Espirales
Revista multidisciplinaria de investigación científica

Population status of two species of Ericaceae in the High Montane Forest

Estado poblacional de dos especies de Ericaceae, en el Bosque Montano Alto

Jorge Marcelo Caranqui Aldaz*
Jenny Elizabeth Núñez Ramos*
Edmundo Danilo Guilcapi Pacheco*
Ana Gabriela Alulema Aucapiña*

Received: December 12, 2022
Approved: February 09, 2023

Cite this:

Caranqui, J., Núñez, J., Guilcapi, E., Alulema, A. (2023). Population status of two species of Ericaceae, in the Montano Alto Forest. *Espirales. Revista Multidisciplinaria de investigación científica*, *7* (45), 38-48.

Abstract

In this work, a demographic study of *Gaultheria glomerata and Disterigma empetrifolium* was carried out in the Indiviso sector of the Baquerizo Moreno parish, Píllaro canton, Tungurahua province. The vegetation was analogous between montane forest and shrubby moorland, located at coordinates 01°18'S; 78°30'W, altitude 3400 m.a.s.l., where the Braun-Blanquet methodology for vegetation cover was adapted by means of plots, which were established randomly, the minimum distance between plot and plot was considered to be 100 meters. In the field work, the existing vegetation cover was quantified by percentages within 10 plots of 10x10m, in each of them were evaluated its subquadrants in the form of L, at each meter. The species were identified in the Herbarium of the ESPOCH, and the calculated data were 35.69% of vegetation cover for *Disterigma empetrifolium* and 13.19% for *Gaultheria glomerata,* which are in an abundance index of 2-3 on the Blanquet scale that tells us that it belongs to a medium abundant and abundant cover, Therefore, it was determined that *Disterigma empetrifolium* has a cover between 25-50%, thus concluding that it is in index 3 on Blanquet's scale, and *Gaultheria glomerata* was found in a percentage of 5-25%, concluding that this species is in index 2 on Blanquet's scale.

Key words: Analogous vegetation, montane forest, shrub páramo, vegetation cover, demographic characterization.

* Master's Degree in Biodiversity in Tropical Areas and its Conservation, Teaching Technician of the Herbarium, Escuela Superior Politécnica de Chimborazo, Riobamba, Ecuador.jcaranqui@espoch.edu.ec
https://orcid.org/0000-0001-7555-1294
* PhD in Sustainable Agriculture, Teaching Technician, Escuela Superior Politécnica de Chimborazo, Riobamba, Ecuador.jenunez@espoch.edu.ec
https://orcid.org/0000-0001-5244-9342
* Master in Biodiversity and Genetic Resources, Professor and Researcher, Faculty of Natural Resources, Escuela Superior Politécnica de Chimborazo, Riobamba, Ecuador. eguilcapi@espoch.edu.ec https://orcid.org/0000-0001-5072-1437
* Associate Researcher, Escuela Superior Politécnica de Chimborazo, Riobamba, Ecuador. ana.alulema@espoch.edu.ec https://orcid.org/0000-0002-4978-0162

Abstract

En este trabajo se realizó un estudio demográfico de *Gaultheria glomerata y Disterigma empetrifolium*, en el sector del Indiviso, de la parroquia Baquerizo Moreno, cantón Píllaro, provincia de Tungurahua. El cual presentaba una vegetación análoga entre bosque montano y páramos arbustivo, ubicado en las coordenadas 01°18´S; 78°30´W, altitud 3400 m.s.n.m., en donde se adaptó la metodología de Braun-Blanquet para cobertura vegetal por medio de parcelas, las cuales fueron establecidas al azar, la distancia mínima entre parcela y parcela se consideró 100 metros. En el trabajo de campo se cuantificó mediante porcentajes, la cobertura vegetal existente dentro de 10 parcelas de 10x10m, en cada una de ellas se evaluó sus subcuadrantes en forma de L, a cada metro. Las especies se identificó en el Herbario de la ESPOCH, y los datos calculados fueron 35,69% de cobertura vegetal para *Disterigma empetrifolium* y 13,19% para *Gaultheria glomerata,* que se encuentran en un índice de abundancia del 2-3 en la escala de Blanquet que nos dice que pertenece a una cobertura medianamente abundante y abundante, por lo cual se determinó que *Disterigma empetrifolium*, posee una cobertura que se encuentra entre los 25-50%, concluyendo de esta manera que se encuentra en un índice 3 de la escala de Blanquet, y *Gaultheria glomerata* se encontró en un porcentaje de 5 - 25% concluyendo que dicha especie se encuentra en un índice 2 de la escala de Blanquet.

Palabras clave: Vegetación análoga, bosque montano, páramo arbustivo, cobertura vegetal, caracterización demográfica.

Introduction

Ecuador is considered one of the most diverse countries in the world according to records deposited in the main herbaria of the world, at least 4,868 species of vascular plants with seeds, of which 1,566 are shrubs and trees, grow above 2,400 m.a.s.l. (Jørgensen and Ulloa 1995). Many of these species are endemic and are considered endangered (Henninger, 1998).

The montane forest has a very diverse vegetation due to the biogeographic barriers common in the mountains such as the presence of horizontal rainfall, thus the humidity remains on site; a unique characteristic of these forests is that the higher the altitude, the greater the diversity of flora (Araujo-Murukami, 2005). However, today they are considered one of the most vulnerable systems to human intervention due to overuse and conversion to agricultural systems and pastures (Brown & Kapelle, 2005). The shrub páramo is of the páramo ecosystems categorized as one of the most biodiverse sites (Pauli et al., 2015). Ecuador has an altitudinal range between 3000 and 4500 m.a.s.l. and contains 30% of vascular plants. At 3100 m.a.s.l., shrubs, herbs of various types, rosette plants and cushion plants (Asteraceae, Apiaceae, Ericaceae, Geraniaceae, Plantaginaceae, Brassicaceae and Juncacea) begin to appear (Sierra, 1999).

The Ericaceae family is one of the most representative, they coexist mainly in mountain forests, in addition, the Ericaceae, ecologically have an important role as a food source

(nectar, fruits and corollas) for species of large mammals such as the spectacled bear and smaller mammals, also for birds such as hummingbirds, among others (Huamantupa et al., 2018). The objective of this work is to contribute to the knowledge on the phenological state and percentage of vegetation cover of the two species Gaultheria glomerata (Cav.) Sleumer and Disterigma empetrifolium (Kunth) Drude.

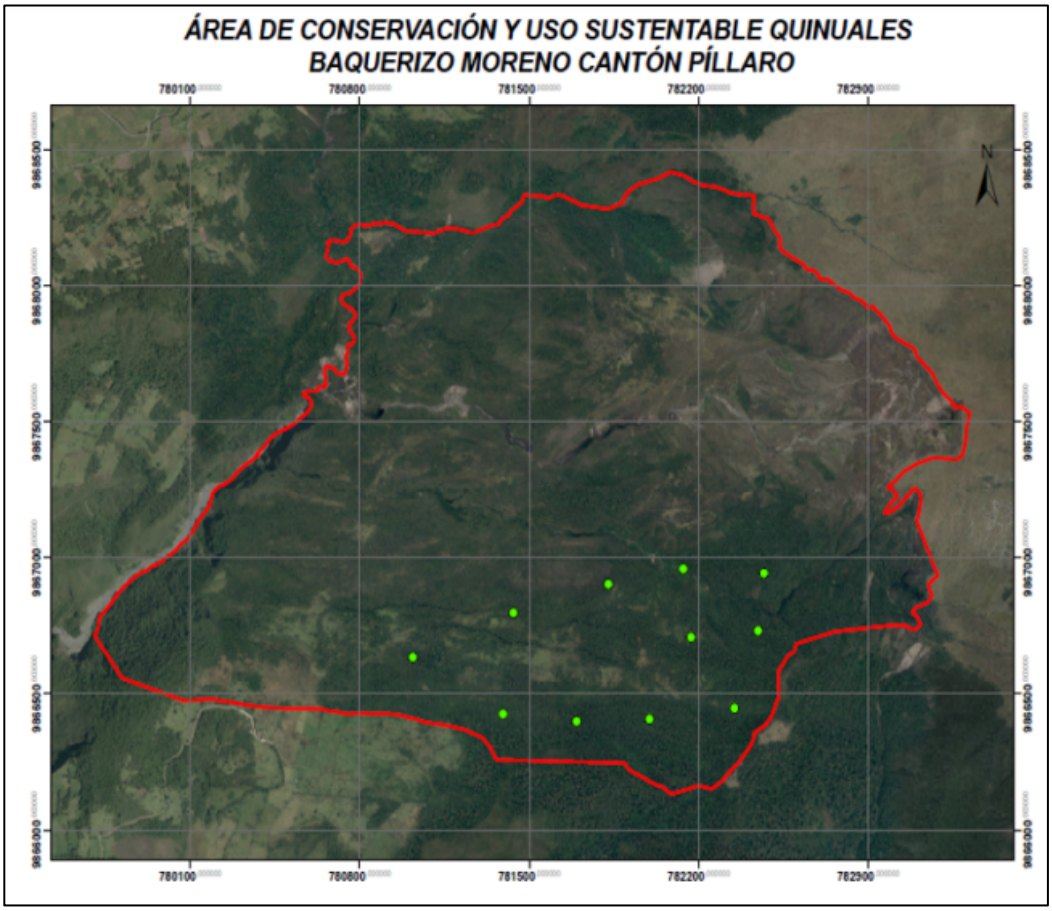
In addition, Baquerizo Moreno is considered a conservation area and the efforts made by its authorities and the Big Mammals Conservation Foundation (which supports the conservation of the Andean bear or spectacled bear), have been of great importance to raise awareness among the inhabitants so that there is a responsibility to protect and conserve the biodiversity of these ecosystems.

Human activity in agricultural and livestock expansion has caused the continuous loss of biodiversity; Ecuador is considered a megadiverse country in flora and fauna as it is crossed by the Andes Mountains. Over the decades, native species have had to adapt to the drastic changes brought about by human activity. By increasing the livestock frontiers causes the disappearance of many native species so the objective of this study is to conduct a demographic study of Gaultheria glomerata and Disterigma empetrifolium, in the analogous vegetation of undivided, in the Parish Baquerizo Moreno, Píllaro Canton, Province of Tungurahua; to benefit the Parish Baquerizo Moreno in the future can restore the montane forest with the species Gaultheria glomerata (Cav.) Sleumer and Disterigma empetrifolium (Kunth) Drude.

Materials and methods

The work was carried out in the buffer zone of the high montane forest (Sierra, 1999; Caranqui and Ortiz 2021; MAE, 2013) located in the Indiviso Sector, at coordinates 01018'S; 78030'W, with an altitude of 3400 meters above sea level in the Baquerizo Moreno Parish, Píllaro canton, Tungurahua province.

Figure 1. Study area



Source: Caranqui, (2019)

We began by identifying the species with the greatest potential in the area and conducted a descriptive analysis that allowed us to calculate basic parameters on the data set obtained in the field (Caranqui, 2011; Caranqui & Romero, 2014; Cerón, 2003; Phillips & Miller, 2002; Jorgensen & León-Yanez, 1999; Trópicos.org, 2022).

For the population study, the Braun-Blanquet methodology of 1979 was used, which is based on the arrangement of floristic data by hand and on fundamental concepts and assumptions. In which data is taken from the survey (relevé), it is a sample of vegetation or stand equivalent to the quadrat. The percentage of vegetation cover is estimated using the Braun-Blanquet scale, in which abundance and dominance are combined; the two lower indices (+, r) record abundance while the remaining ones (1, 2, 3, 4, 5) take into account cover or dominance (Table 1) (Westhoff and Van der Maarel, 1978; Ducuara, 2013).

Table 1. *Braun - Blanquet abundance and dominance scale.*

INDEX	MEANING
R	A SINGLE INDIVIDUAL
+	MORE INDIVIDUALS, VERY LOW COVERAGE
1	COVERAGE LESS THAN 5%.
2	COVERAGE FROM 5 TO 25%.
3	COVERAGE FROM 25 TO 50%.
4	50 TO 75% COVERAGE
5	COVERAGE EQUAL TO OR GREATER THAN 75%.

Source: Ducuara, 2013

Sampling was carried out in the buffer zone of the high montane forest, for which the methodology of random plots was adapted, points were taken at each vertex to identify where each plot was located, in addition stakes were placed at each point to delimit each plot, each stake had a height of 60 cm and was tied with a yellow citation for quick identification. Ten 10 x 10 meter plots were made with a minimum distance of 100 m between plots, thus obtaining a sample area of 1000 square meters. In each plot, data were collected on the percentage of vegetation cover, height and phenological state of the plants. To spatially locate and determine the vegetation cover and phenological state, the plots and their subquadrants were delimited in an L shape and each point was directed in a northerly direction, the subquadrants were located every meter, and were delimited by ropes. Data was taken at each meter, forming quadrants of 1 x 1 m and a scale of coverage was determined, where if the vegetation cover in each meter occupied the entire site of the quadrant, it was considered as 100%, if it occupied half, 50% and if it was a quarter, 25% subjectively, and the percentage of vegetation cover, phenological state, and height were determined in the 10 plots that were established.

Figure 2. Sample collection in the parish of Baquerizo Moreno, province of Tungurahua.

Results

The methodology of plots adapted to Braun - Blanquet, allowed the establishment of subjectively random plots in the Indiviso sector, which is a transition zone between montane forest and shrubby moorland and the total percentage of vegetation cover determined the presence of *Disterigma empetrifolium* in 35,69% on the abundance scale, according to Table 1, it is located in index 3 which belongs to the 25-50% range, determining a moderately uniform coverage, according to Caranqui and Ortíz (2021), in their study cites that *D. empetrifolium* is a shrubby moorland species and the presence of rainfall and abundance of water resources form a viable ecosystem for this species to adapt to this transition zone and *Gaultheria glomerata* with a percentage of 13, 19% on the abundance scale is located in index 2, which belongs to the range of 5 - 25% determining a non-uniform coverage, being a montane forest species they form small shrubs that were found scattered in the plots. According to what is indicated in Table 1 and 2 that speaks of the scale of abundance and the percentage of vegetation cover respectively. Regarding the phenological state of the two species, qualitative data were collected and represented as follows: F (fertile) plants that were in bloom and I (infertile) plants without flower or juveniles, *D. empetrifolium* by forming a compact or grouped vegetation cover could be observed in each plot if it was in bloom, on the other hand in *G. glomerata* being a small shrub and being dispersed the observation was done more carefully. The phenological state of the plots *D. empetrifolium* was in a fertile period, while *G. glomerata was* in an infertile state.

Table 2. *Percentage of vegetation cover, phenological stage and height in (cm).*

PLOT 1			
TOTAL AVERAGE	Percentage	Phenological stage (fertile (F); infertile	Height
Gaultheria glomerata	0	I	0
Disterigma	25,7	F	2,25
PLOT 2			
TOTAL AVERAGE	Percentage	Phenological stage (fertile (F); infertile	Height
Gaultheria glomerata	0,6	F	0,8
Disterigma	1,6	F	0,6
PLOT 3			
TOTAL AVERAGE	Percentage	Phenological stage (fertile (F); infertile	Height
Gaultheria glomerata	16,8	I	6,14
Disterigma	41	F	3,05
PLOT 4			
TOTAL AVERAGE	Percentage	Phenological stage (fertile (F); infertile	Height
Gaultheria glomerata	1,5	F	2,05
Disterigma	60,6	I	4,2
PLOT 5			
TOTAL AVERAGE	Percentage	Phenological stage (fertile (F); infertile	Height
Gaultheria glomerata	29,4	I	5,3
Disterigma	32,9	F	2,45
PLOT 6			
TOTAL AVERAGE	Percentage	Phenological stage (fertile (F); infertile	Height
Gaultheria glomerata	24,4	F	5,94
Disterigma	29,8	F	3,33

PLOT 7			
TOTAL AVERAGE	Percentage	Phenological stage (fertile (F); infertile	Height
Gaultheria glomerata	4,4	I	3,18
Disterigma	49,5	F	3,16
PLOT 8			
TOTAL AVERAGE	Percentage	Phenological stage (fertile (F); infertile	Height
Gaultheria glomerata	6,4	F	3,07
Disterigma	49,5	I	1,9
PLOT 9			
TOTAL AVERAGE	Percentage	Phenological stage (fertile (F); infertile	Height
Gaultheria glomerata	6,4	I	2,11
Disterigma	33,5	I	32,25
PLOT 10			
TOTAL AVERAGE	Percentage	Phenological stage (fertile (F); infertile	Height
Gaultheria glomerata	42	I	10,05
Disterigma	29,6	F	3,12
%TOTAL			
Disterigma empetrifolium		35,69	
Gaultheria glomerata		13,19	

Figure 3. Representative curve of the percentage of vegetation cover of *Gaultheria glomerata.*

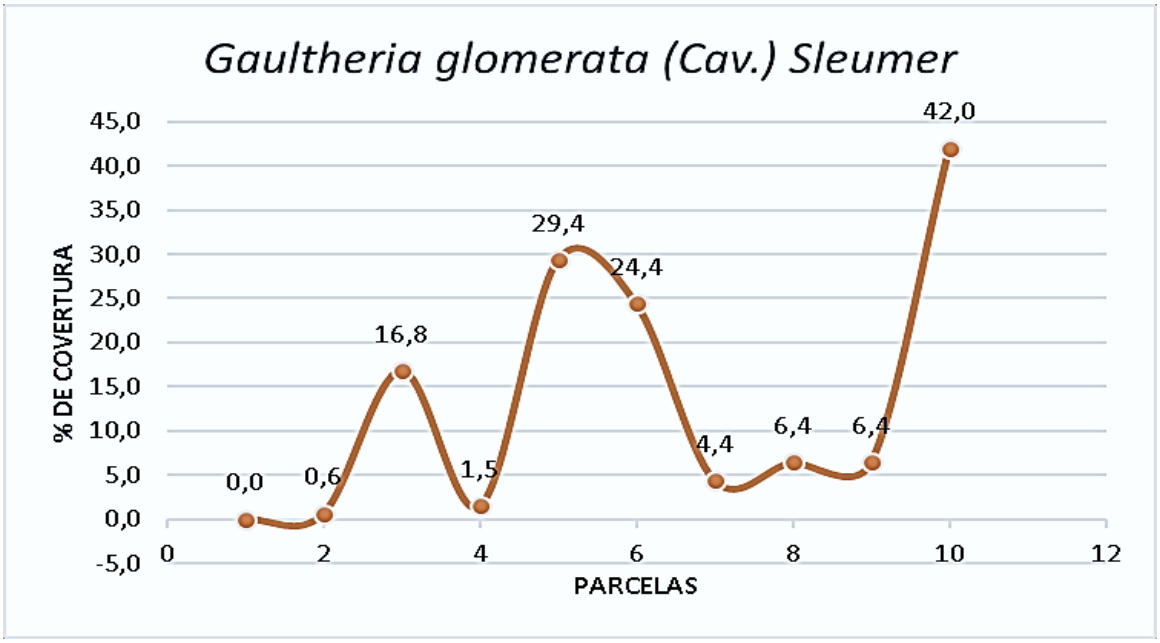
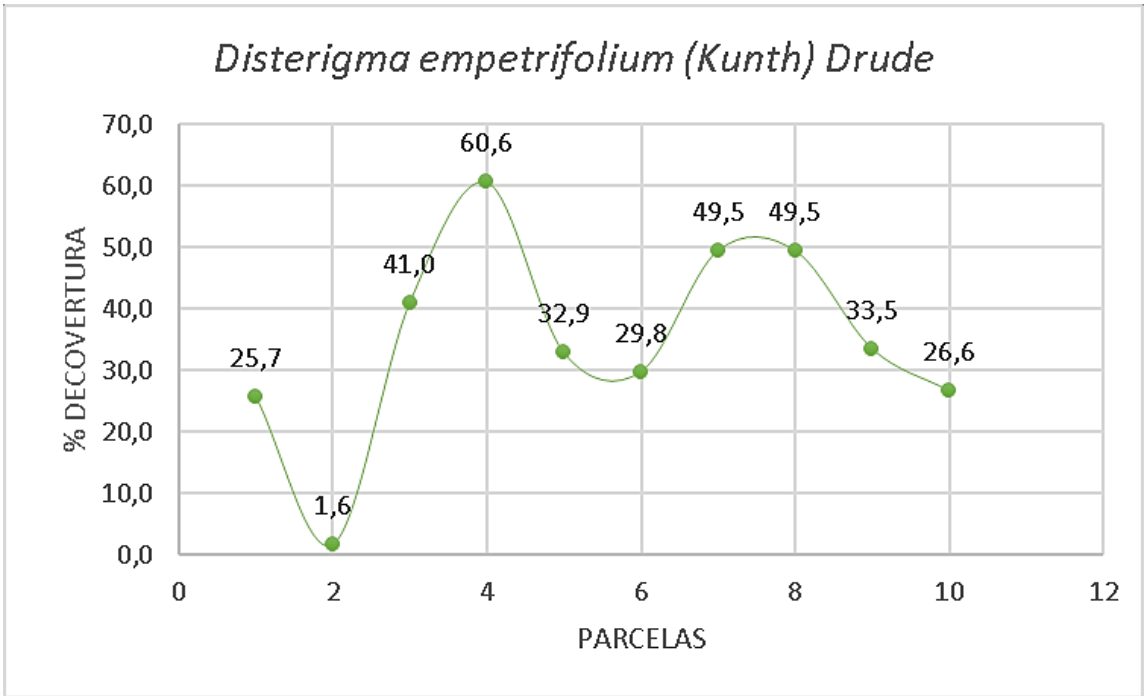


Figure 4. Representative curve of the percentage of vegetation cover of *Disterigma empetrifolium.*



The Indiviso sector has a high diversity of montane forest and shrub páramo vegetation and is considered an analogous ecosystem because it is not possible to delimit whether it is forest or páramo, according to the study of Floristic Diversity and Composition (Caranqui, Ortiz, 2021 p. 1122).

According to (Caranqui et al., 2021: Caranqui & Suarez, 2016); in their study of Regeneration Analysis it can be said that being in an area that was altered, in this case by cattle ranching; the Indiviso sector regenerated naturally, and not necessarily homogeneously. The dominance of the species is going to be heterogeneous, as it was with *D. empetrifolium* that presented high percentages and *G. glomerata* that had low percentages in vegetation cover, the Indiviso sector having regenerated naturally, and having abundant water resources, its vegetation becomes very abundant and comes to present two types of ecosystems such as the montane forest and the shrubby moor.

Conclusions

Taking into account the Braun-Blanquet table (Table 1 and 2), it indicates the scale in which a species can be found by its abundance and dominance respectively, for which we determined that Disterigma empetrifolium (Kunth) Drude, The demographic study of these species determined that the vegetation cover has an abundance index of 3-2, which are medium levels in the Blanquet table, because the plots were strategically located at random and trying to have the greatest amount of vegetation.

References

Araujo-Murakami, A. 2005. Structure and diversity of woody plants in a pre-Andean Amazonian forest in the Quendeque River sector, Madidi National Park, Bolivia. Ecology in Bolivia, Vol. 40(3): 304-324.

Braun-Blanquet, J. 1979. Phytosociology, Bases for the study of plant communities. Madrid Ed. Blume,.

Brown, A. and M. Kappelle 2001 Introduction to the cloud forests of Latin America. A regional synthesis. Pp. 25-40. In: Kappelle, M. & A. D.Brown (eds.) Bosques Nublados del Neotrópico. National Institute of Biodiversity (INBio), Santo Domingo de Heredia.

Caranqui, J., & Romero, F. (2014, May). Diversity and arboreal similarity of montane forests of Chimborazo province. In XI Congreso deficiencia y Tecnología. Aespe. Ecuador (pp. 11-17).

Caranqui, J. 2011. Basic studies of montane forests in central Ecuador. Editorial Académica Española. 67 pages. Published in Germany.

Caranqui, J., & Suarez, D. (2016). Analysis of natural regeneration after pine logging in the Tamboloma páramo (Tungurahua-Ecuador).... Available at: http://dspace.espoch.edu.ec/bitstream/123456789/4623/1/Tamboloma_articulo1.pdf.

Caranqui J.; & Ortíz, M. 2021. "Diversity and floristic composition in the analogous vegetation of Indiviso, Baquerizo Moreno, Tungurahua". ESPOCH Congresses: The Ecuadorian Journal of S.T.E.A.M. [online], 2021, (Ecuador) 1(4), pp. 1120-1128. [Accessed: 12 April

2021]. Available at: https://knepublishing.com/index.php/espoch/article/view/9503/15888.

Ceron, C. 2003. Manual de Botánica, Sistemática, Etnobotánica y Métodos de Estudio en el Ecuador. Herbarium "Alfredo

Paredes" QAP, School of Biology, Universidad Central del Ecuador.

Ducuara, J., Mendoza, R., Tamara, L., & Villadiego, H. 2013. Phytosociological analysis. shorturl.at/cpDIQ.

Henninger, N. (1998). Mapping and geographic analysis of human welfare and poverty: review and assessment. Washington, DC: World Resources Institute.

Huamantupa, I., Urrunaga, R.; & Tupayachi, A. "Diversity of Ericaceae with edible fruits, potentialities for their management and conservation status in the Cusco region, Peru". Q'euña [Online], 2021, (Peru) 9(1), pp. 8-9. [Accessed: 13 April 2021]. ISSN: 2412-2297.Available at: http://revistas.unsaac.edu.pe/index.php/RQ/article/view/585/703.

Jørgensen, P. M., Ulloa Ulloa, C., Madsen, J. E., & Valencia R. (1995). A floristic analysis of the high Andes of Ecuador. A floristic analysis of the high Andes of Ecuador, 221-237.

Jørgensen, P.M. and S. León-Yánez (Eds.) 1999. Catalogue of the Vascular Plants of Ecuador. Missouri Botanical Garden.

MAE. 2013. Classification System of the Ecosystems of Continental Ecuador. Undersecretary of Natural Heritage. Quito

Pauli, H., Gottfried, M., Hohenwallner, D., Reiter, K., Casale, R., & Grabherr, G.

(2003). Fieldwork manual for the GLORIA project. Institute for ecology and biological conservation. University of Vienna. Available at: http://www.gloria.ac.at/downloads/GLORIA_MS4_Web_espanol.pdf (Accessed July 10, 2019).

Phillips, O. and J. S. Miller. 2002. Global patterns of plant diversity: Alwyn H. Gentry's forest transect data set. Monographs in Systematic Botany from the Missouri Botanical Garden 89: 1-319.

Sierra, R.1999. Preliminary Proposal for a Vegetation Classification System for Continental Ecuador [On line]. Quito-Ecuador: INEFAN/GEF-BIRG and Ecociencia Project,. pp. 9-82. ISBN: 978-9942-04-741-0. [Accessed: 10 April 2021]. Available at: shorturl.at/dowRZ.

Tropics database. Missouri Botanical Garden. [Internet Accessed 31 Aug. 2022] http://www.tropicos.org

Ulloa C. & Jørgensen P.M. 1995. Trees and shrubs of the Andes of Ecuador. Second Edition Edt. Abya-Yala, Quito.

Westhoff, V., & Maarel, E. V. D. (1978). The braun-blanquet approach. In Classification of plant communities (pp. 287-399). Springer, Dordrecht.