LAZAROA 34: 257-266. 2013
doi:10.5209/rev_LAZA.2013.v34.n1.43236 ISSN: 0210-9778

The Biological Reserve of San Francisco (Ecuador): revision of the syntaxonomy and nomenclature of the vegetation

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Abstract: Izco, J. *The Biological Reserve of San Francisco (Ecuador): revision of the syntaxonomy and nomenclature of the vegetation. Lazaroa 34: 257-266 (2013).*

After a revision of the syntaxonomy and nomenclature made by R.W. Bussmann of the vegetation of the Reserva Biológica San Francisco, Cordillera Oriental, in the south of Ecuador, new syntaxa and new names are proposed.

Keywords: ICPN application, Ecuadorean tropical forests, Páramos, Bunchgrasses, *Nectandro laurel-Licarietea canellae, Miconio jahnii-Weinmannietalia pinnatae, Gaultherio glomeratae-Puyetalia nitidae, Hesperomelo ferruginae-Weinmannietea reticulatae*.

Resumen: Izco, J. *La reserva biológica de San Francisco (Ecuador): revision sintaxonómica y nomenclatural de la vegetación. Lazaroa 34: 257-266 (2013).*

A partir de la revisión de las propuestas sintaxonómicas y nomenclaturales de R.W. Bussmann sobre la vegetación de la Reserva Biológica San Francisco, Cordillera Oriental, en el sur de Ecuador, se proponen nuevos sintaxones y nuevos nombres.

Palabras clave: aplicación del CNF, bosques tropicales de Ecuador, Páramos, pajonales, *Nectandro laurel-Licarietea canellae, Miconio jahnii-Weinmannietalia pinnatae, Gaultherio glomeratae-Puyetalia nitidae, Hesperomelo ferruginae-Weinmannietea reticulatae*.

INTRODUCTION

At the end of the 1990s, Rainer W. Bussmann made a detailed analysis of the Andean vegetation in the south of Ecuador, in the area around the Biological Reserve of San Francisco, which is located in the Cordillera de Consuelo (part of the larger Cordillera Real or Cordillera Oriental), on the eastern slopes of the Andes in the province of Zamora-Chinchipe. His study concentrated on the altitudinal belt ranging from 1,800 to 3,150 m and dealt with different kinds of vegetation: low to high forests (which he identified with the so-called *jalca*) and the scrub and grass formations peculiar to the paramos. His study included more than 300 relevés which, when arranged into tables, provide evidence for the description of a score of associations and a large number of higher ranked syntaxa. These descriptions are accompanied by vegetation transects and references to the soil type of the plant communities.

R.W. Bussmann published the results of his research at different times and by different means. At all events, his studies constitute the first phytosociological approach to the vegetation of the south of Ecuador, particularly of the complex tropical forests which are very rich in species.

In recent years I have conducted field work in the southern part of the Andes in Ecuador, in the provinces of Azuay, Loja and Zamora-Chinchipe. The results of my research led me to revise the syntaxonomical and nomenclatural contributions made by R.W. Bussmann and to produce a new set of proposals which I put forward in this article.

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MATERIALS AND METHODS

For my analysis I have relied on the different studies on the Andean vegetation in the area around the Biological Station of San Francisco carried out by R. W. Bussmann. The first mention of this vegetation was in the book of abstracts of the *Congreso sobre la Conservación de la Biodiversidad de los Andes y la Amazonía* (BUSSMANN & LANGE, 2001). The fully developed paper was published the following year in digital form (BUSSMANN, 2002a) and printed in the *Herbario LOJA* series (BUSSMANN, 2002b). A year later, new publications reproduced almost exactly these previous papers in the digital journal Lyonia (BUSSMANN, 2003a) and in paper form (BUSSMANN, 2003b). Although there are other publications on the vegetation in the area surrounding the Biological Station, none of them present syntaxonomical proposals (BUSSMANN, 2005, 2008).

The nomenclatural analyses are based on the International Code of Phytosociological Nomenclature (ICPN) (WEBBER & *al*., 2000), which came into effect on 01/01/2002.

The analysis follows the ICPN cascade procedure, namely: effective publication and valid publication regardless of other non-applicable options. For a valid consideration, the following criteria were taken into account: if the original diagnosis is sufficient and, more precisely, if the ranks above the rank of association include a syntaxon of the next subordinate principal rank assigned to it and published with a valid name (Art. 2b, Art. 8, Art. 17); if it is clear from what taxon name(s) (species or infraspecific taxa) it is formed (Art. 3g); if it has been published and indicated *expressis verbis* as new (Art. 3i); if the name includes at least the name of a plant of the highest dominant stratum (Art. 3k, Art. 29b); if typification is correct (Art. 3o); if the term *typus* (*holotypus, lectotypus, neotypus*) is indicated *expressis verbis* (Art. 5); if the type relevé contains the name or names used for the construction of the name-giving taxon (taxa) (Art. 16). Following the ICPN, the names published invalidly according to articles 2-9 are treated as not published names (Def. IV).

Provisional names have been omitted in the analysis, since the ICPN (Art. 3b) regards them as invalid. The names of subassociations have not been analysed either. These are all invalid, as stipulated by Article 5. Finally, the proposals of facies, a rank not affected by the ICPN (Principle II), have also not been considered.

RESULTS AND DISCUSSION

SYNTAXONOMICAL AND NOMENCLATURAL ANALYSIS

The book of abstracts (BUSSMANN & LANGE, 2001) is an effective publication in all respects (ICPN Art. 1). However, it contains no precise nomenclatural proposals. The next publication of the research was in the form of a CD-ROM (BUSSMANN, 2002a), but an electronic publication fails to comply with the requirements for an effective publication (Art. 1). The publication by the herbarium LOJA (BUSSMANN, 2002b), dated after 01/01/2002, complies with the requirements for an effective print publication as stated in Article 1. The proceedings about the conservation of biodiversity of Andes and the Amazon (BUSSMANN, 2003a) in paperback complies with the requirements for an effective publication according the Art. 1 of the ICPN. Finally, for the publication of the research in the journal Lyonia (BUSSMANN, 2003b), it must be pointed out that "Lyonia is an electronic, peer-reviewed, interdisciplinary journal…" and, consequently, it also fails to meet the requirements for an effective publication (Art. 1) and its nomenclatural proposals are deemed not published (Definition III). Consequently, the only publications with concrete syntaxonomical proposals are those included in the Herbario LOJA (BUSSMANN, 2002b) and the hard copy with the contributions to the Congress in Cuzco (Peru; BUSSMANN, 2003a), which provide, without distinction (they both contain the same syntaxonomical proposals), the basis for this analysis.

The phytosociological behaviour and the distribution of species were analysed in order to compose the new names and arrange the lists of characteristic species.

For a better understanding of the analysis, I have followed the same descriptive model used in the mentioned publications.

Low mountain belt

Forests located between 1,800-2,150 m, usually in inaccessible valleys and on 30-50% slopes with an annual average rainfall of 2,500 l/m²/year. Table 1 (columns 48-58 excluded) gives a depiction of these forests. They have 2-3 tree strata with the highest one reaching 25-30 m in height. The tree canopy presents an average covering rate of about 75%, the scrub stratum of 50% and the grass stratum of 35%. These forests are very rich in species, particularly in epiphytes and trees, with more than 300 species in both cases in the Table of this unit. Two thirds of the relevés contain more than 100 species and have an average number of 70 species.

Graffenriedo emarginatae-Clethretum revolutae Izco *ass. nova*
(*Nectandro acutifoliae-Endlicherietum sericeae*, Bussmann 2002b, Tab. 1, cols. 1-11. Invalid name: Arts. 3o, 5 and 16).
Holotypus: Bussmann 2002b, Tab. 1, rel. 175.

Pruno opacae-Alchorneetum pearcei Izco *ass. nova*
(*Alzateetum verticillatae typicum* and *Alzateetum verticillatae Elaphoglossum cuspidatum* facies, Bussmann 2002 b, Tab. 1, cols. 12-27. Invalid names: Arts. 3o and 5).
Holotypus: Bussmann 2002b, Tab. 1, rel. 157.

Chusqueo dombeyanae-Dictyocarietum lamarckiani Izco *ass. nova*
(*Alzateo verticillatae-Dictyocaryetum lamarckianae*, Bussmann 2002b, Tab. 1, columns 28-30. Invalid name: Arts. 3f, 3o and 5).
Holotypus: Bussmann 2002b, Tab. 1, rel. 2.

Maurio membranifoliae-Podocarpion sprucei Izco *all. nova*
(*Alzation [errore, recte Alzateion] verticillatae*, Bussmann 2002b, Table 1, cols. 1-33). The text does not clearly indicate the characteristic or differential species. The wording suggests that the list of characteristic taxa provided corresponds to the order. However, the inclusion of a series of species in a box in Table 1, under the heading "Ch Alzation verticillatae", can be accepted as compliant with the requirements of Art. 8, paragraph 2. Invalid name: Arts. 2b, 3o, 5 and 8 paragraph 1.
Holotypus: *Graffenriedo emarginatae-Clethretum revolutae* Izco
Characteristic species. Trees: *Beilschmiedia olloiophylla, Cinchona macrocalys, Geissanthus vanderwerfii, Hyerominia asperifolia, Hyerominia duquei, Joosia aecuatoria, Mabea elata, Mauria membranifolia, Meriania drakei, Meriania rigida, Miconia corymbiformis, Miconia imitans, Podocarpus sprucei, Prunus opaca, Schefflea dielsii, Schefflea lasiogyne, Symplocos peruviana, Trichillia guianensis*. Epiphytes: *Anthurium dombeyanum, Anthurium incomptum, Blechnum caudatum, Elaphoglossum isophyllum, Lepanthes drymocharis, Lepanthes nummularia, Peperonia ecuadorensis, Pitiphyllum laricianum, Platystela acicularis, Polypodium latissimum, Racinaea euryelythra, Racinaea multiflora, Tillandsia confinis, Vittara gardeniana, Vriesea appendiculata*.

Tibouchino lepidotae-Cecropietum montanae Izco *ass. nova*
(*Cecropio montanae-Isertietum laevis*, Bussmann 2002b, Tab. 1, cols. 34-47. Invalid name: Arts. 3i, 3o and 5).
Holotypus: Bussmann 2002 b, Tab. 1, rel. 187.

Tibuchino lepidotae-Vismion tomentosae Izco *all. nova*
(*Cecropio montanae-Isertion laevis*, Bussmann 2002b, Tab. 1, cols. 34-47. Invalid name: Arts. 2b, 3o, 5 and 8).
Holotypus: *Tibouchino lepidotae-Cecropietum montanae* Izco
The vegetation is first-colonizing wood clearings and made up of fast-growing trees and large-sized shrubs belonging to *Maurio membranifoliae-Podocarpion sprucei*.
Characteristic species. *Alchornea grandiflora, Cousapea villosa, Cecropia montana, Cecropia polyphlebia, Tibuchina lepidota, Vismia tomentosa*.

Nectandro laevis-Clusietalia emarginartae Izco *ord. novus*
(*Alzateetalia verticillatae*, Bussmann 2002b. Invalid name: Arts. 2b, 3o, 5 and 8).

Holotypus: *Maurio membranifoliae-Podocarpion sprucei* Izco
Characteristic species. The order shares characteristic species with the alliances *Maurio membranifoliae-Podocarpion sprucei* and *Tibuchino lepidotae-Vismion tomentosae*. In addition, the following characteristic trees: *Clusia magnoliifolia* emarginata, *Cyathea caracasana, Eleagia karstenii, Graffenrieda emarginata, Hyerominia maritzii, Naucleopsis glabra, Nectandra laevis, Prumnopitys montana*. Epiphytes: *Anthurium breviscapum, Anthurium truncicola, Asplenium harpeodes, Dryadella perpusilla, Pitcairnia riparia, Peperonia eburnea, Polypodium subandinum, Racinaea monticola*.

Nectandro laurel-Licarietea canellae Izco *classis nova*
Holotypus: *Nectandro laevis-Clusietalia emarginartae* Izco
Characteristic species. The class shares characteristic species with the order *Nectandro laevis-Clusietalia emarginatae* (Art. 8). Also are characteristic the following trees and epiphytes: *Guzmania killipiana, Licaria canella, Mauria heterophylla, Mauria simplicifolia, Nectandra laurel, Persea caerulea, Pouteria bangii, Terpsicore dependens, Trichila maynasiana, Weinmannia pubescens*.

Incertae sedis

Brachyoto campanulare-Axinaeetum quitensis Izco *ass. nova*
(*Axineo quitensis-Dicranopteretum flexuosae*, Bussmann 2002b, Tab. 1, cols. 48-58. Invalid name: Arts. 3o and 5).
Holotypus: Bussmann 2002b, Tab. 1, rel. 88.

This is a scrub formation found in the altitudinal range peculiar to low mountain forests, with a low number of species and a low tree cover rate (*Cletra fagifolia, Miconia rivetii, Clusia magnifolia, Graffenrieda emarginata*). The species of *Nectandro laurel-Licarietea canellae* are so rarely found that no link with the class can be claimed.

High mountain belt

Tables 2, 3 and 4 (Bussmann, 2002b) give the results of the analysis at this level. This vegetation is found between 2, 100 and 2, 650/2, 750 m asl and made up of "one single tree stratum of 5-10 m in height, very seldom reaching 15 m". As can be seen in the relevés of Table 2, the total floristic richness is not as high as in the lower belt, with less than 200 tree species as a whole and a lower average number of species per relevé. The number of epiphytes is still high, with about 250 species. Orchids are extremely abundant, particularly those of the genera *Lepanthes* and *Pleurothallis*, and the same is true of some epiphytic polypodiaceae (*Terpsichore* and *Melponeme*).

Table 3 gives a description of some subassociations of *Purdiaeaetum* [*recte Purdiaeetum*] *nutantis*. As mentioned above, these are not dealt with in this analysis. At all events, all these proposals are invalid (Arts. 3o and 5).

Graffenriedo harlingii-Purdiaeetum nutantis Izco *ass. nova*
(*Purdiaeaetum* [*errore, recte Purdiaeetum*] *nutantis*, Bussmann 2002b, [Tab. 4]).

There is no table with that number. It presumably corresponds to the table located between numbers 3 and 5, pp. 71-76, cols. 110-125, 133-161. Invalid name: Arts. 3o and 5. The double proposal and corresponding typification of the association *Purdiaeetum nutantis* and "Purdiaetum nutantis –estado de vejez-" has no nomenclatural effect. The repetition of species in the table (*Myrsine andina, Miconia rivetii, Clusia multiflora, Clusia eliptica*), with different indices in some relevés are not considered as a cause of invalidation either.
Holotypus: Bussmann 2002b, [Tab. 4], pp. 71-76, rel. 6.

Panopsio ferrugineae-Frezieretum canescentis Izco *ass. nova*
(*Clusietum latipedis*, Bussmann 2002b, [Tab. 4], cols. 1-63, 126-132. Invalid name: Arts. 3o and 5). The repetition of species in the table (*Myrsine andina, Miconia rivetii, Clusia multiflora, Clusia eliptica*) with different indices in some relevés is not considered a cause of invalidation.
Holotypus: Bussmann 2002 b, [Tab. 4], pp. 71-76, rel. 285.

Schefflero pentandrae-Cinchonion mutisii Izco *all. nova*
(*Purdiaeion nutantis*, BUSSMANN 2002b, [Tab. 4], pp. 71-76, cols. 110-161. Invalid name: Arts. 2b, 3o, 5 and 8).
Holotypus: *Graffenriedo harlingii-Purdiaeetum nutantis* Izco
Characteristic species: *Cinchona mutisii, Freziera canescens, Graffenrieda harlingii, Guzmania diffusa, Guzmania vanvolxemii, Manettia pichinchensis, Maxillaria kingii, Miconia rivetii, Myrsine andina, Schefflera acuminata, Schefflera pentandra, Schefflera sodiroi, Symplocos coriacea*.

Miconio jahnii-Weinmannietalia pinnatae Izco *ord. novus*
(*Purdiaeaetalia* [*errore, recte Purdiaeetalia*] *nutantis*, BUSSMANN 2002b, [Tab. 4], pp. 71-76, cols. 1-63, 110-161. Invalid name: Arts. 2b, 3o, 5 and 8).
Holotypus: *Schefflero pentandrae-Cinchonion mutisii* Izco
Characteristic species: *Clusia daucoides, Clusia multiflora, Cyatea straminea, Dendrophthora densiflora, Disterigma alaternoides, Faramea flavicans, Geonoma densa,Graffenrieda emarginata, Nepanthes numularia, Masdevallia carruthersiana, Miconia jahnii, Miconia tinifolia, Otoglossum brevifolium, Panopsis ferruginea, Persea mutisii, Purdaea nutans, Semiramisia speciosa, Schefflera ferruginosa, Terpsichore asopteris, Tibaudia floribunda, Tristerix longebracteatus, Weinmannia elliptica, Weinmannia pinnata*.

Incertae sedis

Table 2 includes 63 relevés taken at altitudes ranging from 2,050 to 2,550 m asl. These relevés support the idea of numerous subassociations of *Neurolepietum* [*recte Neurolepidetum*] *elatae*. In these subassociations the grass stratum reaches 100% of the cover rate of all the relevés in the Table, mostly due to *Neurolepis elata*, a small-sized bamboo, 3 m high, which is present in 70% of the relevés and has a cover rate of ≥ 3. On the other hand, the tree stratum has an average cover rate of 27% for all the relevés considered globally, although 70% of them present a cover rate ≤ 25%.

However weakly, these data support the application of Articles 10 and 29 for syntaxon names making use of names of taxa from the lower stratum under a higher stratum exhibiting a cover rate over 25%, or equivalently, a minimum value of 3 on the Braun-Blanquet abundance-dominance scale. According to Article 3k, such names are invalid. However, it must be said that the names of the association and its subassociations are also invalid because the requirements mentioned in Articles 3o and 5 are not met.

Neurolepido elatae-Purdiaeetum nutantis Izco *ass. nova*
(*Neurolepietum elatae*, BUSSMANN 2002b, Tab. 2, cols. 1-63. Invalid name: Arts. 3k, 3o and 5).
Holotypus: BUSSMANN 2002b, Tab.1, rel. 161.

Andean Ceja forest

This kind of vegetation corresponds to a part of what BUSSMANN (2002b) calls *Jalca*, subalpine forest or *Andean Ceja*. These are highly dense and intricate belt, small-sized scrub formations with a very rich epiphytic stratum and a grass stratum with low or medium cover rate (< 50%). These plants are usually located between 2,750 (exceptionally, *communities* at lower altitudes too) and a little over 3,000 masl. The *Rynchosporetum kunthii* community, with species peculiar to flooded soils, is not included in this vegetation group. The community also fails to comply with the requirements to have a valid name and its presence in the Table is probably conditioned by the size of the sampling area, 225 m² in all cases.

Geissantho vanderwerffii-Panopsietum ferrugineae Izco *ass. nova*
(*Clusio ellipticae-Weinmannietum cochensis*, BUSSMANN 2002b, Tab. 5, cols. 1-15. Invalid name: Arts. 3o and 5).
Holotypus: Bussmann 2002 b, Table 5, rel. 200.

Brachyoto andreani-Axinaeetum macrophyllae Izco *ass. nova*

(*Axinieetum* [*errore, recte Axinaeetum*] *macrophyllae*, Bussmann 2002b, Tab. 5, cols. 16-21. Invalid name: Arts. 3o and 5).
Holotypus: Bussmann 2002 b, Tab. 5, rel. 250.
Disterigmo pentandri-Chusqueetum loxensis Izco *ass. nova*
(*Chusqueetum loxensis*, Bussmann 2002b, Tab. 5, cols. 22-32. Invalid name: Arts. 3o and 5).
Holotypus: Bussmann 2002 b, Tab. 5, rel. 242.

The relevés ascribed to this association in Table 5 differ considerably from those of the associations *Geissantho vanderwerffii-Panopsietum ferrugineae* and *Brachyoto andreani-Axinaeetum macrophyllae* as is clearly revealed by the absence or very rare presence of trees and shrubs and the high number of characteristic grasses belonging to the order and the class.

Ilici rimbachii-Hedyosmion luteynii Izco *all. nova*
(*Clusio ellipticae-Weinmannion cochensis*. Bussmann 2002b, Tab. 5, cols. 1-21). Excluded the associations *Chusqueetum loxensis* and *Rhynchosporetum kunthii*. Invalid name: arts. 2b, 3o, 5 and 8.
Holotypus: *Geissantho vanderwerffii-Panopsietum ferrugineae* Izco
Characteristic species: *Berberis beauverdiana, Brachyotum andreanum, Brachyotum confertum, Brachyotum fraternum, Geissanthus vanderwerffii, Gynoxys cuicochensis, Gynoxys mucronata, Hedyosmum scabrum, Hyeronima duquei, Hypericum decandrum, Ilex rimbachii, Miconia bullata, Oreocallis mucronata, Panopsis ferruginea, Persea bullata, Pitcairnia trianae, Ribes ecuadorense, Schefflera acuminata*.

Freziero karstemianae-Weinmannietalia cochensis Izco *ord. novus*
(*Clusio ellipticae-Weinmannietalia cochensis*. Bussmann 2002b. Invalid name: Arts. 2b, 3o, 5 and 8).
Holotypus: *Ilici rimbachii-Hedyosmion luteynii* Izco
Characteristic species: those of the alliances *Ilici rimbachii-Gynoxydion mucronatae*. In addition: *Antidaphne andina, Axinaea macrophylla, Baccharis macrantha, Berberis lutea, Brachyotum setosum, Cyathea brevistipes, Disterigma acuminatum, Freziera karstemiana, Gaultheria glomerata, Geonoma weberbaueri, Gynoxys laurifolia, Hedyosmum luteynii, Hesperomeles ferruginea, Hyeronima maritziana, Ocotea infrafoveolata, Paepalanthus meridensis, Peperomia hartwegiana, Ribes andicola, Themistoclesia epiphytica, Vaccinium crenatum, Valeriana microphylla, Weinmannia cochensis, Weinmannia reticulata*.

Hesperomelo ferrugineae-Weinmannietea reticulatae Izco *classis nova*
Holotypus: *Freziero karstemianae-Weinmannietalia cochensis* Izco

Very compact shrub-like communities in well-developed stages but relatively sparse in juvenile stages with many small-sized trees; inmature formations and those in wind-swept places host many of the species of the arbustive *páramos* located at higher altitudes. The class is found at 2,500 to 3,000 m on the eastern side of the southern Ecuadorean Andes.
Characteristic species: those of the order *Freziero karstemianae-Weinmannietalia cochensis*.

Páramo belt

This vegetation is found at relatively high altitudes (from 2750 to 3100 masl, which corresponds to the low paramo). The cover rate of the grass stratum is very high, over 80-90%, and reaches 100% in 62% of the relevés. As is usually the case in a typical *pajonal*, perennial species are dominant. The floristic richness of this stratum is also worthy of note. The scrub stratum covers 10-30% of the surface and there is no tree stratum.

Puyo eryngioidis-Calamagrostietum intermediae Izco *ass. nova*
(*Puyetum eryngioidis*, Bussmann 2002b, Tab. 6, cols. 22-36. Invalid name: Arts. 3o and 5).
Holotypus: Bussmann 2002b, Tab. 6, rel. 213.

Epidendro frigidae-Calamagrostietum intermediae Izco *ass. nova*
(*Epidendretum frigidae*, Bussmann 2002b, Tab. 6, cols. 37-42. The sets of relevés indicated for *Epidendretum frigidae* and *Epidendretum frigidae typicum* in the text do not coincide with those of Table 6. Invalid names (Arts. 3o and 5).

Holotypus: BUSSMANN 2002b, Table 6, rel. 134.
Puyo eryngioidis-Chuquiragion jussieui Izco *all. nova*
(*Puyon* [*errore, recte Puyion*] *eryngioidis*. BUSSMANN 2002b, Tab. 6, cols. 22-42). The association *Puyetum nitidae* (Tab. 6, rels. 43-45) proposed by Bussmann is excluded from the alliance. The presence of *Isoetes ecuadorensis, Isolepis inundata, Pinguicula calyptrata, Ranunculus peruvianus*, etc., together with species of relatively dry environments reveals that these relevés belong to a different kind of vegetation, peculiar to peaty, flooded soils. Probably the area of the sampled sites (225 m^2 in all the cases) has something to do with this fact, because they include vegetation mosaics. Invalid name (Arts. 2b, 3o, 5, 8).
Holotypus: *Puyo eryngioidis-Calamagrostietum intermediae* Izco
Characteristic species: *Bomarea brachysepala, Bomarea uncifolia, Chuquiraga jussieui, Gaultheria manigera, Gaultheria tomentosa, Lupinus interflorens, Puya eryngioides, Puya nitida*.

Gaultherio glomeratae-Puyetalia nitidae Izco *ord. novus*
(*Neurolepio-Puyetalia*, BUSSMANN 2002b, Tab. 6, cols. 22-42). *Gynoxion* [*errore, recte Gynoxydion*] *cuicochensis excluded*. The original name does not indicate the specific epithets, nor is it evident which one must be used, because *Neurolepis laegaardii, N. weberbaueri, N. nana, N. asymetrica, N. aristata* are present in Table 6, but *Puya eryngioidis* and *P. nitida* are also mentioned. Invalid name: Arts. 2b, 3g, 3o, 5 and 8.
Holotypus: *Puyo eryngioidis-Chuquiragion jussieui* Izco
Characteristic species: those of the alliance *Puyo eryngioidis-Chuquiragion jussiaei* and *Chusquea perligulata, Chusquea tesselata, Dorobaea pimpinellifolia, Gaultheria amoena, Gaultheria glomerata, Huperzia hypogea, Neurolepis asymetrica, Oritrophium peruvianum, Rumex tolimensis, Paepalanthus meridensis*.

Incertae sedis, páramo belt

In the paramo belt Bussmann (2002b) describes a series of associations differing from the others included in Table 6. Their ascription to higher ranks requires further information for an adequate systematic arrangement.

Neurolepido laegaardii-Geonometum weberbaueri Izco *ass. nova*
(*Neurolepio* [*errore, recte Neurolepido*] *laegaardii-Geonometum weberbaueri*, BUSSMANN 2002b, Tab. 6, cols. 1-3. Invalid name: Arts. 3o and 5).
Holotypus: BUSSMANN 2002b, Tab. 6, rel. 128.

Neurolepido laegaardii-Brachyotetum campanulare Izco *ass. nova*
(*Neurolepietum laegaardii*, Bussmann 2002b, Tab. 6, cols. 4-11. Invalid name: Arts. 3o and 5).
Holotypus: BUSSMANN 2002b, Tab. 6, rel. 226.

Both plant communities, *Neurolepio laegaardii-Geonometum weberbaueri* and *Neurolepio laegaardii-Brachyotetum campanulare*, subordinate to the alliance *Neurolepion* [*errore, recte Neurolepidion*] *laegaardii* (BUSSMANN 2002 b), seem to correspond to a kind of vegetation different from the *achupallales* of *Puya eryngioides* and *Puya nitida*. There is even doubt as to whether both associations belong to the same vegetation group. The nomenclatural proposal of the alliance is nevertheless invalid (Arts. 2b, 3o, 5 and 8).

Neurolepido laegaardii-Chusqueetum loxensis Izco *ass. nova*
(*Gynoxietum cuicochensis*, BUSSMANN 2002b, Tab. 6, cols. 12-16. Invalid name: Arts. 3o and 5).
Holotypus: BUSSMANN 2002b, Table 6, rel. 230.

Neurolepido aristatae-Chusqueetum leonardiori Izco *ass. nova*
(*Neurolepietum* [*errore, recte Neurolepidetum*] *aristatae*, BUSSMANN 2002b, Tab. 6, cols. 17-21. Invalid name: Arts. 3o and 5).
Holotypus: BUSSMANN 2002b, Tab. 6, rel. 147.

These last two associations, subordinate to the alliance *Gynoxyon* [*errore, recte Gynoxydion*] *cuicochensis* in the publication by BUSSMANN (2002b), differ from the others included in Table 6. Regardless of any possible relationship bet-

ween the two, integration into higher units requires further investigation. The nomenclatural proposal of the alliance is nevertheless invalid (Arts. 2b, 3o, 5 and 8).

CONCLUSIONS

Of R. W. Bussmann's published contributions on the vegetation of the Estación Biológica San Francisco, on the eastern slopes of the Andes which include syntaxonomical proposals, only two (Bussmann, 2002b, 2003a) meet the requirements for an effective publication (ICPN Art. 1). As stated in the both publications, the publication date of the contribution is > 1.1.2002. In all cases, the nomenclatural proposals are accompanied by the word "holotípo" and, therefore, they fail to comply with the rigorous requirements demanded by the ICPN Arts. 3o and 5: "On or after 1.1.2002 the Latin word '*typus*' ('*holotypus*', '*lectotypus*', '*neotypus*') is to be used *expressis verbis* for the designation of the type of a syntaxon name". In some cases the requirements stated in Articles 2b, 3f, 3g, 3i, 3k, 8, 16 and 17 are not met either. The mere non compliance with Articles 3o and 5 means that the proposal is invalid and, according to Definition IV, invalid names must be treated as "not published names", which justifies new proposals for adequate naming of syntaxa. The subassociations proposed in Bussmann's works are also invalid as a result of non compliance with Articles 3o and 5. Some of the associations or high-ranked syntaxa proposed merit complementary documentation before any decision is taken as to their acceptance or rejection.

As a result of the previous observations, propose the following syntaxonomical classification is proposed:

Low mountain forest belt

Nectandro laurel-Licarietea canellae Izco *classis nova*
Nectandro laevis-Clusietalia emarginartae Izco *ord. novus*
(*Alzateetalia verticillatae* nom. inval.)
Maurio membranifoliae-Podocarpion sprucei Izco *all. nova*
(*Alzation verticillatae* nom. inval.)
Pruno opacae-Alchorneetum pearcei Izco *ass. nova*
(*Alzateetum verticillatae* typicum nom. inval.)
Chusqueo dombeyanae-Dictyocarietum lamarckiani Izco *ass. nova*
(*Alzateo verticillatae-Dictyocaryetum lamarckianae* nom. inval.)
Graffenriedo emarginatae-Clethretum revolutae Izco *ass. nova*
(*Nectandro acutifoliae-Endlicherietum sericeae* nom. inval.)
Tibuchino lepidotae-Vismion tomentosae Izco *all. nova*
(*Cecropio montanae-Isertion laevis* nom. inval.)
Tibouchino lepidotae-Cecropietum montanae Izco *ass. nova*
(*Cecropio montanae-Isertietum laevis* nom. inval.)

***Incertae sedis*. Low mountain forest belt**

Brachyoto campanulare-Axinaeetum quitensis Izco *ass. nova*
(*Axineo quitensis-Dicranopteretum flexuosae nom. inval.*)

High mountain forest belt

Miconio jahnii-Weinmannietalia pinnatae Izco *ord. novus*
(*Purdiaeaetalia nutantis nom. inval.*)
Schefflero pentandrae-Cinchonion mutisii Izco *all. nova*

(*Purdiaeion nutantis nom. inval.*)
Graffenriedo harlingii-Purdiaeetum nutantis Izco *ass. nova*
(*Purdiaeaetum nutantis nom. inval.*)
Panopsio ferrugineae-Frezieretum canescentis Izco *ass. nova*
(*Clusietum latipedis nom. inval.*)

***Incertae sedis*. High mountain forest belt**
Neurolepido elatae-Purdiaeetum nutantis Izco *ass. nova*
(*Neurolepietum elatae nom. inval.*)

Andean Ceja forest
Hesperomelo ferruginae-Weinmannietea reticulatae Izco *classis nova*
Freziero karstemianae-Weinmannietalia cochensis Izco *ord. novus*
(*Clusio ellipticae- Weinmannietalia cochensis nom. inval.*)
Ilici rimbachii-Hedyosmion luteynii Izco *all. nova*
(*Clusio ellipticae-Weinmannion cochensis nom. inval.*)
Brachyoto andreani-Axinaeetum macrophyllae Izco *ass. nova*
(*Axinieetum macrophyllae nom. inval.*)
Disterigmo pentandri-Chusqueetum loxensis Izco *ass. nova*
(*Chusqueetum loxensis nom. inval.*)
Geissantho vanderwerffii-Panopsietum ferrugineae Izco *ass. nova*
(*Clusio ellipticae-Weinmannietum cochensis nom. inval.*)

Páramo belt
Gaultherio glomeratae-Puyetalia nitidae Izco *ord. novus*
(*Neurolepio-Puyetalia nom. inval.*)
Puyo eryngioidis-Chuquiragion jussieui Izco *all. nova*
(*Puyon eryngioidis nom. inval.*)
Epidendro frigidae-Calamagrostietum intermediae Izco *ass. nova*
(*Epidendretum frigidae nom. inval.*)
Puyo eryngioidis-Calamagrostietum intermediae Izco *ass. nova*
(*Puyetum eryngioidis nom. inval.*)

***Incertae sedis*. Páramo belt**
Neurolepido laegaardii-Geonometum weberbaueri Izco *ass. nova*
(*Neurolepio laegaardii-Geonometum weberbaueri nom. inval.*)
Neurolepido laegaardii-Brachyotetum campanulare Izco *ass. nova*
(*Neurolepietum laegaardii nom. inval.*)
Neurolepido laegaardii-Chusqueetum loxensis Izco *ass. nova*
(*Gynoxietum cuicochensis nom. inval.*)
Neurolepido aristatae-Chusqueetum leonardiori Izco *ass. nova*
(*Neurolepietum aristatae nom. inval.*)

ACKNOWLEDGEMENTS

I am grateful to José Guevara and Iván Vélez for their help in finding some papers by R. W. Bussmann and to Federico Fernández for his comments on the original manuscript.

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Received: 3 September 2013
Accepted: 15 November 2013