filamentosus*, Bagre; *Polydactylus virginicus*, Barbo threadfin; *Phallichthys tico*, Pepesca tica; *Cichlsoma alfaroi*, Mojarra de Alfaro; *Gambusia nicaraguensis*, Pepesca de Nicaragua; *Cichlsoma tuba*, Tuba; *Centropomus undecimalis*, Snook; *Pornadasys grandis*, Tronador; *Astyanax fasciatus*, Sabalete; *Cichlsoma friedrichsthalii*, Guapotito; *Caranx hippos*, Crevalle jack; *Oligoplites saurus*, Leatherjacket; *Cichlsoma longimanus*, Carate pecho rojo; *Gerres cinereus*, Mojarra playera

OTHER OSERVATIONS

The social and economic value of these ecosystems is high as

it supplies a source of income for local communities, fish, and shrimp as well as a tourism.

This ecosystem is seriously threatened by solid wastes (rubbish and sediment) and liquid (hydrocarbons), also the over-exploitation of the breeding populations of some shrimp and fish.

CHARACTERISTIC	DESCRIPTION
CLASSIFICATION-CODE AND MAP-CODE	**SA1d(2) / 134** **or VIII1d(2) in the newly proposed system**
NAME	**Coral reef of the Caribbean (134)** **Arrecife coralino del Caribe (134)**
ECOSYSTEM DINAMYCS SPECIAL CONDITIONS	Moderate in shallow water very low as depth increases. Very sensitive to the sedimentation and pollution. It has some ability to clean itself through mucous, but that mechanism is limited.
WATER REGIME	
Moist regime	Below sea level.
Water cover	Permanently.
Water formation	Marine.
Water characteristics	For optimal development it needs sea water of a normal salinity: 30 - 40 ppm and temperature that fluctuate between 23 ^{o} and 25^{o}, but never less than 18 ^{o}, (Britanica, 2000). Some species are more tolerant of brackish water, (Gúzman, 1998), but in such conditions the biodiversity is less. The minimum depth is just below the tidal zone with species adapted to this zone to a maximum depth of 60 m.
AQUATIC (SEMI) SESSILE LIFE FORMS	
Submerged vegetation	In the shallow waters with abundant sediment frequently mixed with sea-grass beds. On the hard substrate macro-algae grow. (for Nicaragua are mentioned: *Rhodolith* spp. and *Halimeda* spp., *USAID, 1996)* that can occupy up tp 50% of the surface area. In areas where algae dominate it can be classified as an ecosystem of submerged vegetation of macro-algae or as a corral reef dominated by macro algae.
Submerged (semi) sessile fauna	A coral is a calcareous formed for a variety of organisms, of which the corals are the most important; other organism include mollusks and organisms with calcareous spines, such as sponges and sea cucumbers. Layers of blue-green algae also contribute in the cementing the calcareous fragments into a solid mass. In the coastal zones the corals are buffeted by waves and experience a continual process of construction and destruction. The debris can form coral sand, that makes up banks and quays. In the shallows this forms conditions for the development of sea-grass beds. Important sessile animals of the coral reef are the corals (already mentioned), the octocorales that lack the calcareous skeleton, the anemones, the zoántids, black corals and mollusks.

Gúzman (1993, 1998a, b, c) lists the species for Bocas del Toro and some for the Pacific. Species lists and records of different authors have been integrated into lists at the bottom of this description.

Of these just 4 genera, appear in both oceans, but with different species.

FAUNISTIC OBSERVATIONS

Some fish mentioned for Nicaragua by Villa (1982) are: *Sphoeroides spengleri*, *Lutjanus apodus*, *Lutjanus griseus*

Amongst the sea turtles are: The Green-backed turtle (*Chelonia mydas*), up to 1m in length and 100 kg, is totally herbivorous, which determines its dependence on the coastal sea-grass beds. The other species are omnivorous. Leatherback turtle (*Dermochelys coriacea*), from 1.5 m in length, 350 Kg, is rarely a coastal species, preferring to feed on jellyfish. The loggerhead turtle (*Caretta caretta*), from 1m in length,125 Kg, numerous but dispersed due to its mainly carnivorous diet, shellfish, fish, sponges, jellyfish, sometimes herbs and algae. The hawksbill turtle (*Eretmochelys imbricata*), from 0.75 m in length and 60 Kg, feeds on fish, sponges, starfish, coral polyps, sea conch, algae and sometimes herbs on the coral reefs and on shallow rocky seabed's, and they travel great distances (Nietschmann,1977).

OTHER OBSERVATIONS

In many cases the coral reefs are too small to map. For this reason none of the Pacific reefs where mapped (VIII1d(1)). It is however important to distinguish between the two ocean systems.
The barrier reef of Belize is the largest in the western hemisphere. It extends for 220 to 250 Km, with atolls of coral and some strips of coastal reefs.