

Homeostasis I in abandoned rainforest fields on metamorphic rocks

Abstract

Clear differences are encountered between dominant species in the Homeostasis I in the north and south expositions of the territory located on the most rainfull zone of Cuban archipelago, in first *Cyathea arborea* is observed while *Miconia prasina* as the second. In the evolution of vegetation after the disturbance, the Homeostasis I successional stage it's the first where heliophilous species (sun-loving) closet a cover layer that create stable coverage and better conditions to emerge rainforest species (shade-loving), and begin to disappear pioneer heliophilous species with a type of "r" selection. For the work Braun Blanquet methodology was employed and the objective is to analyze the phytocoenological composition in the Homeostasis I areas.

Keywords: secondary succession, rainforest, homeostasis I, metamorphic rocks, Eastern Cuba

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Introduction

Submountain rainforest over metamorphic rocks¹ is developed over schist of Sierra del Purial geological formation which is an easily weathered material, and for that it is a relatively favorable soil conditions and as these terrains form part of the most rainfall zone of the Cuban archipelago, it have the adequate conditions to vegetal develop. Actually is found inside of Cuchillas del Toa Biosphere reserve.²

Much of this rainforest areas have been altered by using the "clean - tomb - itch - burn - inhabits" method to prepare for subsistence agriculture; nevertheless, there are many forest possessions, some of them relatively vast and much different successional stage areas; for that the objective of the present is study the phytocoenological composition in the Homeostasis I areas.

Methodology

Natural conditions of the studied area

Natural conditions were described in the first work of this group.³ The area is located inside the more rainy territory of Cuban archipelago, between 2 500 to 3 000 mm⁴ regularity distributed. Geology is represented by Sierra del Purial Formation⁵ composed by different kind of schist, intermediate tuffs between other rocks. Relief is much dissected with slopes between 35 and 45° rarely less. Soil is ferralitic red and leached red-brown color,⁶ frequently little deep, over ferralitic weathering crust.

Sampling methodology

The sampling methodology is found in the former work of this group (3); although the last were exposed summarily.

According to Braun Blanquet⁷ methodology phytocoenological inventories (lists, stands, samples, relevés) in a minimum area of 625 m² were made.¹ In addition, observations of the oecotope (slope; exposition; altitude; general, nano and micro relief) in the place of the samples it's surroundings were made too.

For the characteristic combination of the associations, the species with degrees of presence IV and V were used,⁸ and for the subassociations and variants the differential combinations.⁹ was followed for the categorization and the name of syntaxa. Completed scientific names (genus, species and author) are observed in Tables and¹⁰⁻¹⁴ sometime amended by

Discussion

In Reyes et al.,³ was explicated the successional stages; according the secondary one the Homeostasis I is an Early communities where an small group of heliophilous species close the canopy, creating for first time the conditions to permit entrance of mature community species and the disappearance of much stricter heliophilous.¹⁵⁻¹⁷

Result an interesting thing how due the relativity favorable ecological conditions, mainly highest and frequent rainfalls, the community evolution is to fast in this territory, because of get this stage (Homeostasis I) had took between 12 and 16 years. Is too important how due the big inclinations of slopes and the quantity of rainfalls, in this stage the consistent develop of the humus layer is absent. The greater frequency of canopy species in *Clidemio-Cyatheetum arboreae* is due to be close to forest fragments, and for that the rain of seeds work efficiently.¹⁸

Results

The following phytosociological arrangement was made:

- Class Clidemio - Cyatheetea arboreae Reyes 2021.
- Order Clidemio - Cyatheetalia arboreae Reyes 2021.
- Alliance Miconio prasinae – Cyatheion arboreae Reyes 2021.

This alliance have five associations, in this work two of them were described:

- Miconietum prasinae,
- Clidemio-Cyatheetum arboreae.

Miconietum prasinae Reyes & Acosta ass. nov.

(Table 1, holotypus inv. 3.)



Figure 1 Association *Miconietum prasinae* in south exposition.

Miconietum prasinae association with 29,1 species average is present in abandoned fields with exposition south, soils are red ferralitics and leached, coming from Sierra del Purial formation schist. Microrelief is regular and slope is between 12 to 45 degrees, with 20 to 22 degrees dominance; studied altitude was between 480 and 580 mosl.

Mainly layer was the shrub, between 4 and 5 m high and a cover of 80 to 100 %; the said layer is composed almost totally of

Miconia prasina (Sw.) DC., frequently isolated individual of *Cupania americana* L. and sometimes *Psidium guajava* L. were encounter. According to Viento Frio's inhabitants, this stage is reach about the 12 years to be abandoned the field. The same corresponding for the layer close with a Homeostasis I.

In this stage a humus layer developed still not observed, more frequent results L layer sometimes dispersed, the rest are traces, only where Fiera II begin is more developed (Inv. 7) layers L and F are defined; with frequency rainfalls had washed the surface.

Some stages with the beginning of Fiera II were found, with an incipient canopy layer of 7 to 12 m high and 10 to 30 % cover; where furthermore of *Cupania americana*, *Bactris cubensis* Burret, *Buchenavia tetraphylla* (Aubl.) R.A. Howard, *Calyptronomia occidentalis* (Sw.) H.E. Moore, *Sapium laurifolium* (A. Rich.) Griseb., *Clusia rosea* Jacq., *Spondias mombin* L., *Alchornea latifolia* Sw. and more dispersed *Chrysophyllum oliviforme* L. subsp. *oliviforme*, *Cecropia peltata* L. and *Schefflera morototoni* (Aubl.) Maguire were locally observed.

Two variants were differentiated *Byrsonima coriacea* and *Cupania americana*. It was studied 17-19.02.2004 (central part of territory N20°17', W74°43,4').

Table 1 Association *miconietum prasinae* in south exposition

Variants	<i>Byrsonima coriacea</i>		<i>Cupania americana</i>				
	1	2	3	4	5	6	7
N. order	1	2	3	4	5	6	7
Altitude (mosl)	480	480	580	580	540	540	560
Inclination (degrees)	22	22	20	20	12	20	45
Exposition	SE	SE	WSW	WSW	NNW	W	SSW
E ₃ - Canopy layer (covers %)	.	.	.	.	10-20	.	30
E ₂ - Shrub layer (%)	80	5	80	100	85	.	90
E ₁ - Herbaceous layer (%)	80	100	85	20	100	100	95
N. species	34	35	23	22	25	28	37
Characteristics							
E _{2,1} - <i>Miconia prasina</i> (Sw.) DC.	4	3	4	5	5	4	5
E ₁ - <i>Spermacoce laevis</i> Lam.	r	+	+	r	1	3	+
<i>Elephantopus mollis</i> Kunth	l	l	r	(+)	l	3	l
<i>Desmodium triflorum</i> (L.) P.DC.	r	+	l	r	l	+	+
<i>Nephrolepis brownii</i> (Desv.) Hovenk. & Miyam.	3	+	4	+	4	.	+
<i>Stachytarpheta cayennensis</i> (L.C. Rich.) Vahl	r	l	r	r	.	l	.
<i>Urena lobata</i> L.	.	.	l	+	l	l	+
<i>Clidemia hirta</i> (L.) D. Don	.	.	r	r	r	l	+
<i>Lycopodiella cernua</i> (L.) Pic. Serm.	2	2	l	.	.	l	+
Variants							
E ₂ - <i>Byrsonima coriacea</i> (Sw.) DC.	l	+	.	.	.	.	.
<i>Citharexylum fruticosum</i> L.	+	+	.	.	.	.	.
<i>Eugenia pinetorum</i> Urb.	+	+	.	.	.	.	.
<i>Guettarda valenzuelana</i> A. Rich.	+	+	.	.	.	.	.
<i>Casearia sylvestris</i> Sw.	l	l	.	.	.	.	.
<i>Conostegia xalapensis</i> (Bonpl.) D. Don	l	2	.	.	.	.	.
E ₁ - <i>Andropogon virginicus</i> L.	+	r	.	.	.	.	.
<i>Schizachyrium gracile</i> (Spreng.) Nash	+	l	.	.	.	.	.
<i>Miconia</i> sp.	+	2	.	.	.	.	.
<i>Eupatorium</i> sp.	+	+	.	.	.	.	.

Table I Continued...

Variants	<i>Byrsonima coriacea</i>		<i>Cupania americana</i>				
<i>Pteridium caudatum</i> (L.) Maxon	+	+	.	.	.	.	.
<i>Cyathea parvula</i> (Jenm.) Domin	+	l	.	.	.	.	.
<i>Sticherus bifidus</i> (Willd.) Ching	2	+	.	.	.	.	.
E _{3,2,1} - <i>Cupania americana</i> L.	.	.	r	r	r	.	2
E ₁ - <i>Tibouchina longifolia</i> (Vahl) Baill.	.	.	r ⁰	r ⁰	.	+	r ⁰
<i>Axonopus compressus</i> (Sw.) P. Beauv.	.	.	+	l	l	r	.
L- <i>Mikania micrantha</i> Jacq.	.	.	r	r	r	r	.
E ^{3,2} - <i>Psidium guajava</i> L.	.	.	r	.	.	+	l
E _{2,1} - <i>Guarea guidonia</i> (L.) Sleumer	.	.	r	.	r	.	r
E ₁ - <i>Blechnum occidentale</i> L.	.	.	.	r	2	.	4
<i>Oplismenus hirtellus</i> subsp. <i>setarius</i> (Lam.) Mez ex Ekman	.	.	.	r	l	.	l
<i>Scleria lithosperma</i> (L.) Sw.	.	.	.	r	.	2	3
<i>Spathoglottis plicata</i> Blume	.	.	.	(r)	r	.	+
Accompaniers							
E _{3,2} - <i>Calyptrogonia occidentalis</i> (Sw.) H.E. Moore	l	2	.	.	+	.	.
E ₃ - <i>Bactris cubensis</i> Burret	+	r	.	.	r	.	.
L- <i>Scleria secans</i> (L.) Britt.	+	.	l	+	2	.	.
E ₁ - <i>Coccocypselum herbaceum</i> Aubl.	2	l	+	.	.	.	.
<i>Rhytidophyllum exsertum</i> Griseb.	r	l	.	.	.	.	l
<i>Andropogon bicornis</i> L.	+	.	+	.	.	2	.
<i>Desmodium canum</i> (J. F. Gmel.) Schinz & Thell.	+	.	.	.	.	l	+
E _{3,1} - <i>Clusia rosea</i> Jacq.	+	.	.	.	.	.	l
<i>Sapium laurifolium</i> (A. Rich.) Griseb.	r	.	.	.	.	.	r
<i>Cecropia peltata</i> L.	.	r	.	.	.	.	+
E ₁ - <i>Cyathea horrida</i> (L.) Sm.	.	.	r	r	.	.	.
<i>Piper umbellatum</i> L.	.	.	.	r ⁰	.	r	.
<i>Clidemia umbellata</i> (Mill.) L.O.Wms.	r	.	.	.	.	r	.
<i>Hyptis verticillata</i> Jacq.	.	.	.	.	.	+	(r ⁰)
<i>Piper aduncum</i> L.	.	.	.	.	.	2	r
<i>Triunfetta semitriloba</i> Jacq.	.	.	.	.	+	+	.
<i>Gleichenella pectinata</i> (Willd.) Ching	.	+	.	2	.	.	.
L- <i>Turbina corymbosa</i> (L.) Raf.	.	.	r	(r)	.	.	.
<i>Mimosa pudica</i> L.	.	+	.	.	.	+	.

In addition to Table 1. Inv. 1. *Securidaca virgata* L. r, *Ipomoea microdactyla* Griseb. r, *Panicum* sp. +, *Philodendron lacerum* (Jacq.) Schott r; Inv. 2. *Polygala leptocaulis* T. & G. 1, *Sauwagesia brownei* Planch. 2, *Pitirogramma calomelanus* (L.) Link +, *Zanthoxylum martinicense* (Lam.) DC. r, *Tabebuia* sp. r, *Neurolaena lobata* (L.) R. Br. r, *Solanum nigrum* L. r, *Pentalinum luteum* (L.) Hansen & Wunderlin r; Inv. 3. *Passiflora suberosa* L. r; Inv. 5. *Buchenavia tetraphylla* (Aubl.) R.A. Howard (+), *Schefflera morotoni* (Aubl.) Maguire r, *Thelypteris reticulata* (L.) Proctor r, *Guazuma ulmifolia* L. r, *Zyzygium jambos* (L.) Alston r, *Pisonia aculeata* L. r; Inv. 6. *Chromolaena odorata* (L.) R.M. King & H. Rob. 1, *Vernonia cinerea* (L.) Less. r, *Sida rhombifolia* L. +, *Canavallia* sp. r, *Stenorhynchus lanceolatus* r; Inv. 7. *Cyathea arborea* (L.) Sm. +, *Spondias mombin* L. +, *Alchornea latifolia* Sw. r, *Eugenia* sp. +, *Phaius tankervilleae* (Banks) Blume r, *Macrothelypteris torresiana* (Gaudich.) Ching r, *Solanum antillarum* O.E. Schulz r, *Campyloneurum phyllitidis* (L.) C. Presl +, *Guzmania monostachia* (L.) Rusby ex Mez +, *Paulinia* sp. r, *Lygodium volubile* Sw. r.

Clidemio-Cyatheetum arboreae Reyes & Acosta ass. nov.

(Table 2, holotypus inv. 3.)



Figure 2 Association *Clidemio-Cyatheetum arboreae* in north exposition.

This phytocoenosis with 32.2 species average corresponding to an Homeostasis I developed in soils embrasure as results of an intramountain road build (Vía Mulata). This part of the road was made about 1988, extracted material were dumping down by the bulldozer, with the objective to carry out big slopes for circulation flat.

This unstable group of rocks (schist) and soils (red and leach ferralitic) was quiet without vegetal protection, and for that rainfalls took up part of surface material, resulting in an irregular microrelief. Inclination is between 40 to 45 degrees and fundamental exposition is in north direction.

Actually is covered by a low canopy layer, between 8 and 12 m high with a cover of 90 to 100 %, predominantly composed by *Cyathea arborea* (L.) J. Sm., conforming the first stable cover. Although the cover is practically total, this fern has a thin foliage allowing light filtration inside the ecosystem. Isolated in this layer *Piper aduncum* L., *Brunellia comocladifolia* subsp. *cubensis* Cuatrec., *Cecropia peltata*, *Trema micranthum* (L.) Blume, *Clidemia umbellata* (Mill.) L.O. Wms. and occasionally *Psidium guajava* and *Alchornea latifolia* are present.

The shrub layer is variable, between 5 and 30 %, sometimes there

are abundant species these are *Cyathea arborea* and *Rhytidophyllum exsertum* Urb.; *Piper aduncum*, *Clidemia umbellata*, *Heliconia caribaea* L., *Guarea guidonia* (L.) Sleumer are found too and occasionally *Psychotria grandis* Sw., *Brunellia comocladifolia* subsp. *cubensis*, *Miconia prasina* and *Spondias mombin*.

The herbaceous layer is the floral more diverse and cover between 70 and 90 %. More abundant species locally varying these are *Nephrolepis brownii* (Desv.) Hovenk. & Miyam., *Desmodium axillare* (Sw.) P. DC., *D. triflorum* (L.) P. DC., *Miconia prasina*, *Begonia wrightiana* A. DC., *Oplismenus hirtellus* subsp. *setarius* (Lam.) Mez ex Ekman, *Rhytidophyllum exsertum*, *Blechnum occidentale* L. and *Thelypteris reticulata* (L.) Proctor; with less cover other species are presents (Table 2).

In this community humus layer is not stabilized yet. The mainly fallen leaves contributed is *Cyahea arborea*, which provided an small, soft and easy discomposed material and hard woody foliage; due to the great slopes, intensity and high frequency of rainfalls that drag all the fine material, and for that there are only foliage traces of the before mentioned specie with irregular disposition, even over shrubs. It was studied 16-17.02.2004 (central territory N20°17,7', W74°42,4')

Table 2 Association *Clidemia - Cyatheetum arboreae* present in north exposition

N. order	1	2	3	4
Altitude (mosl)	490	510	530	520
Inclination (degrees)	40	40	40	45
Exposition	NW	NNW	NNW	NW
E ₃ - Canopy layer (%)	90	100	90	95
E ₂ - Shrub layer (%)	10	20	5	30
E ₁ - Herbaceous layer (%)	80	70	90	90
N. species	26	35	39	29
Characteristics				
E _{3,2,1} - <i>Cyathea arborea</i> (L.) J. Sm.	5	5	5	5
<i>Piper aduncum</i> L.	l	r	r	r
E _{2,1} - <i>Rhytidophyllum exsertum</i> Urb.	+	l	2	+
E ₁ - <i>Miconia prasina</i> (Sw.) DC.	l	2	2	2
<i>Clidemia hirta</i> (L.) D. Don	r	l	l	+
<i>Desmodium axillare</i> (Sw.) P. DC.	2	l	2	l
<i>D. triflorum</i> (L.) P. DC.	l	+	+	2
<i>Spathoglottis plicata</i> Blume	l	r	l	r
E ₃ - <i>Trema micranthum</i> (L.) Blume	.	r	l	2
E _{3,1} - <i>Cecropia peltata</i> L.	r	r	r	.
E _{2,1} - <i>Clidemia umbellata</i> (Mill.) L.O.Wms.	+	r	l	.
<i>Guarea guidonia</i> (L.) Sleumer	.	+	+	r
<i>Psychotria grandis</i> Sw.	.	+	+	r
E ₁ - <i>Myrsine coriacea</i> (Sw.) R. Br.	r	.	+	r
<i>Prestoea acuminata</i> subsp. <i>montana</i> (Graham) Greuter & R. Rankin	+	+	r	.
<i>Piper umbellatum</i> L.	.	r	+,l	r
<i>Oplismenus hirtellus</i> subsp. <i>setarius</i> (Lam.) Mez ex Ekman	.	3	3	+
<i>Axonopus compressus</i> (Sw.) Beauv.	+	l	+	.
<i>Rhynchospora colorata</i> (L.) H. Pfeiff.	+	+.2	+	.
<i>Nephrolepis brownii</i> (Desv.) Hovenk. & Miyam.	3	.	+	r ⁰
<i>Thelypteris reticulata</i> (L.) Proctor	+	.	+	2
<i>Macrothelypteris torresiana</i> (Gaud.) Ching	r	.	+	+
<i>Blechnum occidentale</i> L.	.	+	2	3
Accompaniers				
E _{3,2} - <i>Brunellia comocladifolia</i> subsp. <i>cubensis</i> Cuatrec.	r	.	2.	.
<i>Alchornea latifolia</i> Sw.	.	r	l	.

Table 2 Continued...

N. order	1	2	3	4
E _{3,1} - <i>Psidium guajava</i> L.	r	.	.	r
<i>Sapium laurifolium</i> (A. Rich.) Griseb.	r	.	.	r
E _{2,1} - <i>Dendropanax arboreus</i> Dcne. & Planch.	.	r	r	.
E ₂ - <i>Heliconia caribaea</i> L.	+	.	.	r
E ₁ - <i>Cupania americana</i> L.	.	+	r	.
<i>Piper arboreum</i> Aubl.	.	r	r	.
<i>Urena lobata</i> L.	.	.	+	r
<i>Machaerina cubensis</i> (Kuk.) T. Koyama	+	.	.	r
<i>Scleria secans</i> (L.) Britt.	.	r	.	l
<i>Begonia wrightiana</i> A. DC.	.	2	+	.
<i>Phaius tankervilleae</i> (Banks) Blume	.	r	.	+
<i>Thelypteris grandis</i> A.R. Sm.	r	.	+	.
L- <i>Paullinia</i> sp.	.	r	r	.
<i>Mucuna urens</i> (L.) DC.	.	r	r	.
<i>Mikania lindenii</i> S. Moore.	.	.	r	r

In addition to Table 2. Inv. 1. *Hedyosmum nutans* Sw. +, *Fabaceae* +, *Guzmania monostachia* (L.) Rusby ex Mez 1; Inv. 2. *Ocotea leucoxyloides* (Sw.) Mez (r), *Aiouea montana* (Sw.) R. Rohde 1, *Schefflera morototoni* (Aubl.) Maguire. r, *Campyloneurum brevifolium* (Lood. ex Link) Link +, *Cissus trifoliata* L. +, *Philodendrum lacerum* (Jacq.) Schott 1, *Miconia* sp. r; Inv. 3. *Clusia* sp. r, *Campyloneurum phillitidis* (L.) C. Presl r, *Citharexylum fruticosum* L. r, *Clethra cubensis* A. Rich. r, *Stachytarpheta cayennensis* (L.C. Rich.) Vahl r; Inv. 4. *Spondias mombin* L. r, *Scleria lithosperma* (L.) Sw. +, *Sticherus bifidus* (Willd.) Ching r, *Pavonia fruticosa* (Mill.) Fawcett & Rendle r, *Mikania micrantha* Kunth r.

Conclusions

In the study two types of Homeostasis I with different dominant species are described due mainly to the exposition in these rainy places. While in the south slope *Miconietum prasinae* with two layers *Miconia prasina* prevailing were, in the north slope *Clidemia-Cyatheetum arboreae* for the main species *Cyathea arborea* in all three layers predominant were. The time since the beginning of this series until the Homeostasis I is considered between 12 and 16 years.

Acknowledgments

None.

Conflicts of interest

There is no conflicts of interest.

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